CREATING JOBS THROUGH ENERGY POLICY

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HEARINGS

BEFORE THE

SUBCOMMITTEE ON ENERGY

OF THE

JOINT ECONOMIC COMMITTEE

CONGRESS OF THE UNITED STATES

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MARCH 15 AND 16, 1978

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CREATING JOBS THROUGH ENERGY POLICY

WEDNESDAY, MARCH 15, 1978

CONGRESS OF THE UNITED STATES,
SUBCOMMITTEE ON ENERGY
OF THE JOINT ECONOMIC COMMITTEE,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 5110, Dirksen Senate Office Building, Hon. Edward M. Kennedy (chairman of the subcommittee) presiding.

Present: Senators Kennedy and McClure; and Representative Heckler.

Also present: Jerry Brady, subcommittee professional staff member; Kent H. Hughes, professional staff member; Mark Borchelt, administrative assistant; and Stephen J. Entin and George D. Krumbhaar, Jr., minority professional staff members.

OPENING STATEMENT OF SENATOR KENNEDY, CHAIRMAN

Senator KENNEDY. Ladies and gentlemen, this is the first hearing held by the Congress explicitly on the relationship between energy and employment. This alone should make our hearings interesting and provocative and I welcome you here.

I asked for these hearings today for one simple reason: I could not see where the national energy plan took employment into account. I wondered if the need to expand employment was considered when the plan was written. I suspected, without knowing, that too little was known about the subject, then and now.

All of us have heard for years the argument that we must keep building more and more powerplants, strip more and more land for coal and build huge shale oil and coal gasification plants to keep the economy running and provide jobs. In the next few weeks we will be hearing more about the need to spend billions to convert coal to gas or liquid fuel at a cost of something like $30 a barrel of oil equivalent. The Congress will be asked to subsidize shale oil and geopressured gas production. We are told that more and more capital must go into energy production—even though energy already consumes one-third of our entire capital investment.

With the fervor of missionaries, the energy companies have promoted this proposition as if it were gospel. And indeed most of us have assumed there was an absolute relationship between energy and economic growth—making more difficult any argument against projects which harm the environment or create safety hazards.

Today we cannot continue to accept uncritically this assumption. We cannot accept higher prices from highly priced technologies because we are told jobs are at stake.

I am hopeful these hearings will give us insight into these questions: How much energy do we really need to sustain economic growth? To what extent can labor be substituted for energy and capital? What energy production systems make the most favorable contribution to employment?

Before we hear our witnesses, I would like to note that there has been a great deal of interest in this. A great many people could not be accommodated. I regret that.

At this point in the record, without objection, I will submit a statement by the NAACP and the American Association of Blacks in Energy, together with a large number of additional statements, which will all appear in the appendix to the hearings.

Our first witness is Maudine R. Cooper. Ms. Cooper is the deputy director of the Washington Bureau, National Urban League and has been kind enough to appear before us. The president of the Urban League could not be with us.

Ms. Cooper, please proceed in any way you wish.

STATEMENT OF MAUDINE R. COOPER, DEPUTY DIRECTOR, WASHINGTON BUREAU, NATIONAL URBAN LEAGUE, INC.

Ms. COOPER. Thank you. I ask your indulgence. I have a severe case of laryngitis.

Senator KENNEDY. We brought you a little sunshine this morning in order to help you get over that.

Ms. COOPER. Mr. Jordan is not here this morning, and for those of you in the audience, obviously, I am not him. I am too short. He sends his warmest regards.

As you know, minority employment has been the top policy and program priority of the NUL for over 65 years. Energy policy, however, is a more recent concern of our organization. Recently, some critics have suggested that minority based organizations such as the League are perhaps overstepping their bounds or losing sight of their priorities by focusing attention on what some term, related or tangential priorities such as energy or environment.

However, our organization is increasingly aware of the fact that the lives of poor blacks and other minorities in this country are dependent on securing an adequate income base through productive employment. Therefore, the league cannot and does not view such issues as energy as outside of the purview of our concerns for the plight of black and other minority Americans. We know that in 1978 we must examine as forthrightly as resources will allow, all of the major forces which foster sound economic growth. We cannot blindly advocated jobs without a basic understanding of the mechanisms by which jobs are created and maintained. Energy production, distribution, consumption and conservation raise issues and problems which ultimately affect the economic health and employment potential of all Americans, but especially low income people, too many of whom are black.

Indeed, we are here today to call the attention of this distinguished Joint Economic Committee of our Congress to a very basic concern, that is, while our Government has recently created a new cabinet-level agency, the Department of Energy, to deal with energy problems, little has been done to directly address the implications of alternate energy policies on employment. Indeed, we would like to suggest some concrete ways in which various entities of government should be cooperating to look more closely with energy and employment.

Let me begin by reviewing for you the underpinnings of the National Urban League's basic approach to energy policy. Last January 20, 1978, Mr. Vernon E. Jordan, Jr., president of the National Urban League spoke before a consumer/utility conference in Minneapolis, Minn., and set forth our basic thinking.

He said:

In my view, the three pillars of a sound energy policy include conservation, development of renewable energy resources, and shielding the poor from the negative fallout effects of energy policies.

He went on to state:

These three pillars must support the structure of continued economic growth with emphasis on including the minorities in that growth.

We look upon conservation as a key initial step in a successful energy policy. Indeed conservation fosters it. Conservation means rational application of limited national resources toward their most productive uses and the elimination of waste. They are not inconsistent policies. In our opinion energy conservation should also mean jobs. Insulating our homes, expanding and upgrading our mass transit systems, and recycling materials all mean jobs—and not jobs solely for the unskilled but employment for those semiskilled and skilled workers so hard hit by our Nation's economic slide.

We know in the United States the poorest fifth of all families use about 25 percent of their budget to buy energy intensive items; the wealthiest fifth of the families use only 5 percent of their budget for this purpose. When the prices of energy rises the poor suffer most. Conservation we believe can reduce the demand on our current nonrenewable energy supplies and encourage attention to development of alternative technologies.

Alternative energy technological development is the second pillar of the Urban League's approach. The creativity, imagination, and ingenuity which produced the productive technologies which made our Nation great must be put to work in developing alternate means of energy production.

Traditional energy modes utilizing fossil fuels or uranium for energy production require increasing capital investments per Btu produced. One dollar invested in oil production in 1974 produced about 17 million Btu's of energy per year. But that same dollar invested in producing strip-mined coal yielded only 2 million Btu's per year; in shale oil only about 400,000 Btu's per year and nuclear power brings up the rear with the equivalent of 20,000 Btu's per year.

Thus, investment in our traditional energy enterprises will continue to place an inordinate drain on investment capital so badly needed for investment in productive enterprise which create jobs. Those traditional energy industries generate fewer jobs per dollar of investment than almost any other major industries. The Ford Foundation found that the 15 largest energy using industries consumed 45 percent of the energy used in manufacturing, but accounted for only 6 percent of manufacturing jobs. Furthermore, the environmental and health cost of continued use of fossil fuels and uranium to generate power are now being documented and are proving to be indeed quite high.

So we are forced to turn to alternate technologies. Clearly the demonstrated potential is great. In fact, they are competitive with traditional sources in specific markets. Undoubtedly, your hearings will produce accounts of technical feasibility studies and demonstrations. The league defers to the experts in presentation of all the evidence for alternate energy development. However, we must express our genuine concern that the Federal Government is not doing enough to first, foster alternate technologies on an immediate priority national basis, and second, incorporate employment effects in their studies of means of stimulating energy supplies.

It is increasingly evident that our energy crisis is central to both inflation and unemployment in this country. This is the heart of the Urban League's concern. I might add, not to be placed as a first or second priority but to be largely tangential.

Senator KENNEDY. As I understand, you think as we are fashioning, in the Congress, a national energy policy we ought to have a kind of employment assessment evaluation of these various alternatives?

Ms. COOPER. Absolutely.

Senator KENNEDY. I think it is a matter of national policy when we develop environmental assessments, when we are developing new buildings or making major decisions that make an impact on the environment as a result of Government policy. But we really have not, in the effort to fashion and shape an energy policy, really given a great deal of attention as to what the employment impact will be. We may make judgments that we may feel that in some instances if the employment impact is not one way or the other we still have to move ahead in terms of our energy requirements. But we must be more mindful of what the implications of those energy decisions will be.

As I gather from your statement there, that has really not been an issue that has been addressed in the fashioning of a national energy policy, nor is it very apparent in terms of congressional direction of the energy approach.

Ms. COOPER. You are absolutely correct.

Senator KENNEDY. And perhaps given the statistics that you point out, where the need is and the lowest income groups in our society are the most impacted by energy decisions, at least their interest or concerns ought to be addressed. And I gather from what you have stated here that that has not been the case.

Ms. COOPER. That has not been the case. If I might expand, in previous testimony we have called for employment impact statements, similar to what we now have in the environmental impact statements, on all major national policy. We believe that it is inconsistent with national policy to have, for example, a full employment policy on the one hand and then other policies being implemented by the Congress which may have inconsistent outcomes.

Senator KENNEDY. So on the one hand we are being asked to deal with whether it is a CETA program, jobs program, youth employment program, on the one hand, and putting hundreds of millions of dollars in that, and as the result of an energy decision working in the opposite direction. We really don't know what that relationship is.

We will have other witnesses who have studied this and have given a good deal of attention to it.

Ms. COOPER. Unfortunately, we see little or no evidence that the Department of Energy, with primary responsibility to solve our Nation's energy problems, is effectively cooperating with the Department of Labor, the Department of Commerce, or other Federal agencies in identifying the effects of their proposed energy policies on employment, inflation, or business investment before developing its own energy strategies.

What we hear from DOE are plans for advanced fossil fuel and nuclear technologies, oil stockpiles, ways to decrease imports, crude oil equalization taxes, natural gas deregulation issues—an endless list of technical solutions. Little is heard about the employment and inflationary effects of those proposals, and even less is heard about their employment and inflationary effects in comparison with the alternate technologies.

Right now, DOE proposes that technologies be tested and employment and inflation will be addressed later. Even in its approach to alternative technologies the government omits employment concerns. The President has recently established a Solar Policy Coordinating Committee of cabinet officials and heads of critical Federal agencies; but did not include the Secretary of Labor in that group.

A memorandum from Senate Commerce Committee staff to the Carter transition team in December 1976 pointed to a feasible program for creating 100,000 jobs through a $1.6 billion investment in solar. Has that recommendation been implemented?

What we have before us is a very basic need to shift our national goals and priorities to the needs of the future. And the needs of poor people and workers in this country must be taken into the equation rather than left as an afterthought. Our Department of Energy is simply not doing a complete job. There are basic equity issues at stake.

In conclusion, the National Urban League is asking that those Government entities responsible for the development of energy policy place a priority on jobs and simultaneously address the inflation and unemployment impacts which affect the economic opportunities of black people.

I will entertain questions.

[The prepared statement of Ms. Cooper follows:]

PREPARED STATEMENT OF MAUDINE R. COOPER

Mr. Chairman, I am Maudine R. Cooper, Deputy Director of the Washington Bureau, National Urban League, Inc. We welcome this opportunity to respond to your invitation to give our views on the relationship between energy and employment.

The National Urban League is a non-profit, charitable and educational social service organization founded in 1910 to secure equal opportunities for Black Americans. Its scope has since been expanded to include all minority groups, and poor and disadvantaged Americans, whoever they may be. But its major thrust continues to be on behalf of Black people in the nation's cities. The League is nonpartisan and interracial in its leadership, staff and membership. Through its impressive network of 109 affiliates, the NUL has carried out its mandate with a view towards the concerns of poor and minority Americans.

The League is committed to enhancing employment opportunities for minorities and the disadvantaged and to educating that portion of the population to existing opportunities. The demonstrated effectiveness of the League in this area has been proven through the development and operation, nationally as well as locally, of over 100 highly successful training and employment programs. Approximately eighty-five of our one hundred nine affiliates Urban Leagues operate employment programs, and many affiliates address the problems of youth employment.

Thank you for the opportunity to discuss with you the concerns the National Urban League shares regarding the relationship between energy and employment. As you know minority employment has been the top policy and program priority of the NUL for over sixty-five years. Energy policy, however, is a more recent concern of our organization. Recently some critics have suggested that minority based organizations such as the League are perhaps overstepping their bounds or losing sight of their priorities by focusing attention on what some term, related or tangential priorities such as energy or environment. However, our organization is increasingly aware of the fact that the lives of poor Blacks and other minorities in this country are dependent on securing an adequate income base through productive employment. Therefore, the League cannot and does not view such issues as energy as outside the purview of our concerns for the plight of Black and other minority Americans. We know that in 1978 we must examine as forthrightly as resources will allow, all of the major forces which foster sound economic growth. We cannot blindly advocate jobs without a basic understanding of the mechanisms by which jobs are created and maintained. Energy production, distribution, consumption and conservation raise issues and problems which ultimately affect the economic health and employment potential of all Americans—but especially low income people—too many of whom are Black.

Indeed, we are here today to call the attention of this distinguished Joint Economic Committee of our Congress to a very basic concern; that is, while our government has recently created a new Cabinet-level agency, the Department of Energy, to deal with energy problems—little has been done to directly address the implications of alternate energy policies on employment. Indeed, we would like to suggest some concrete ways in which various entities of government should be cooperating to look more closely with energy and employment.

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He went on to state "These three pillars must support the structure of continued economic growth with emphasis on including the minorities in that growth."

We look upon conservation as a key initial step in a successful energy policy. Indeed it fosters it. Conservation means rational application of limited national resources towards their most productive uses and the elimination of waste. In our opinion energy conservation should also mean jobs. Insulating our homes, expanding and upgrading our mass transit systems, and recycling materials all mean jobs—and not jobs solely for the unskilled but employment for those semi-skilled and skilled workers so hard hit by our nation's economic slide.

Conservation also has another important effect. Benefits flow from decreases upon the demand for scarce non-renewable resources upon which our economic system has come to depend. Reduction in demand, while not a panacea for inflation, is certainly a step in the right direction. In addition, the rising energy costs of non-renewable resources are basic ingredients in the inflation gripping the nation as a whole, and simultaneously strangling the low income ghetto family squeaking by on income far below the poverty level.

In the United States, the poorest fifth of all families use about 25 percent of their budget to buy energy intensive items; the wealthiest fifth of the families use only five percent of their budget for this purpose. When the prices of energy rises the poor suffer the most. Conservation we believe can reduce the demand on our current non-renewable energy supplies and encourage attention to development of alternative energy production technologies.

Alternative energy technological development is the second pillar of the Urban League's approach. The creativity imagination and ingenuity which produced the productive technologies which made our nation great must be put to work in developing alternative means of energy production. Traditional energy modes utilizing fossil fuels or uranium for energy production require increasing capital investments per BTU produced. One dollar invested in oil production (in 1974) produced about 17 million BTU's of energy per year. But that same dollar invested in producing strip-mined coal yielded only two million BTU per year; in shale oil only about 400,000 BTU per year and nuclear power brings up the rear with the equivalent of 20,000 BTU per year.

Thus, investment in our traditional energy enterprises will continue to place an inordinate drain on investment capital so badly needed for investment in productive enterprise which create jobs. Those traditional energy industries generate fewer jobs per dollar of investment than almost any other major industries. The Ford Foundation found that the 15 largest energy using industries consumed 45 percent of the energy used in manufacturing, but accounted for only six percent of manufacturing jobs. Furthermore, the environmental and health cost of continued use of fossil fuels and uranium to generate power are now documented and are proving to be indeed quite high.

So we are forced to turn to alternate technologies. Clearly the demonstrated potential is great. In fact, they are competitive with traditional sources in specific markets. Undoubtly, your hearings will produce accounts of technical feasibility studies and demonstrations. The League defers to the experts in presentation of all the evidence for alternate energy development. However, we must express our genuine concern that the federal government is not doing enough to first, foster alternate technologies on an immediate priority national basis, and second, incorporate employment effects in their studies of means of stimulating energy supplies.

It is increasingly evident that our energy crisis is central to both inflation and unemployment in this country. This is the heart of the Urban League's concern. Unfortunately, we see little or no evidence that the Department of Energy, with primary responsibility to solve our nation's energy problems, is effectively cooperating with the Department of Labor, the Department of Commerce, or other federal agencies in identifying the effects of their proposed energy policies on employment, inflation, or business investment before developing its own energy production strategies. What we hear from DOE are plans for advanced fossil fuel and nuclear technologies, oil stockpiles, ways to decrease imports, crude oil equalization taxes, natural gas deregulation issues—an endless list of technical solutions. Little is heard about the employment and inflationary effects of those proposals; and even less is heard about their employment and inflationary effects in comparation with the alternate technologies. Right now, DOE proposes that technologies be tested and employment and inflation will be addressed later. Even in its approach to alternative technologies the government omits employment concerns. The President has recently established a Solar Policy Coordinating Committee of Cabinet officials and heads of critical federal agencies; but did not include the Secretary of Labor in that group. How else will we be able to generate unemployment data? The Small Business Administration disregards the Congressional Office of Technology Assessment's report of March, 1977 which states that solar technology will result in jobs both in unskilled and skilled trades in areas now suffering from chronic unemployment through the construction of buildings and industrial facilities which are the backbone of America's small businesses. Instead, SBA views the solar industry as having limited or speculative potential. Indeed this lack of priority attention to employment pervades the energy community. The April 1977 report of the American Bar Associations Special Committee on Energy Policy to the Section on Natural Resources Law looks solely at means of increasing supplies—oil, gas, electric power, hydroelectric, coal and energy conversion and takes on extremely negative view of solar. Never once does it mention employment implications of any of these.

A memorandum from Senate Commerce Committee staff to the Carter Transition Team in December 1976 pointed to a feasible program for creating 100,000 jobs through a $1.6 billion investment in solar. Has that recommendation been implemented?

What we have before us is a very basic need to shift our national goals and priorities to the needs of the future. And the needs of poor people and workers in this country must be taken into the equation rather than left as an afterthought. Our Department of Energy is simply not doing a complete job. There are basic equity issues at stake.

As the Department of Energy directs the course of American energy development in the coming years, it must work closely with other agencies and organizations to examine the jobs impact of each major decision it considers. DOE should be playing a central role in stimulating investment in employment generating energy technologies. The financing mechanisms must be implemented in order to direct massive investments to small business and homeowners to convert to solar and other already-proven technologies.

Development of renewable energy sources amounts to creation of a new sector of the energy industry, an industry in which Black participation has been minimal. Adoption of new energy technologies typically requires less capital, fewer skills, and generates more jobs. Neighborhood-based heating installations, roof-top solar devices and community based energy technologies are suited to small scale business development and to the training and employment of poor and minority persons. So too are insulation programs and programs to modify existing structures to make them more energy-efficient.

We can no longer afford to divert our capital into energy sources without demonstrated employment benefits.

DOE should be working with DHEW to get the educational system to turn out engineers and conduct research to develop our alternate technologies. Corporations must be assisted in meeting the challenge of energy conversion.

In all, what is needed is government creativity and leadership in the large scale conversion of our economy to renewable resources and alternate technologies. In doing so, we are fostering economic growth as a whole while softening the inevitable blow which such a major conversion can entail. And, as an interim measure, DOE should be working with CSA, HUD, HEW and other agencies which provide services to inner-city persons, to seek short-term means of shielding or at least cushioning the poor from escalating energy prices.

In conclusion, the NUL is asking that those government entities responsible for the development of energy policy place a priority on jobs and simultaneously address the inflation and unemployment impacts which affect the economic opportunities of Black people.

Thank you.

Senator KENNEDY. Thank you, Ms. Cooper. We will hear in greater detail later in the morning about the impact, very direct impact for alternative energy sources from a jobs point of view and we will get into that in some detail. I don't know whether you have some specific suggestions or recommendations as it applies to the urban areas, cities of this country, what your own studies have shown would be the most effective way of meeting the problem of employment, particularly in the minority groups and also in low-skilled groups.

Ms. COOPER. All of the information that we have seen, studies done on solar energy, for example, show that you do not need the high-skilled technology that you would need in the construction of a nuclear facility. We have also found that those kinds of facilities can be constructed within urban areas rather than in the outlying suburban areas.

The question is, Why is this country lagging in the use of solar energy in comparison to other countries? We keep hearing it is not technologically feasible at this time. If it is not, what is it that is causing the delay in getting the appropriate dollars out there to make the technology feasible?

Those kinds of jobs that would be created, for example, in installing solar window boxes in apartment dwellings of low-income persons, why is it we cannot do that on a large-scale basis?

Putting aside solar, going to insulation of homes, for example, why is it we don't have massive dollars being put into the weatherization program instead of the small sums being put forth in this present budget?

It seems to me if we are serious as a Nation about energy conservation we ought to reallocate our scarce resources in a manner which will both conserve energy and create jobs. I don't see us doing that. I don't think it takes an awful lot of creativity to do that. There is just a lack of willpower on the part of some of our Federal Agencies and/or leaders.

Senator McClure. You make that statement because you believe it will be more efficient in the production of employment. And do you think it would also be more efficient in the production of energy?

Ms. Cooper. Not in the production of energy but energy conservation.

Senator McClure. Conservation. Do you think that dollar expenditure is more efficient?

Ms. Cooper. We are talking about saving energy right now. We keep hearing about the balance of payments, about the OPEC pricing potential for increases, all of concern to us as well as the immediate job impact upon Joe Blow in the inner city. We are not oblivious to such international issues as the balance of payments and the impact of OPEC on our internal domestic pricing policy and structure.

Senator Kennedy. As we are making judgments and tradeoffs in terms of where we are going in the direction of alternatives, we have a variety of different ways of dealing with a national crisis and we have been exploring those. But your point is that in each of these we ought to be coordinating our policy as it relates to the major segment of our population, and that is generally the poorest both in terms of pricing and employment. We ought to be doing an impact study of both of these.

In your prepared statement you mentioned pricing. You admit you have some recommendations that weatherization, obviously it is a program that has impacted in terms of jobs and employment and impacted in terms of conservation. But the program, weatherization program, the model program that was stimulated worked very successfully. It did up our way in New England. It was one of the really effective programs.

You have some other recommendations in that area. I wonder if you would just mention those.

Ms. Cooper. We have a great concern for those on fixed income or those who receive income, for example, like welfare. When the costs of that individual's life style go up considerably, especially for something like utilities, there is no immediate way to save that person from the devastation that occurs when they have suddenly been faced with a fuel adjustment clause, or an increase in their utility by virtue of that fuel adjustment. There ought to be some immediate escalation clause to make sure they do in fact receive immediate assistance rather than when they are being evicted.

We also talk about fuel stamps as a way of assisting low-income persons. To be very candid with you, we have had to recant from that position because we found you don't get utility reform with fuel stamps. You just get Federal subsidy. We are sort of quiet on that, but I understand in some areas fuel stamps are being used and used successfully.

Our bigger goal is utility reform rather than fuel stamps and we believe that will get more directly at the program rather than using the stamps.

In addition, we would like to see an emergency assistance program which is paid for by the Federal Government, monitored, evaluated, and made to work. For example, we find it ludicrous that in this area we recently heard that the emergency funds for energy utilities are not being used or not being spent. I believe it was Washington, D.C.

It seems that DOE ought to be on top of those programs. They ought to know at any point in time if the dollar is being spent, how it is being spent; and if it is not being spent, why not. They are not doing this. The money is being sent out to the States and it is sitting there. People are being evicted or they have to make choices between fuel and food.

Senator KENNEDY. We are aware of that and we are working with Senator Muskie with that 200 million set aside. The earlier decision, of course, was absolutely essential in terms of the number of people, and generally the poorest people in the areas of the country that were most adversely affected by the extraordinary cold weather last winter, not this current one.

I think your testimony is helpful. I again understand that in each of these areas of energy as we make policy that the economic impact ought to be very carefully considered. And the economic impact in terms of employment and jobs, and that we really ought to, in terms of making choices, give weight to that particular impact. What we need is the coordination and consolidation of policy and not just targeting of jobs but looking at the job impact and the fashioning of an energy policy. That has not been done to date.

You raise these issues and across the spectrum, and primarily targeting in on the poorest and unskilled people in our society that are bearing both the burden in terms of increased prices and the impact in terms of increased unemployment. I think that is what we want to address in the course of our hearings about how we can deal with that.

I want to thank you.

Senator MCCLURE. I certainly agree that there are alternatives and we ought to weigh the economic and social costs of the alternatives. I think that perhaps hasn't been done as fully as it should be, and we ought to be addressing ourselves to the question. I appreciate your comments along that line.

I am also concerned with the aspect of whether or not our society will continue to grow and whether or not the disadvantaged in our society will have opportunities to grow if our economy does not grow. Will the opportunities for those who are least behind now be enhanced—be more easily attained in a growing economy or more easily attained in an economy that is somewhat constrained and in which policy then must make the allocation to the benefits of the disadvantaged? Do you have an opinion as to which course is the better one?

Ms. COOPER. No growth versus slow growth, I guess is the shorthand capsule of your question. We have some problem with that whole concept. To begin with, again, if you were to examine, for example, a nuclear facility, you walk in and see absolutely no people. You see computers. If you were to look at one of the energy company's production facilities, you see no people. What I see us doing is growing but using less and less manpower. We are becoming a technological society. What that means for our constituency is no jobs.

Senator McClure. Does that mean that? That may be the basic question we have to answer. But it may mean they don't have any jobs where the energy is produced but there are jobs where it is consumed.

Ms. Cooper. That is also questionable. We can go into our manufacturing companies and we will see now assembly lines where there is little or no manpwoer. I know the argument has been well documented that we are becoming a technological society.

Senator McClure. And you think that is bad?

Ms. Cooper. It is bad if it means we will have only machines rather than people.

Senator McClure. I recall going through that same argument at the end of World War II. Now that the war was over and the war machinery was being disbanded and world production was going to decline, that now we are going to go back to the Great Depression days of breadlines and WPA projects and that there was no way our economy could provide enough jobs for our people. Yet, quite the contrary occurred. There was a great upsurge of of job production for civilian and nonmilitary segments of our society, and more people found more jobs at better wages than they ever had before.

You are entitled to say what you wish. I am only trying to get from you what your position is. If I understand it, you would go back to building the interstate highway by use of pick and shovel and wheelbarrows instead of using tractors?

Ms. Cooper. No. I think that a balance should be struck between the technologies that are being advanced today and full employment as a national goal. I don't think we are doing that. I think we are going full speed ahead and using cost-benefit analyses that say it is far more productive to use some kind of construction technology and use 5 people rather than 55 people, which is fine. But after you do a full cost-benefit analysis that includes a social and economic analysis of the impact on people, you might find that those figures aren't accurate.

For example, does it make a lot of sense to have us spending $45,000 a year to keep a person incarcerated when we could have given that person a job, cut back a little on technology 5 or 10 years before he or she was arrested? Does it make sense for us to continue developing high technology when we should be putting those monies into the educational system to keep young, poor kids from dropping out in inordinate numbers? Nobody seems to be looking at this.

We look at the cost-benefit analysis in terms of direct machine costs rather than the social cost or the long range social cost.

Senator McClure. I think the point is valid, and I think we need to take a look at what we can do. But at the same time we have to look at what technology has been able to do in increasing the availability of goods and services at a cost which people in society can afford to pay, recognizing that some can and some cannot pay that cost.

I agree with you that there needs to be a careful look at the total long-term cost. I suspect what you are really suggesting is that we address this with the same fervor of indirect costs that we direct at the indirect costs of environmental degradation and that we have an employment impact statement, as horrendous as that may sound to some, in the same way that we have an environmental statement. At the same time we have to understand that there are societies that are backward in the world and also the society that produces very little in terms of per capita production of energy or per capita consumption of energy, and that the society with the lowest standard of living and the least opportunity for the people to raise that standard of living are the people living in very simple societies that are nontechnological.

The technological society does something to create the environment in which all people can elevate their standard of living.

Ms. COOPER. I agree. As a matter of fact, we are in the business of suggesting to what you call backward countries——

Senator McCLURE. To become more like us.

Ms. COOPER [continuing]. Which I assume is based on their desire as well as our desire to help those who are less fortunate, if you will.

However, I go back to my original statement, there has to be a balance. How long do we let technology take over before we say we have to slow down or stop the process in order to maintain what we have?

Senator McCLURE. You sound like a true conservative.

Ms. COOPER. I don't like to be classified as a conservative or a liberal. We have to strike a balance. We are paying the cost on the other end. You mentioned goods and services that people can't afford. As we keep getting more and more money in our pockets, we are finding those goods and services that you say we can't afford are costing more and more.

Also, the ancillary services are costing more. I mentioned the prison system, consider also the juvenile justice system. Even additional welfare money outlays to those who cannot afford to buy those goods and services. So we have to say that technology is now being cost ineffective because of those indirect, ancillary problems.

Senator McCLURE. There is a little being done, perhaps not as much as should be. There was a statement released by the Department of Labor and the Department of Energy, a joint study, a joint report on labor and capital requirements dated January of this year; January 13, 1978. So some work is being done. Perhaps not enough, perhaps not enough indepth or with enough range.

I noted with a great deal of interest the statement made by the NAACP in January in regard to energy growth. As a matter of fact, I think that may be one of the most important statements made in the last several years on the question of energy. It was important because it came from a sector of our society from which it was not not expected. We have expected statements like that from a number of other people but I regard that statement as being one of the most clear and lucid statements of the desire of a group of people representing a minority, and sometimes a disadvantaged minority of our country, in regard to demand for energy growth in order to keep our economy growing enough that people who do not now enjoy all of the benefits of our society will have the opportunity to elevate themselves to that status.

I thought that statement by the NAACP was a very important statement, and I have written to Mr. Hooks to congratulate him for that, because it to me indicated their assessment which may be somewhat different from yours, that energy growth was essential to the well-being of the constituency that they serve.

So you find yourselves in disagreement with that statement?

Ms. COOPER. I think, though, that perhaps you ought to read our statement that came out in Minneapolis, and you may find that it is equally clear, equally lucid, or equally clarifying our position——

Senator MCCLURE. I didn't mean to indicate that yours wasn't clear and lucid. I happen to like this. I have read yours. Some of what you say I can't follow quite as easily. Maybe it is my perception rather than your statement.

Ms. COOPER. Just as congressional representatives may disagree or not take the same position with impunity, I don't think that there is any mandate that all organizations, be they black or white, take the same position on any issue.

Senator MCCLURE. We haven't gotten to that point yet.

Ms. COOPER. We are not rubberstamping the NAACP and they are not rubberstamping us.

Senator MCCLURE. You do find yourself in some disagreement with that statement?

Ms. COOPER. Yes, clearly.

Senator MCCLURE. Do you regard growth in GNP as essential?

Ms. COOPER. I keep going back to my original statement, growth for what purpose and how much is necessary to maintain a standard of living that all in this country can enjoy and not just some. With the kind of studies we have been talking about, I don't know how I could, or you could, sit and say we must grow, we must continue to grow, until we have looked at all of the options. I don't think we have.

There is a blatant assumption that we must continue to grow and everyone——

Senator MCCLURE. You haven't decided that no growth is the best policy?

Ms. COOPER. No, no; definitely not.

Senator MCCLURE. You haven't adopted that policy?

Ms. COOPER. No, we have not.

Senator MCCLURE. Do you believe that there is a correlation between GNP growing and energy consumption?

Ms. COOPER. Yes, there is.

Senator MCCLURE. The Humphrey-Hawkins bill calls for setting national goals including the economic goals of growth. Do you support that concept or would you say that the Humphrey-Hawkins bill is off target on that area?

Ms. COOPER. We support the Humphrey-Hawkins bill, but I think you also should know that within that bill is enough of a caveat that when the President finds those goals are either unreachable or causing such disruption within the economy that those goals may be set aside. I think that is the reason we can support it.

Senator MCCLURE. You can accept it because it has that caveat so that if we look at growth as slowing down we can rearrange it or stop it.

Ms. COOPER. Or maybe we want more.

Senator MCCLURE. That kind of growth. Do you believe, as some do, that the GNP can grow with the rate of energy consumption growing at a much slower pace than the rate of growth in GNP?

Ms. Cooper. I am not sure. I am not an economist. I hate to speculate. I know you do have some economists coming on after me. I hope that they present all sides of the issue.

But I question whether or not we can have growth in GNP without growth in energy consumption. I see those two as going hand in hand. The question is how much growth. I keep going back to my original statement—for us to maintain a standard of living that most Americans can afford and will enjoy we must examine implications of growth. I am just not sure, frankly, how to answer your question.

Senator McClure. Thank you. While I may have questions, I think your statement was clear. I do understand the point you are trying to make, and I think the evaluation, as Senator Kennedy has said, must be a central piece, not a peripheral piece of policy development, to determine what this kind of energy policy, or any other policy, we adopt as a major U.S. policy does as to the aspirations of our people, including the employment and social framework in which that growth takes place.

I thank you for your statement.

Senator Kennedy. Just before recognizing Congresswoman Heckler, we will hear later from economists. There are other industrialized societies that are increasing significantly in terms of growth and have established their energy consumption. We have some interesting testimony on this issue in our joint economic hearings.

One of the particular things that we will hear is that the opportunity for employment in alternative sources of energy, in solar energy, for example, shows that there is an increase in employment of some 270 percent, double the output of energy with less capital investment, which means less capital, particularly among the low-income groups. Those are the issues we want to get into in more detail.

I think these are things that are theories that are challenged. But I don't know if you have to accept the proposition that with trying to meet the issue of unemployment that it doesn't necessarily mean that we can't increase our capacity of energy and not mean additional jobs as well.

We will hear some of the economists that have done work on it.

Senator McClure. I think we would all agree, and perhaps even stipulate, that the most labor intensive form of energy is muscle power, and maybe we will want to substitute human muscle for that consumption of coal and nuclear. And perhaps we would rather have people again working rather than having machines doing the work for themselves. That is an option which our country can pursue.

Senator Kennedy. Even in a broader context, what do we do, for example, in the recycling of various materials, bottles, and cans? Do we make a decision that we are going to provide more intensively to produce more of a product that will consume more energy, or do we recycle which means less energy and more jobs?

It doesn't mean you have to do it with a pick and shovel. It means you can conserve energy and do more jobs. Are our tax policies, investments, writeoffs so skewed in such a way that we will encounter counterproductive areas? I don't think that any of us have suggested that we go back to the pick and shovel.

Senator McClure. Some have.

Senator KENNEDY. But not in this committee.

Senator McCLURE. Ten percent of a population in the northernmost part of my State is populated by young people who have gone back to the soil movement, which they believe precisely that.

Senator KENNEDY. They are doing that in my part of the country, too. God bless them. That isn't what we are trying to focus on. Maybe there will be attention focused on that, but I think we will be more fundamental and basic to the question of priorities during the course of these hearings.

We will have some administration witnesses. Al Alm has to be out at a given time. Having taken more than my share of time, we will ask Congresswoman Heckler to question.

Representative HECKLER. I would like to ask a brief question. I feel that your testimony speaks to a very significant issue in terms of energy policy, and it is one that isn't usually discussed. So it is a facet that has to be explored.

I am interested in knowing which you would prefer in terms of dealing with problems of unemployment in the black community. Would you prefer to see an expansion in employment opportunities in the private sector or public sector? Do you see the component of employment as part of an energy policy as a private question or a public question?

Ms. COOPER. If you are talking private or public in the sense that we use in our manpower legislation——

Representative HECKLER. I am talking about CETA versus private sector jobs.

Ms. COOPER. We firmly believe that private sector jobs are preferable. But you also have real problems to consider. Can the private sector on its own initiative deal with the hardcore, structurally unemployed? That is the big question. That is why I think the administration is pushing so hard for its private sector initiative. It feels it has to have private sector direction in job policy formulation and job creation.

Public sector jobs are definitely—I shouldn't say definitely, generally dead end with very little training and what we want to do is get people into long-term employment, employment that will be a transition into the mainstream, if you will, and that is why we do in fact support private sector jobs.

Unfortunately, it seems as though this country has not been able to absorb this large segment of the population that is unemployed and that is ready, willing, and seeking a job.

Representative HECKLER. In order to achieve a long-term employment, that I think is desirable and needed. But has the Urban League taken a position on any of the tax proposals which can stimulate the private sector? Are you going into tax legislation as part of the resolution, as a part of the central issue of unemployment?

Ms. COOPER. We will be. I mentioned in my testimony that we will be looking at a number of areas that exist within our resources. You do need experts when you look at these issues. And frequently we have to call on a number of our friends.

Representative HECKLER. Are you supportive of the President's initiative in terms of the development of private sector employment?

Ms. COOPER. The new title VII of CETA, the reauthorization, we have serious problems with. I will be testifying before the Hawkins subcommittee on that very issue tomorrow. There are some specific recommendations we have for changing that private sector initiative.

Representative HECKLER. Thank you.

Senator McCLURE. Thank you.

I will be listening for that statement because I am very interested in this Youth Employment Act which was adopted last year. I was one of the original sponsors of that legislation. I think it is important. I will be very interested in seeing that it works better.

Thank you for your testimony.

We will proceed to have Mr. Alvin Alm, Assistant Secretary for Policy and Evaluation in the Department of Energy. Mr. Alm was part of the team which created the national energy plan and organized the new department.

He is accompanied by Mr. Clark Bullard, who is a widely respected authority on energy economics.

I also understand that you have a time limit, so you can either give your statement in its entirety, place it in the record, summarize it, or however you desire.

STATEMENT OF HON. ALVIN L. ALM, ASSISTANT SECRETARY FOR POLICY AND EVALUATION, DEPARTMENT OF ENERGY, ACCOMPANIED BY CLARK W. BULLARD, DIRECTOR, OFFICE OF CONSERVATION AND ADVANCED ENERGY POLICY

Mr. ALM. I propose not to summarize but rather to cut out certain parts of my prepared statement.

Senator McCLURE. Your prepared statement will appear in the record in full, and you may summarize or give portions as you wish.

Mr. ALM. Our position on energy and employment was stated clearly in the national energy plan, NEP, last April: "It is an axiom of public policy that full employment be promoted. The energy problem can be solved without turning off or slowing down America's economic progress. * * * Indeed, in the long run, the Nation can continue to enjoy economic health only if it solves its energy problems."

The Department of Energy has some capability for analyzing the manpower, material, and capital requirements for constructing and operating a variety of energy supply technologies. For each type of facility, studies have been performed to calculate manpower requirements in each occupational category, and have determined that the total figure was doubled when the jobs created indirectly in the manufacture and transportation of materials to the construction site were taken into account. These results and the computer models are now used by my staff on a continuing basis to evaluate the employment impact of energy supply development policies.

Investments in energy conservation also create employment. It is important to distinguish here between conservation and curtailment. Curtailment has given conservation a bad name. Conservation is achieved through investments in efficiency. Whenever any input to production is used more efficiently, economic growth and disposable income are increased. This is true for energy as well as for capital and labor.

Investments in energy conservation also serve to increase the tax base where people live and work instead of the more remote areas where new energy supplies are increasingly found. Moreover, investments in conservation reduce expenditures for fuels and increase the demand for other products which tend to be less energy intensive and more labor intensive, creating added employment over the long term.

Analyzing the energy-employment relationship is no easy task, because investments in energy supply and conservation necessarily alter the structure of the Nation's stock of capital equipment. Therefore, many aggregate economic models, which may perform other tasks well enough, are inadequate for analyzing job impacts of proposed energy policies. Most econometric models are based on relationships observed during an era when energy costs were a small and decreasing part of everyone's budget, and consequently reflect a stable relationship between energy use and capital investment.

Such models tend to reinforce the myth that cutbacks in energy use must necessarily reduce economic growth, by retarding capital investment. Nothing could be further from the truth. Many detailed studies have shown that energy efficiency—that is, energy productivity—can be increased by substituting capital for energy without reducing employment. For example, most people are employed in the service sector, where most of the energy is used in space heating and cooling. The energy efficiency of the building and its heating system can be improved without affecting the number of people employed by the firm. Similar findings hold for energy intensive industrial processes.

During the development of the first NEP we relied on studies by the Ford Foundation and others that indicated the generally favorable impacts of energy conservation on total employment. However, in many cases it is not sufficient to look simply at the total number of jobs created; it is necessary to be able to direct programs toward the regions and occupational categories where unemployment is highest. The NEP tax credit for insulating existing structures is an example of such a policy initiative.

The tax credit is designed to create jobs where they are most needed, and to spur economic growth by allocating capital more efficiently to investments that are often economically equivalent to buying oil at less than half the OPEC world oil price. It will also provide the consumer with savings on monthly utility bills that can be spent on more labor intensive goods and services.

At the present time, the Department does not have an adequate capability for analyzing the employment impact of specific energy conservation investments in a way that permits easy comparison with energy supply investments. Therefore, I am unable to report on comparisons today. However, the Department is developing better methods and collecting needed data and will perform analyses of employment effects as an integral part of the development of the 1979 national energy plan.

Several steps have been taken to permit better analysis. We are developing a regional energy activity and demographic model, based on county-level data, that will improve our capability for understanding subnational impacts of energy supply options.

The Department is also increasing its activity in energy manpower data collection and analysis. Studies have been completed on manpower needs in energy research and on the skills needed by installers of solar equipment. In conjunction with the Bureau of Labor Statistics, (BLS), a survey of manpower in the nuclear industry has been initiated.

In addition, manpower surveys of the solar, geothermal, and construction industries are now underway.

These efforts are not intended to develop a long-range forecasting capability that would calculate detailed requirements for pipefitters and insulators 30 years in the future; the uncertainty is simply too great for any model to accomplish such a task. Rather, we are taking a pragmatic line of inquiry to more fully understand how energy is now being used in the economy, and to assess both the energy and employment impacts of emerging technologies.

At the present time, we are engaged in two types of cooperative efforts with the Department of Labor. One program is actually creating jobs and conserving energy today; others are improving our ability to develop and analyze new policy initiatives.

DOE, the Community Services Administration, and the Department of Labor are jointly participating in a weatherization program which employs over 12,000 CETA workers to insulate and weatherstrip the homes of the poor and the elderly. DOE funds buy the materials which are installed by the CETA workers.

Through an interagency agreement with the Bureau of Labor Statistics, we have already begun to improve the Labor Department's employment impact model so it can accurately reflect the way energy related investments change the structure of the economy. We hope to expand this cooperation in the future and explore policy initiatives that can help us achieve employment and energy goals together.

This brings me back, in closing, to our commitment in the NEP to develop an energy policy which supports and promotes fuller employment. I am very glad that you have called these hearings on this subject at this time. It will help us to refocus ourselves on this issue and to be more conscious of employment goals. I hope that these hearings and the work which will develop out of them will increase understanding and support for our efforts.

[The prepared statement of Mr. Alm follows:]

PREPARED STATEMENT OF HON. ALVIN L. ALM

I am pleased to appear before you today to discuss the relationship between energy and employment. In your letter of invitation, you asked three basic questions. In response, I will first present our view of the linkage between energy and employment and how the creation of jobs can be taken more fully into account in energy policy. Second, I will discuss improvements in our analysis that should help everyone to better understand this problem. Finally, I shall describe how we are now working with other Departments to achieve our energy and employment goals.

Our position on energy and employment was stated clearly in the National Energy Plan (NEP) last April: "It is an axiom of public policy that full employment be promoted. The energy problem can be solved without turning off or slowing down America's economic progress. . . Indeed, in the long run, the Nation can continue to enjoy economic health only if it solves its energy problems."

The connection between jobs and energy was forcefully demonstrated when energy use had to be suddenly curtailed during the 1973 oil embargo, and again during the cold winter of 1977. As a result of these experiences, the Department of Energy has taken several actions to protect America's labor force from the threat of layoffs induced by energy supply interruptions. We have accelerated development of the Strategic Petroleum Reserve to reduce our vulnerability to an embargo, and have initiated a variety of contingency planning studies to improve our ability to efficiently handle energy curtailments in ways that minimize unemployment. NEP was developed to reduce our dependence on foreign oil by eliminating energy waste, stimulating energy production, and encouraging utilities and industry to convert to coal. The tax provisions in the NEP are designed to encourage investment in more efficient autos and industrial equipment.

To effectively deal with the real causes of our energy problem, energy policies must influence investment decisions. Almost 25 percent of the Nation's gross private domestic investment goes for facilities that produce energy; the other 75 percent for buildings, vehicles, and industrial plant and equipment that consume it. As conventional resources are depleted, existing energy supply facilities must be replaced by newer—often more capital intensive—technologies. As energy prices rise, energy-consuming capital stocks must be replaced by newer, more efficient vehicles, buildings and capital equipment. Each investment decision, therefore, affects both energy and labor requirements. Our national goals require that high priority be given to policies which encourage investments that simultaneously reduce unemployment and close the gap between energy supply and demand.

These hearings provide an opportunity to distinguish between the type of employment impacts associated with energy curtailments and those associated with energy-related investments. While the impacts of energy curtailment are generally negative, the effects of energy investments are generally positive. Investments in energy production, conversion and conservation have somewhat different, but positive, impacts on employment.

The Department of Energy has some capability for analyzing the manpower, material and capital requirements for constructing and operating a variety of energy supply technologies. For each type of facility, studies have been performed to calculate manpower requirements in each occupational category, and have determined that the total figure was doubled when the jobs created indirectly in the manufacture and transportation of materials to the construction site were taken into account. These results and the computer models are now used by my staff on a continuing basis to evaluate the employment impact of energy supply development policies.

Investments in energy conservation also create employment. It is important to distinguish here between conservation and curtailment. Curtailment has given conservation a bad name. Conservation is achieved through investments in efficiency. Whenever any input to production is used more efficiently, economic growth and disposable income are increased. This is true for energy as well as for capital and labor. Investments in energy conservation also serve to increase the tax base where people live and work instead of the more remote areas where new energy supplies are increasingly found. Moreover, investments in conservation reduce expenditures for fuels and increase the demand for other products which tend to be less energy intensive and more labor intensive, creating added employment over the long term.

ANALYTICAL CAPABILITIES

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Senator KENNEDY. Thank you very much.

Isn't it true, the fact of the matter, in the drafting of the national energy programs the issue was very seldom mentioned about employment and the question of the impact of employment? I don't know how you characterize it, but it doesn't appear to have been one of the prime or front-burner decisions in terms of recommendations; was it?

Mr. ALM. There was a great deal of concern in the development of the national energy policy on two issues relating to this hearing. One was the macroeconomic impact. We prepared an analysis of macroeconomic impact of the national energy plan, together with the Council of Economic Advisers. This was made available to the Congress and to others.

The analysis showed that the national energy plan had no impact on employment one way or the other. This is because most of the revenue from the energy plan is recycled.

Second, the plan dealt with the equity impact of the plan itself. To balance the equity there were certain provisions in the plan, such as the one concerning which would keep consumer costs down for oil-heated homes. Other provisions, such as the refund of tax money would have provided per capita rebates which would have a progressive impact. There was a concern for equity impacts and the macroeconomic impact. There was not a close checking of the primary economic impact.

Senator KENNEDY. Was there an evaluation in terms of alternative sources of energy, about what the impact was going to be? Obviously, not the totality of the issue and not macro but in terms of various alternatives, conservation versus increasing nuclear versus solar. Was there an evaluation of that?

Mr. ALM. It is fair to say that the evaluation was a very crude calculation. It was not the kind of analysis that this subcommittee is concerned about, nor the kind the Department of Energy is concerned about performing in the future.

Senator KENNEDY. Was there a study done by the Department of Labor? Were they called in?

Mr. ALM. No, they were not. We worked mainly with the Council of Economic Advisers.

Senator KENNEDY. You have a second stage of the national energy plan that is coming out.

Mr. ALM. No; they were not. We worked mainly with the Council early in 1979. That plan will, among other things, look at employment impact.

Senator KENNEDY. Maybe you can talk about that.

Mr. ALM. We will be looking at a very large range of supply initiatives. When I say supply initiatives, this includes conservation, and soft technology as well as hard technology.

We will be considering those periods in the future when we would have energy gaps which would require either rising imports; some domestic supply source, or conservation to fill the gap. We will be looking specifically at the economic impact of the various alternatives. This will give us the ability to consider employment as well as other factors in the development of the national energy policy, including environmental factors, institutional and the like.

Senator KENNEDY. When they submit the plan, will they be doing an analysis on the employment implications of various provisions of the second plan?

Mr. ALM. My intention is that there will be a section dealing with employment impacts along with other economic impacts.

Senator KENNEDY. Do you intend to ask the Department of Labor to work with the Department on this?

Mr. ALM. We certainly do. We are undertaking a number of cooperative arrangements with the Department of Labor now, and I think this hearing underscores the need for us to do more in that regard.

Senator KENNEDY. You are not prepared to make any prediction about the relationship between conservation instead of production or solar instead of coal?

Mr. ALM. I might make a general observation, Mr. Chairman. The detailed analyses have not been done to give you hard numbers. I think it is true that whenever you can bring a source of supply on more cheaply than other sources, then you are providing more disposable income which has a multiplier effect in terms of job creation. Insofar as job creation activities can result in savings at half the cost of the world price of oil, you are providing, on the one hand, direct jobs in installation and production, and on the other hand more disposable income which is also job creating.

Senator McCLURE. I would like to focus on that last statement because it is one I highlighted as you read through your statement, because it runs directly counter to what the previous witness was suggesting. That is the portion of your prepared statement which you just paraphrased in almost the same language. "Whenever any input to production is used more efficiently, economic growth and disposals income are increased."

That may not be directly counter to what she was saying, because she was focusing on the distribution of that income rather than the quantity of it.

But you might expand just a little more on whether or not you think the benefits to the less technologically qualified, the least educated in what sometimes are grouped together as the disadvantaged, may hope to achieve from that increase in disposal income or growth in economics, total economic activity.

Mr. ALM. My personal view, although I am not a macroeconomist, is that the benefits of growth can be spread rather widely. Focusing particularly on conservation, outlined in my prepared statement, if there is more disposable income, the less advantaged are helped in two ways. One, if the particular weatherization is conducted in their own residences, they will save money directly. Indeed, this is the reason for the administration pushing the weatherization program.

Second, whoever has more disposable income will spread that money throughout the economy through the purchase of goods and services. Obviously, that will create jobs in the service, manufacturing, and distribution sectors.

Senator McCLURE. Incidentally, as one Member of the Senate, I am particularly glad to have the administration's assistance on the weatherization program. The Senate passed that three times, as I recall, before we got the House to go along with us and twice before we could get the administration to go along with us.

I do think it has some real potential for conservation, a very real potential for decreasing the cost to many people who live in housing from an energy conservation standpoint that is substandard and often substandard by any test. We may be dealing directly with a sector of our society that very desperately needs relief from the increased energy costs.

So for a whole variety of reasons I think it is a good program and I hope it will be implemented. And I hope we can fund it fully. I hope when this bill is passed, and I hope it will be passed, that it will embrace in it the elements that are in the Senate-passed version of that bill.

One of the concerns that I have, and this deals with your question that we are addressing today of employment opportunity, it gets a little into the question of macroeconomic policy. We focused for a long while on unemployment, on underutilized capacity saying stimulative efforts cannot be inflationary as long as they are unused capacity. I am not subscribing to that argument, I am only repeating it.

Yet the Federal Reserve Bank of St. Louis has issued several articles criticizing the measure of potential GNP and full employment capacity because the higher energy prices that have gone into effect since 1974 have made many plants and pieces of equipment obsolete. And the total plant capacity, effective plant capacity, has been reduced by as much as 5 percent between 1973 and 1975. We may be very much near full capacity than old and more traditional measures may indicate.

If that is true, then one of the great needs for our economy must be investment in new plant capacity, particularly when measured against the rate of investment of the United States as against other industrialized countries. Our efforts in energy production or conservation may inhibit the ability to generate the plant capacity, investment that is necessary if we are going to meet our employment goals.

Would you care to comment?

Mr. ALM. I have not read that particular article. Since the OPEC embargo there has been a tremendous increase in the efficiency of industrial operations in their use of energy. I have talked personally to many members of industry who have told me that they had woken up to the things that they could do to make their plants more efficient. The dramatic impact of the embargo showed them in a dollars and cents way, ways that they can save money.

I would think that generally improvements in efficiency are very consistent with general investment in improving productivity of an industry by reducing costs of any input. That is what capital investments are usually about. As part of the national energy plan there are provisions for tax credits for investments made by energy industries in which energy conservation measures are used. So this would be an incentive for industry to move along in installing energy conservation systems.

Senator MCCLURE. My question was not so much directed toward capital investment for energy conservation or energy production, which we have talked about a great deal, but the need for capital investment in productive capacity not related to energy. If we lag in that, we will not have jobs. Unemployment will go up instead of down.

Mr. ALM. First, in the industrial sector, where total energy costs are about 5 percent of production, the investment in energy conservation would not be a serious drain on a particular firm's ability to invest in expanding production, though this varies by industry.

Second, I think the expanded capacity, obviously, will be considerably more energy efficient than current capacity. But I think that, as sheer numbers indicate, most industry energy conservation investments made in light of higher oil prices should not be a serious impediment for investment.

Senator McClure. Again, I am looking at it in much different terms than that. And that is, that there is a certain pool of capital available for investment in the United States, total. One of the reasons we have a high rate of inflation today is because we have a rate of monetary growth that has doubled the rate of GNP. No other country in the world has done that without experiencing the effect of inflation that follows it. So there is a limited pool which can be increased only by increasing inflationary pressures.

As a matter of fact, we are nearer industrial capacity than the total number of jobs in our society will diminish, unless we have an increased investment in productive capacity, in plant, capital and equipment. I am not talking about energy now.

To the extent that energy development or energy conservation absorbs capital, there is less capital available for alternative investment. It is quite unlike saying it doesn't inhibit their ability to make an investment. It either reduces their ability to make the investment, or it increases the demand for capital markets that will drive interest rates up which will lead to an expanded monetary policy which will lead to inflation which again causes economic problems, including unemployment problems. That is the context in which I asked the question.

Mr. Alm. I think my original answer focused too narrowly on conservation. There is no doubt that with the type of energy investments that are projected, and some estimates are up to a trillion dollars of energy investment by 1985, that there will be a significant impact on total capital markets. I don't have a good answer now. One part of the analysis that will underly the next national energy plan will be an analysis of total investment requirements.

The Department of Energy alone is not fully competent to draw all of the monetary implications of that investment. But the information will be available to the Council of Economic Advisers, the Federal Reserve Board, and the Congress to draw whatever policy implications that would derive from such policy.

Senator McClure. I would just comment, the best data I have been able to develop over the past several years in deciding the energy question is that the energy investment requirements for the Western industrialized world between now and 1985 exceeds $1.5 trillion. If we don't meet it, we will see a declining standard of living, and political pressures, and perhaps political change resulting from it.

Representative Heckler. I am very concerned about the contradictions. The President's energy proposal and some of the analysis which have been recommended on the Hill by DRI and the Wharton School and Chase Econometrics—the President does say that the energy plan would increase employment. He assumes that all investment spending would be expanded, would produce expanded capacity in hiring.

However, isn't it true that coal conversion would be a diversion of the funds from the steel mill modernization, from all plants in newer parts of the country, as well as that plus the tax implications of the energy bill will potentially reduce production and make us less competitive abroad by increasing costs?

So there seems to be a genuine difference of very, very serious consequences in terms of payment activity of energy policy on employment. On the one hand one group of economists asserts that this will be diversion of existing funds. On the other hand, the President, your administration asserts that this will produce new investment in plant and capacity and new employment opportunities.

How do you reconcile this?

Mr. ALM. I have studied all of the various projections and what has impressed me is how amazingly close they all came. The figure that the administration developed as compared to the DRI is almost in the range of statistical error. The fact is that the energy plan has very little impact on employment either way. The analysis, using different assumptions, show either a slight positive impact or a slight negative impact.

The reasons are, for example, the crude oil utilization tax would be fully rebated under the President's program. There would be no change in total disposable income in the society, only a slight redistribution. It is true that because so many programs are tied to the Consumer Price Index there is a mild inflationary impact just because of the way we keep our books. For example, labor contracts are often tied to the CPI. So there is a mild inflationary impact.

In terms of investment, you mentioned the coal conversion program. Most of the investment in coal would be in new facilities, not conversion of existing facilities. In the utility rate reform part of the original plan there would have been a reduction in investment, because utility loads would be stabilized somewhat, which would have reduced investment in peak facilities.

Senator McClure probably has said that some of those issues are questionable. There was a great deal of debate in the Senate and a somewhat different bill came out. But I think the bill that came out is a good bill and will have some impacts.

Senator McCLURE. But the net impact would be an increase in production costs and we are not talking at all about the environmental effect of massive coal conversion which I have not seen analyzed. I am sure they are being conducted but they aren't public. We are not at all aware of any environmental tradeoffs in this coal conversion program.

But isn't it true that the energy program itself must of necessity increase production costs which can have a negative impact and usually does in terms of employment?

Mr. ALM. The impact in cost from the initial energy plan was, as I recall, in the range of 1 percent or thereabouts over a number of years. In terms of the impact of inflation, first, from the crude oil and the indexing impact, and, second, from cost increases arising from oil and gas user taxes—I think it is amazing that the economic impacts are so small from such a comprehensive program.

I did want to comment on the environmental impacts. There has been a number of studies on the environmental impacts of the energy program, which have been made public. I will be glad to send them to you. The President appointed a blue ribbon panel to look at the environmental impacts, as are promised in the plan. That panel report was issued by the Department of Health, Education, and Welfare. The report concluded that, with the use of environmental controls required by the Clean Air Act, the environmental impact would not be severe.

Representative HECKLER. I will say, Mr. Alm, I am encouraged by some aspects of your testimony and the very fact that you are embarking on an evaluation of employment implications of the program is encouraging to me. The fact that it is done in conjunction with the Bureau of Labor Statistics proceeding in the usual order—I would hope that your forecast would be based on measurement tools that are more accurate for today's economy and society than the current method of acquiring unemployment statistics.

Just recently in Massachusetts, last year, we had a benchmarking of our unemployment statistics which were completely revised, and before this committee we have heard repeated affirmations of the inadequacy and outdated methods used in the collection of unemployment statistics. That is a pervasive problem. I would say that, therefore, any new study in which you would be involved would be based on current measurement tools that would be representative of the best thinking and ability of this society.

I am concerned, however, that you are looking into the regional activities and hope to assemble county level data, while counties are not relevant, nevertheless employment data is desperately needed.

Again, the shortcomings of the whole methodology of collecting unemployment figures is further increased by the fact that we have very inadequate statistics for the cost of employment controls around the country, and specifically on a regional basis. If there is any one area where the glaring weaknesses of our system become apparent to any Member of Congress, it is this area where we are attempting to count unemployed people, especially young, college-educated, or masters degree recipients and Ph. D.'s that cannot find job opportunities.

If we can have tools for assessing employment consequences in the energy program updated, our pathetic present system of forecasting employment opportunities, and on a regional basis perhaps given a 5-year forecast on the short range, we would be serving the whole society. I hope you will undertake the general problem of employment and its consequences in energy policy with the kind of narrow perspective as well as the long range view that is needed.

Mr. ALM. You have given us good counsel and we will follow it.

Senator KENNEDY. We will have the Secretary of Labor here tomorrow who will comment on these issues. I think Secretary Marshall has been very much concerned about the inadequacy of the formulation of unemployment statistics, measuring unemployment and being a real reflection of where these statistics are, as Congresswoman Heckler has stated.

I think we will be glad to indicate to the Secretary that he may comment on those matters tomorrow.

There was the establishment of a group to recommend to the Secretary 2 years ago more efficient and effective ways of dealing with this particular kind of an issue. This has been something that has been of concern to many of us. We are glad to have you note our concern on this issue and hope you will—probably the Secretary will respond to some of those questions tomorrow.

We are delighted that you have been familiarized with the sentiment on this committee.

Senator McClure. I would like to add to that one other thing which I wanted to mention earlier when Ms. Cooper was testifying. I hope the Department, and all the departments of Government will become a little more sensitized to the fact that the Environmental Policy Act of Congress is a balanced act. It requires that the considerations must include the concerns about the political and social framework in which man finds himself, including whether or not he has a job.

Sometimes, whether Government willingly does it not, the courts will interpret that act to require that employment impacts be included in the environmental impact statement, and I think they should be. I think the law requires it.

I think that what the Congress said at the time that act was passed was that. It has been almost totally ignored, not only by this administration, but by past administrations. Not only by Government, but by various groups who are outside looking at the employment picture. They do not avail themselves of the tools which are there in that act to force evaluation of employment impact.

Senator Kennedy. These are going to be reviewed. One of the things that we have seen in terms of the materials made available to us is that actually the Fortune 500 which had received the greater benefit, for example, on investment credits with a clear idea of increasing employment for a period of the past 9 years has seen a total increase of 0.15 percent. The second 500 has seen 2.5 percent, and small businesses have actually increased employment 14 percent. So we start talking about capital and investment and all of the rest. We have to do a good deal more thinking about it. That isn't where you are in terms of our hearing this morning, but these are obviously factors.

Thank you very much.

Next we will have a panel, Mr. James Benson, economist for the Council on Economic Priorities in New York; Mr. Duane Chapman, associate professor of resource economics at Cornell University and visiting professor at the University of California at Berkeley; and Mr. Bruce Hannon, associate professor and director of the Energy Research Group of the Center for Advanced Computation, University of Illinois.

Mr. Benson, would you lead off, please.

STATEMENT OF JAMES W. BENSON, PROJECT DIRECTOR, COUNCIL ON ECONOMIC PRIORITIES, NEW YORK, N.Y.

Mr. Benson. Thank you. I appreciate the opportunity of being here and giving some preliminary results of a year-long study that I have been engaged in with the Council on Economic Priorities. I would like to point out I am not an economist. I have degrees in geology and urban planning with about 6 years of experience in systems and energy analysis.

Just very briefly, to summarize the prepared statement I brought with me today, in comparing a package of conservation and solar energy measures with a total cost of $6 billion for a regional area, we have found that three times as many jobs would be created than for nuclear. Roughly 30 jobs per million dollars invested for conservation and solar compared to 10 jobs per million dollars invested in nuclear power. That same package would provide about twice as much energy to the end users as would the nuclear option. Energy produced through solar and conservation is 1.8 quadrillion Btu's as compared to 0.8 quadrillion Btu's for nuclear power.

I might also point out a most important finding. The employment created is locally based and it is where the poor and unemployed need the employment the most.

I would like to describe very briefly the study we are engaged in. It is a year-long study concerning the Long Island region, which consists of approximately 900,000 households. We are studying two proposed nuclear plants of 1,150 megawatts. We are comparing three solar energy measures, 30 conservation measures, and 12 improved appliances as outlined by the Federal Energy Administration. The results will be released in June. We will construct scenarios which will show year-by-year energy savings for each of the solar energy and conservation measures, the amount and type of labor required for construction of a nuclear powerplant, and the conservation and solar measures, the economic costs and other parameters.

The statement I am giving is on my own behalf and not on behalf of the council. Our findings are just coming in. They are somewhat preliminary. I have submitted a 20-page prepared statement and I will now go through and summarize some of the major conclusions.

The prepared statement that I brought with me is consumer oriented in that we are examining the whole system cost, from the construction of a powerplant all the way through to supplying energy to the end users in the form of hot air to heat houses and hot water at the tap. It is very important to stress that it is the whole system cost which must be looked at and not just how much it costs to build plants.

This testimony does not include the indirect and induced employment that is required to manufacture materials—that which comes forth through the economic multiplier effect. This testimony presents the direct employment required for manufacturing the materials and goods that go into the plant, but not all of the supporting industries throughout the economy. However, that will be covered in our final study in June.

For this package of three conservation measures which consist of insulating attics, insulating rooms, installing storm windows and supplying hot water through solar, approximately 178,000 jobs would be created over a 30-year period compared to the 72,000 jobs created by nuclear power and the construction, operation, and maintenance.

The cost for the two options would be $6 billion for 960,000 packages of conservation and solar compared to $7 billion for the nuclear powerplants. This includes the cost of construction, transmission and distribution, overhead, 20 percent reserve margin, and other things. We tried to take into account the entire cost from the meter to the hot water itself. On an overall average the cost of energy with the conservation and solar package comes to $1.22 per million Btu for a homeowner. Homeowners paying for electricity on Long Island now pay 6 cents per kilowatt hour. The savings are tremendous.

The same package which costs $6 billion for conservation and solar will result in an overall energy savings of 6 cents per kilowatt hour, or $32 billion over a 30-year period. The $7 billion investment in nuclear powerplants, paid for at the 6 cents per kilowatt hour results in a cost to the households of $17 billion.

One of the most important aspects we are looking at in more detail is the effect of these households paying $17 billion to utility companies. The money then flows into large financial institutions where it is reinvested in other projects in society, usually very large ones.

In comparison with the conservation and solar scenarios, there is a savings in energy per household which result in disposable income being increased by a net amount of $26 billion. That means those homeowners make the decision on how to spend that additional $26 billion which has been released through conservation and solar energy, rather than paying out $17 billion to the utility company. This reinforces the argument we are hearing more often about, democracy—about democratic considerations related to the difference of energy supply technologies, to social equity. Who is making the decisions and how is the money spent? Much of this $26 billion will be spent by households in the local economy. It seems only logical that local, small businesses and the regional economy itself is going to be stimulated much more directly than having the $17 billion flow out of the regional economy through the utilities, to pay for nuclear powerplants.

In the type of jobs we are looking at, there is a large difference in constructing a nuclear powerplant and installing conservation and solar. Most of the construction work is done over a 7 year period and much of it is fairly specialized, many workers are imported from other parts of the country.

Conservation and solar require small businesses in the regional economy to supply not only the material but also the manpower to install and maintain this equipment over the life of the equipment itself. We are examining types of labor where it is needed the most, and that is in the building trades where the highest unemployment exists now; for carpenters, plumbers, sheet metal workers, and so forth. That is where unemployment is highest and that is where conservation and solar creates jobs.

There is a fortuitous linking of more jobs being created plus being created at the skill level where jobs are most needed. This brings up some major issues; when you discuss whole systems and energy savings. I would like to run through several issues very quickly.

First, there are existing, large subsidies to other sources of energy, especially nuclear power. The nuclear industry is constantly asking for more subsidies. The breeder reactor is a good example of more and more money being taken from the taxpayer and put into a reactor which almost by every economic study shows it won't pan out as originally thought.

Solar and conservation have no incentive, no support at all. Yet in spite of this people are still trying to conserve using their own money in addition to paying out higher taxes for energy supplies that in most part they don't want and don't need.

I would also like to point out very briefly that there is a national security consideration here. As we go to larger and larger energy sup-

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ply systems, especially to the concept of energy parks where 10 or more powerplants could be co-located together, there are serious implications for national security. It is a further concentration and centralization and makes our entire energy supply more vulnerable. It does not require much to knock out a major energy park. But with conservation and solar, the energy system is dispersed, and increases national security.

Second, spreading nuclear power in developing countries and other nations around the world does in fact lead to increased weapons proliferation, upsetting the international balance of power, because it gives small countries access to nuclear material.

I would also like to point out that solar and conservation are supported by environmental groups around the country, such as the Environment for Full Employment. They understand fully the link between protecting the environment and increased jobs. They have been working hard to support the Humphrey-Hawkins bill and the Labor Reform Act.

The final example I would like to give is that of the way we have been doing business in the past. We tend to concentrate on projects such as urban renewal—or urban removal as it is sometimes called—this example consists of building new buildings in urban areas in order to stimulate the economy. What happens is the poor are driven out. The high rises go up. The poor have to leave to find other dwellings. The new buildings are energy inefficient and require massive amounts of electricity.

I recommend very strongly that instead of that, money be transferred directly from capital intensive programs directly to the poor so they can rebuild and renovate the buildings in the inner cities, own the dwellings themselves, acquire a trade while learning conservation and installing solar energy on their own places. This approach will strengthen the local economy. It will save the environment because of conservation and solar energy. It is less expensive, requires no new taxes and creates more jobs.

There is a lot to say and too little time. I will stop here and answer any questions.

Senator KENNEDY. I think we best hear from the panel. The only thing is maybe you can just run through that chart.

Mr. BENSON. I would be happy to. Over on the left, under "on-site man-years," we have three types of labor. One category is what we call on-site man-years; that is the labor required in the locality to construct or install solar conservation or the nuclear power plant. In other words, these are the real jobs, on the spot.

There is a very large difference, 75,000 jobs created for this package for solar and conservation compared to 32,000 jobs for nuclear powerplant construction. The second category is called direct manufacturing. These jobs result from the fabrication and manufacturing of materials that go into the different packages. For example, the installation of concrete, the reinforcing steel, and so forth.

There is quite a difference, 36,000 compared to 12,000 for nuclear.

The third category is labor spread out over a long number of years, and that is for operation and maintenance for nuclear facilities and so forth—67,000 for conservation/solar versus 28,000 for nuclear.

The middle category is direct manufacturing and is often spread out through the economy. The local economy is on the left, the national in the center, and then back to the spread over a number of years for the operation and maintenance category.

[The prepared statement of Mr. Benson, together with the chart referred to, follows:]

PREPARED STATEMENT OF JAMES W. BENSON

My name is James W. Benson. I am Project Director at the Council on Economic Priorities located at 84 Fifth Avenue in New York City, 10011. The Council is a non-profit research organization supported by foundation and government grants. For the past twelve months, I have directed the Jobs study of the Council. Results of the CEP Jobs study are scheduled for release in June. Preliminary results are just beginning to emerge and cannot be quoted at this time. For this testimony, I have performed independent calculations and will speak on my own behalf.

The Jobs Study was designed to provide a detailed analysis of on-site, direct, indirect and induced employment, cost and amount of energy supply/savings for conservation, nuclear and solar technologies. Findings will indicate the type, amount and timing of labor requirements. Energy supply and savings will be calculated for electricity, gas and oil. Capital costs for approximately 30 conservation measures, a twin 1150 MW PWR nuclear plant, 12 improved appliances and 3 solar energy measures will be provided. Scenarios are being constructed which will involve retro-fits and new construction for residential and non-residential buildings over a thirty year period. Results will be given for both the Long Island region and for the nation.

Results of the CEP Jobs Study study will be released later in the year. Preliminary results are just beginning to emerge and cannot be quoted at this time. For this testimony, I will speak on my own behalf and discuss major issues in the energy/employment area, the need for values to be considered, preliminary calculations I have performed and other recent studies related to this issue.

PART I

As requested by the Chairman, much of my testimony will deal with energy conservation, employment and costs. All of this information is presented in quantitative form. Unfortunately, too many members of our society have been trained to respond to quantitative considerations more comfortably than to qualitative considerations. The numbers I discuss have no meaning in and of themselves. What is more important is the context in which these numbers reside.

Dealing exclusively with numbers leads to decision which can be stated in quantitative terms. For example I example I have found that solar and conservation do indeed result in more employment per dollar spent than nuclear. So what? If our leaders continue following existing decision making methods, they will continue to treat symtoms rather than treat the cause. As long as our leaders continue to follow the path of least political resistance our wants will continue to be called needs.

The issues we are discussing here today are fundamental to society. While it is a truism that everything is related to everything else, and everything affects and is affected by everything else, energy is the center from which the web of the universe radiates. Energy (and employment) cannot be examined without getting involved in the most fundamental assumptions about the values and the workings of our society. It is challenging and provides the ultimate regard; to openly explore the basis of our social and physical existence.

How is this related to a hearing of the Joint Economic Committee of the Congress of the United States? Members of this committee vote on issues in a manner which results in their re-election (they hope). Economics is an arbitrary system for the allocation of material wealth and power which various interest groups try to control in such a way that the system will favor them. History is the documentation of the manipulation of the economic system for the benefit of the wealthy minority. It is not necessary to cite examples of economic catastrophes caused by greed nor the failure of the once much vaunted trickle-down theory in which the poor would move to the middle class as a natural result of economic growth.

The poor have continued to become poorer and minorities suffer ever greater proportions of unemployment.

There was once a time when most citizens of this nation were proud of being citizens. There were clear and positive visions and myths which enabled them to joyfully sing "American the Beautiful" and our national anthem without looking down at the ground out of embarrassment. Our great dreams and hopes have been entirely replaced by the pursuit of economic growth. Economic growth is held by many to be a necessary prerequisite to the functioning of democracy. It is claimed that more growth will create more jobs, make the poor rich, keep us ahead of the communists, lower the crime rate, ensure increasing material affluence.

Even this, the last of the great myths, is rapidly being seen for the fraud that is it. We have entered a new era in the unfolding of the history of this planet. The global population and corresponding "wants" exceed the capacity of the planet to survive even the "demands" of today. For energy, resource and environmental reasons which have been well documented elsewhere, the consumption of goods will soon begin a permanent decline, with short term shifts and expansions taking place in a few parts of the globe.

Another myth which has faded is that of the technological fix. If we spend more money we will develop new technology to get around the latest warning our Mother Earth has given. Man has always triumphed over Nature with technological progress. We can overcome all of these problems. Or can we? A close examination of modern technological progress will show that it is this very "progress" which has so rapidly caused us to deplete resources, foul the environment, start a cancer epidemic and dull the minds and quell the spirit of the two most recent generations through exposure to commercial mass media.

It is the single-minded pursuit of ever greater profits (mainly through the exploitation of Nature) combined with the economic ploy of "productivity" and the myth of a free market that is the root of the problem. Counting only dollars as profit causes the private sector to count wages and salaries as costs in the universally used cost/ benefit test of all decisions. The thousands of private sector daily decisions which minimize costs leads to massive and structural unemployment. Political influence buys business loopholes such as the investment credit which is responsible for disemploying large numbers of workers.

The public sector rightfully sees employment as a societal good. This direct conflict of values illustrates the failing of the present value system and is at the heart of industrial societies. Business cuts costs by reducing employment, cuts cost by shifting them to the public (eg. dumping its known carcinogens into drinking water supplies), by manufacturing ever cheaper merchandise while touting it as the best through advertising and the mass media.

Corporations become larger. Political influence increases. Their actions have ever larger impacts upon our lives. We are forced to demand protection and redress through the only channel we think is available: the federal government. As industry and technology grow, as their impacts grow, so grows the government. As it grows it becomes more inefficient and inconsistent in its policies and all but the most wealthy are squeezed. Squeezed out of jobs, squeezed into inhumanly, boring jobs, squeezed as tax-payers to pay the cost of the government to clean up after industry, squeezed by crime, uncertainly and ever present advertising.

It is time to step back and take a fresh look at the overall state of our nation. We import half of all our oil. We now claim to be dependent on the economies of Japan and Germany. The Mid-East could blow up any day. We could suffer a real and lasting embargo, our currency could collapse, a nuclear plant could melt down, someone could steal a few more pounds of plutonium and ransom a nation. We are beginning a race to arm space. There is no improvement in our slipping human rights, right here in the U.S. Talk to a Native American who had to go to Geneva to ask for help.

The solution to our problems does not lie entirely in numbers. Nor in legislation. Especially not in more growth of business and technology. We are engaged in the game of life, characterized by playing by our own rules, hoping that those who suffer will not suffer to the point of rising up and upsetting the game. It is time for a new universal rule. We can win only by all playing the game of the whole. We must learn to think in terms of the whole interrelated system of rocks, plants, water, air, animals, feelings, friends, right livelihood, simplicity, selflessness.

Our condition cannot improve until we examine our values and acquire a new set which leads to peace and harmony with all people and all aspects of our fragile life support system. This new set of values will recognize that small businesses create more jobs than large businesses. That small, appropriately designed technology is safer, cleaner and results in more jobs. That constant pursuit of material goods and status lead to uclers, murder and worse. Life can be full, light, friendly, deeply rewarding through a shedding of the heavy load acquired during the reign of our old myths.

The military and utility sectors create less jobs per dollar than solar and conservation. Bigger technologies such as Trident submarines and nuclear plants increase our vulnerability. Dispersed defense mechanisms and dispersed small scale energy systems improve our defense. Small renewable energy technologies are cheaper from a whole-system view and conserve depleting resources leaving material for developing countries. Smaller systems can be better understood by the public. Democracy requires an informed and participatory citizenry, but the scale and complexity of technology, business and government exclude the public from participating. Solar and conservation technologies lessen our reliance on imports. Their use creates local jobs in greater proportion than large systems. The type of labor required corresponds best to the skills of those out of work.

Upon combining new values with these technological considerations, it can be seen that the strength and sustainability of the nation can be increased by lessening energy and resource consumption and by shifting money from the military-industrial complex into community projects. One such project is to revitalize inner cities. Not through urban removal, but by transferring money which would have gone to capital intensive aerospace industries and utilities directly to inner city residents to acquire old buildings in need of repair.

The poor and unemployed would learn new skills or use unemployed skills to insulate, re-finish and clean the old buildings and neighborhoods. Money would be used to install solar water heaters, solar space heat, wind machines, urban farming and other techniques which would lessen dependence upon large, remote institutions. After rehabilitation and upon moving in, the property would be maintained in good condition. This program would improve the environment, save energy, increase the local economic activity of small businesses, lower crime, increase pride and give hope to people and cities which seem to have been given up on long ago.

Without this type of integrated, consistent conceptualizing we will be doomed to an increasingly unfortunate future. If we do not change our ways soon, we will find that first one form of energy will be rationed, then another. Then something else will be rationed, perhaps water, then food. One by one we will find all aspects of life rationed and controlled. Controlled by what means and by whom?

It is those who continue to call for more growth, who continue to confuse the issues. It is they who lead us to a most unpleasant future of universal scarcity. Those who question growth as a national priority are contributing to a much needed public discussion of our fundamental goals. Those who peacefully occupy the sites of deadly technologies are patriots who are calling to our attention that certain aspects of technology and related institutions are out of control. They warn us that massive changes in our society are taking place, with little or no opportunity for the public to participate.

PART II

The following calculations for nuclear costs are based upon data from the Long Island Lighting Company (LILCO), the Nuclear Regulatory Commission and the Energy Research and Development Administration (ERDA). Direct employment figures were calculated using the Bureau of Labor Statistics (BLS) 1970 Input-Output matrix (134 sector). Conservation and solar specifications are preliminary. More detailed specifications are being developed for the Council on Economic Priorities Jobs study.

The two power plants consist of 1150 MW PWR nuclear reactors. The capacity factor is assumed to be 55 percent. Transmission losses are assumed to be 12 percent. Distribution losses have not been calculated for this example. A reserve margin of 20 percent is assumed. The tables which follow summarize cost and labor requirements for plant construction, transmission and distribution (T&D), utility company administration and overhead and nuclear fuel for 30 years.

Plant construction costs have been allocated to the appropriate industrial sectors of the BLS matrix. Direct employment was calculated as follows. Divide Domestic Output by Employment to obtain Total Output per Job. Output per Job was divided by expenditures per industrial sector. This produces the number of jobs per expenditure.

Domestic Output (Gross Duplicated Domestic Output) represents the total dollar output of each industrial sector minus all transfer imports, valued at port value. Employment represents the number of jobs within each industrial sector and includes wage and salary workers, self-employed individuals and unpaid family workers. The data and conventions were derived from The Structure of the U.S. Economy in 1980 and 1985 by the BLS.

For this example, a prototype single family detached home of 1500 square feet was used. The number of degree days for the region is assumed to be 5200. Attic insulation was increased from 2.5'' to 12''. The windows had a U value of 1.13 before and .56 after installation of storms. Wall insulation went from none to 3.25'' of foam. The solar system provides 70 percent of the hot water in the winter and 90 percent during the summer.

The same methodology was used for both the nuclear and the conservation and solar calculations. Materials expenditures were allocated to the BLS Input-Output sectors and direct employment was calculated. In both cases, indirect and induced employment have not been calculated. The Council's Jobs Study will calculate these effects.

The Council is currently developing detailed design and performance data for approximately 30 conservation measures, 12 home appliances and 3 solar energy systems. These data will be available upon release of the final report.

Insulate walls:
- Materials BLS I/O code, 44.
- Homeowner expenditure (1963 $), $180.
- Domestic output (millions $), 10,611.
- Employment (000s), 294.
- Dollars per man-year, 36,092.
- Man years, .004987.

Note: All $ below are 1976.
- 1911 square feet of insulation.
- 38 hours of on-site labor (.0226 man years).
- $470 for installation.
- $420 for materials.
- $890 total cost to end-user.
- 23.9×10^6 BTUs saved per year.
- 26.6×10^6 BTU displaced at average efficiency of 90 percent.
- $468 saved each year at $.06/Kwhr.
- 798×10^6 BTU's displaced over 30 year life.
- $890 total cost to end-user (no depreciation and maintenance).
- $1.11 per million BTU (insulation).
- $19.55 per million BTU ($.06 Kwhr minus 10 percent loss).
- 53 percent return on investment.

Insulate attic:
- Materials BLS I/O code, 48.
- Homeowner expenditure (1963 $), $78.56.
- Domestic output (millions $), 3554.
- Employment (000s), 178.
- Dollars per man year, 19,966.
- Man years, .003935.

Note: All $ below are in 1976.
- 1000 square feet of fiberglass insulation.
- 24 hours on-site labor (.0143 man years).

$296 for installation.
$172 for materials.
$468 total cost to end-user.
9.3×10^6 BTUs saved per year (1.7×10^6) summer $+7.6\times10^6$ winter).
10.3×10^6 BTU's displaced at average of 90 percent efficiency.
$182 saved each year at $.06/Kwhr.
309×10^6 BTUs displaced over 30 year period.
$468 total cost to end-user (no depreciation and maintenance).
$1.51 per million BTU (insulation).
$19.55 per million BTU ($.06/Kwhr minus 10 percent loss).
39 percent return on investment.

Storm Windows:
Materials BLS I/O code, 60.
Homeowners expenditure (1963 $), $73.72.
Domestic output (millions $), 10,157.
Employment (000s), 434.
Dollars of output/job, 23,403.
Man-years, .00315.

Note: All $ below are 1976.
188 square feet of aluminum triple track storm windows.
9 hours on-site labor (.00536 man years).
$100 for installation.
$225 for materials.
$325 total cost to end-user.
12.9×10^6 BTU's saved per year (12.2×10^6 winter $+.7\times10^6$ summer).
14.3×10^6 BTU's displaced in electric home with average 90 percent efficiency.
$252 saved each year at $.06 Kwhr.
430×6^6 BTU's displaced over 30 year life.
$520 total cost over 30 years with 2 percent depreciation and maintenance.
$1.21 per million BTU (storm windows).
$19.55 per million BTU ($.06 Kwhr minus 10 percent loss) at end-use.
74 percent return on investment.

SOLAR HOT WATER SYSTEM

Materials BLS I/O Code	Homeowner expenditure (1963 dollars)	Domestic output (millions)	Employment (thousands)	Dollars of output/job	Manyears
48	24.80	$3,554	178	19,966	0.001292
59	191.30	2,058	81	25,408	.007529
60	151.00	10,157	434	23,403	.006452
62	124.20	11,406	454	25,123	.004944
69	66.91	6,923	288	24,038	.002784
88	50.20	4,048	215	18,916	.002654
Total					.025655

Note: all $ below are 1976.
48 square feet of flat plate collector.
60 hours on-site labor (.0357 man years).
$821 for installation.
$1,315 for materials.
$2,136 total system cost to end-user.
10.72×10^6 BTU's produced at end-use per year.
11.28×10^6 BTU's of electricity displaced at 95 percent efficiency.
$198 saved each year at $.06/Kwhr.
338×10^6 BTU's displaced over 30 year life.
$4272 total cost over 20 years with 3.3 percent depreciation and maintenance .0636 man years maintenance.
$18.90 per million BTU (solar).
$18.52 per million BTU ($.06/Kwhr minus 5 percent loss) at end-use.
5 percent return on investment.

JAMESPORT NUCLEAR PLANTS

BLS I/O Code	LILCO expenditure [1963 dollars]	Total domestic output [millions of 1963 dollars]	Employment [thousands]	Dollars of output/job	Man-years created
14	35, 530, 305			31, 700	1, 120
23	20, 228	5, 410	132	40, 985	1
28	1, 164, 557	6, 164	298	20, 685	56
30	847, 384	2, 592	146	17, 753	48
31	480, 276	15, 724	481	32, 690	15
33	60, 035	12, 365	610	20, 271	3
34	444, 256	10, 361	563	18, 403	24
41	431, 797	2, 974	70	42, 486	10
42	595, 279	28, 156	191	147, 414	4
44	120, 650	10, 611	294	36, 092	3
46	151, 962	3, 866	186	20, 785	7
47	9, 178, 169	7, 118	291	24, 461	38
48	3, 477, 909	3, 554	178	19, 966	17
49	396, 554	21, 601	628	34, 397	12
50	467, 499	5, 966	296	20, 155	23
56	7, 299, 322	3, 818	99	38, 566	190
59	1, 451, 726	2, 058	81	25, 407	57
60	91, 935, 333	10, 157	434	23, 403	3, 928
62	441, 872	11, 406	454	25, 123	18
63	21, 630, 074	4, 176	110	37, 964	570
65	3, 899, 849	5, 625	205	27, 439	140
66	1, 432, 104	2, 420	92	26, 304	54
67	488, 418	6, 575	327	20, 107	24
68	1, 122, 323	4, 651	200	23, 255	48
69	37, 832, 102	6, 923	288	24, 038	1, 573
71	2, 687, 114	6, 830	233	29, 313	92
73	1, 323, 520	6, 549	148	44, 230	30
74	9, 925, 468	4, 532	204	22, 216	447
75	13, 467, 681	5, 130	217	23, 641	570
76	49, 301	6, 557	184	35, 636	1
77	3, 588, 213	4, 273	200	21, 365	170
79	10, 156	3, 737	163	22, 926	0
80	237, 343	9, 063	337	26, 893	9
82	124, 160	3, 108	117	26, 564	5
88	14, 295, 087	4, 048	214	18, 916	756
89	128, 666	1, 830	84	21, 787	6
91	84, 000	4, 078	112	36, 411	2
92	132, 076	8, 871	449	19, 757	7
93	1, 895, 986	12, 744	627	20, 325	93
95	2, 875, 963	17, 383	1, 259	13, 807	208
96	2, 195, 527	4, 344	219	19, 836	111
99	637, 241	24, 593	990	24, 563	26
104	14, 912, 967	69, 681	4, 098	69, 681	877
105	5, 427, 061	96, 066	13, 470	96, 966	761
Total direct man-years					12, 129

Note: All $ below are 1976.

1150 MW PWR nuclear reactors (2).

$2.76 billion for plant construction.

39,310,000 man-hours of engineering, on-site construction labor, utility company project management, start up and test.

$.55 billion for 20 percent reserve margin.

7,862,000 man-hours calculated from above construction costs.

$.37 billion for construction of transmission and distribution facilities (based on Long Island Lighting Company marginal system requirements).

6,750,000 man-hours of engineering, on-site construction, utility company project management and administration.

$.56 billion for operation and maintenance of plant and T & D system for 30 years of operation.

6,550,000 man-hours for O & M personnel.

$.65 billion for utility company administrative and overhead costs associated with electric production, operation and maintenance of 2300 MW system for 30 years.

18,160,000 man-hours for utility company personnel including executive and legal staff, management and support staff.

$1.96 billion for nuclear fuel supply for 2300 MW operating at 55 percent capacity factor for 30 years.

21,823,000 man-hours for mining, milling, conversion, enrichment, transportation of fuel required during 30 years.

Subtotals:

$3.68 billion for construction reserve, transmission and distribution 53,922,000 man-hours of labor.

$3.17 billion for operation and maintenance, utility company overhead and fuel supply—all for a 30 year period.

46,533,000 man-hours of labor.

Total:

$6.85 billion dollars.

100,455,000 man-hours (59,790 man-years at 1680 hrs/yr).

20,368,300 man-hours from manufacture of materials (12,124 man-years).

Comparison

The nuclear plants cost $3.68 billion for construction reserve, transmission, and distribution. The total number of man-years required for this is 38,920 (on-site plus direct). Divide this cost by $3,819 for the conservation/solar package (storms, $325; walls, $890; attic, $468; solar, $2,136), giving 963,600 packages resulting in equal costs for the two cases. To put this into perspective there will be approximately the same number of households in the Nassua/Suffolk region during the next three decades.

The conservation/solar packages have the following characteristics in comparison to the nuclear case:

75,120—vs.—32,100—on-site man-years.

36,350—vs.—12,124—direct manufacturing.

66,880—vs.—27,000—portions and maintenance.

178,350—vs.—71,924=250 percent more employment for conservation/solar.

1.81×10^{15} BTUs at end use saved by package over 30 years.

$.88 \times 10^{15}$ BTUs at end use (55 percent capacity factor, 12 percent transmission loss, 90 percent efficiency).

206 percent more energy from conservation/solar.

Conservation/solar costs:

$5.9 billion over 30 year, total, including maintenance.

1.81×10^{15} BTUs saved over 30 years ($31.8 billion saved at 3,26 million BTUs $.06/kWh).

$33,100 per man-year (30.2 man-years per million dollars).

Conservation:

$1.80 billion total.

1.48×10^{15} BTUs over 30 years ($26 billion saved at $.06/kWh).

$1.22 per million BTUs.

$31,100 per man-year (32.2 man-years per million dollars).

Solar:

$4.11 billion total including maintenance.

$.33 \times 10^{15}$ BTUs over 30 years ($5.8 billion saved at $.06/kWh).

$12.45 per million BTUs.

$34,100 per man-year (29.3 man-years per million dollars).

Nuclear:

$6.8 billion excluding full insurance, R&D, regulation, waste disposal, decommissioning, health effects, etc.

$.88 \times 10^{15}$ BTU over 30 years ($17 billion spent at $.06kWh at the meter).

$17.60 per million BTU (at the meter).

$102,100 per man year (9.8 man-years per million dollars).

The Northeast suffers from high unemployment, high fuel rates and a paucity of domestic fossil fuels. Two simple options are presented here. One option consists of supplying electricity from nuclear plants. The direct cost of this option is very conservatively estimated to be about $7 billion, excluding many hidden and subsidized costs. At $.06/kWh, users would pay out $17 billion over the thirty year period, to the utility company. This rate is being charged customers of LILCO with the rate for Con Ed near $.075/kWh. Rate increases are a constant feature these days, so $.06/kWh will prove to be a low estimate over the next three decades.

With the conservation/solar option, the direct cost would be about $6 billion. Twice as much energy would be made available for end-use. Under this option however, households would save about $32 billion at $.06/kWh. The net dollar transaction would provide $26 billion in additional disposable income ($32–6 billion). Some of this would be saved, some spent, thereby stimulating the local economy and producing an even greater requirement for employment. (The Council's study will examine this effect on a year-by-year basis).

The Council presently has under consideration a study which would compare the flow of money under the two options. Questions to be asked are: Who pays the $17 billion? How much money stays in the local economy? How much goes to centralized institutions such as banks and insurance companies? How are the recipients related to the planning, design, construction and financing of the nuclear facilities? Similar questions would be asked for the other option, but it is expected that a small proportion would flow directly to the largest institutions, with most money remaining in the local economy. What would households do with the new savings of $26 billion? What effect would this have on the economy and upon unemployment?

CONCLUSIONS

1. Of the four categories (conservation, conservation/solar, solar, and nuclear) considered in this example, conservation provides energy for the least cost. Utilization of conservation creates more jobs than the other options. Disposable income is greatest with conservation.
2. Conservation and solar reduce non-renewable energy consumption, reduce resource use, reduce air and water pollution, reduce carbon dioxide release, reduce carcinogen release, reduce radiation induced cancer.
3. Conservation and solar contribute directly to increased national security through decreased imports and decreased reliance upon large, expensive centralized systems which are prone to sabotage, disruption and self-destruction.
4. A program which directly transferred spending for the proposed 200 new nuclear plants to conservation for all homes would cost half as much while producing full employment.
5. Such a program would permanently lessen inflationary pressures because a shift to renewables moves the economy partially away from increasingly expensive energy (caused by scarcity through depletion).

RECOMMENDATIONS

1. All new dwelling units be required to be constructed so that no active systems are needed for space and water heating.
2. All new non-residential buildings be required to be constructed so that no non-renewable resources be needed to supply heat and hot water.
3. All existing structures be re-insulated to reduce energy consumption by more than half.
4. The expenses for the above recommendations should be transferred from existing capital intensive programs (candidates include defense, space, and highway construction). This shift of expenditures would require no new taxes, would create more jobs and would decrease inflation.

FURTHER CONSIDERATIONS

The solar system in this example utilizes a copper based flat plate collector. As demand increases, plates may become non-metalic. This will result in cheaper collectors and a saving of resources, especially if the material used is a renewable substance such as paper (treated with plastic).

Active solar space heating systems should only be used to retro-fit existing buildings. All new construction should be required to be excruciatingly energy conserving in the first place and passively conditioned in the second place. Passive heating and cooling costs little or nothing in new buildings. It is as close as one can come to a free lunch. Heating needs which cannot be satisfied by conservation and passive design should be made up with active solar systems. No new buildings need be constructed after 1980 which require a non-renewable source of energy for any portion of heating. Only ignorance and political intransigence stand in the way of building zero energy buildings in all climate areas of the United States.

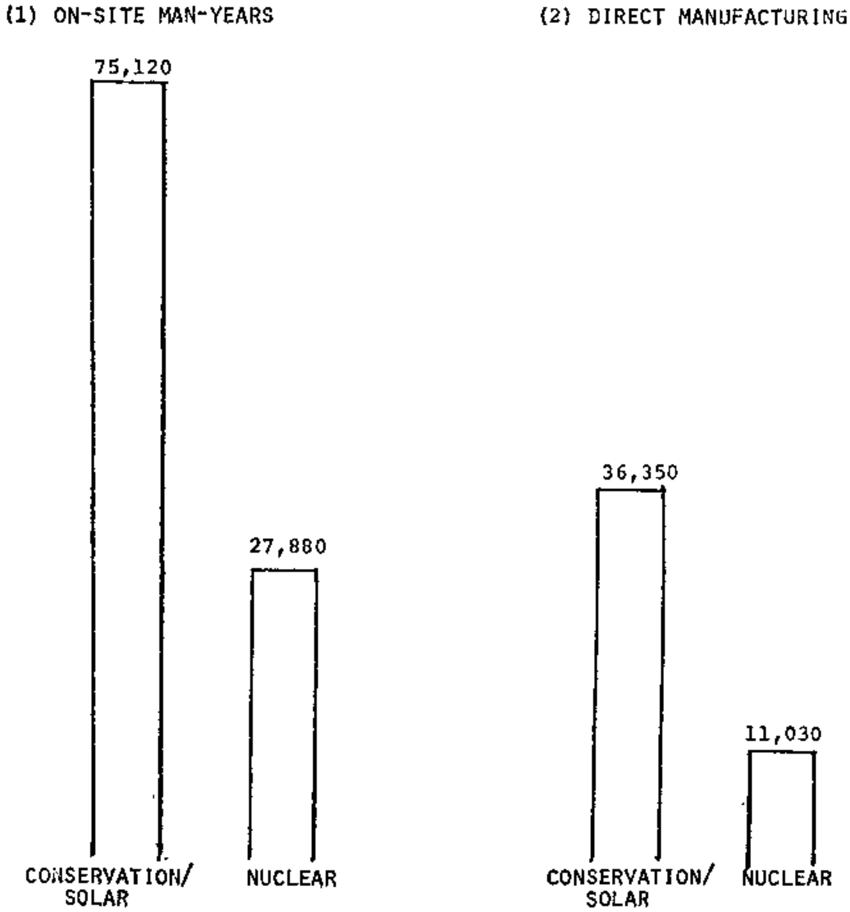
Training solar mechanics will be required. Several training programs are currently in existence. Some use CETA funds to train unemployed, one program on Long Island is sponsored by the Sheet Metal Workers local, for its members.

In this example I have not calculated this type of additional manpower requirements needed to support the solar industry, but the number will be significant. It will be calculated in the Councils' Jobs Study.

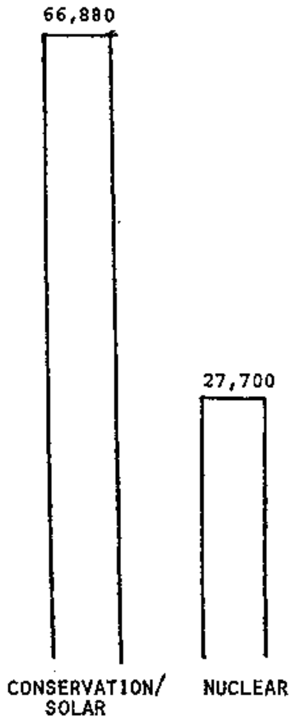
Some amount of work will be done by the home owner. This is especially true for measures such as insulating attics. Other measures require special skills or tools. The Jobs study scenario generator has the ability to accept and calculate a percentage of do-it-yourself for each of the 30 conservation and solar measures.

An examination of alternative energy options leads to policy issues of all types. One example is that of equity. Under the nuclear option, it is the utility company which decides upon the design, siting, and timing of nuclear facilities. Customers have little say in the decision making process. There is no competition, utilities are government created and maintained monopolies. Because they are so capital intensive, only the largest institutions can afford to finance their projects. Billions of dollars of customers' money flows through the utilities to the multinational corporations and banks. The wealthy few make the decisions about what type of projects to finance. With the conservation option, each household makes its own decision and spends money in the local economy, often with small businesses (which create more jobs than large businesses). This option is more equitable and produces plurality where the nuclear option further concentrates wealth and power (through the exercise of that wealth).

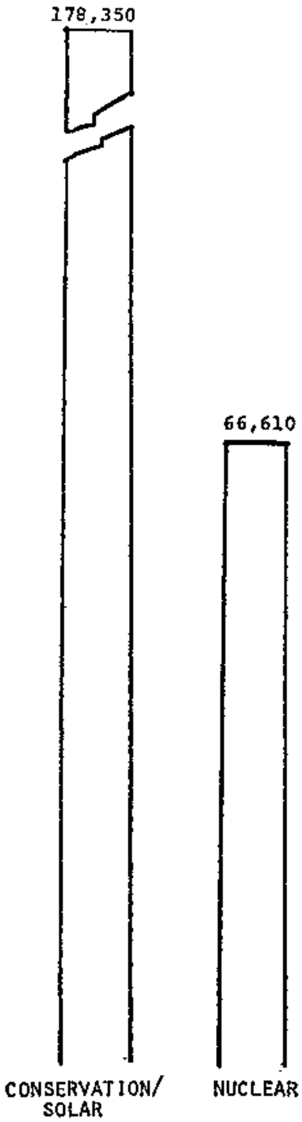
BENSON:
MANPOWER COMPARISON OF
NUCLEAR POWER PLANT,
LONG ISLAND, NEW YORK
TO A CONSERVATION/SOLAR EQUIVALENT



(3) OPERATION AND MAINTENANCE



(4) TOTAL MANPOWER REQUIREMENTS



Senator KENNEDY. Thank you, Mr. Benson. I will ask Mr. Chapman and then Mr. Hannon to give their presentations.

STATEMENT OF DUANE CHAPMAN, ASSOCIATE PROFESSOR OF RESOURCE ECONOMICS, DEPARTMENT OF AGRICULTURAL ECONOMICS, CORNELL UNIVERSITY, AND VISITING ASSOCIATE PROFESSOR, ENERGY AND RESOURCES PROGRAM, UNIVERSITY OF CALIFORNIA, BERKELEY

Mr. CHAPMAN. I was interested in the exchange between Senator McClure and Ms. Cooper on the present nature of the economy with respect to employment and energy. I think there are three or four points which ought to be major concerns with respect to the kind of paradox that exists at the present time.

First, I would like to point out that the current business recovery is very similar to the typical business cycle of the postwar period in the sense that it is related to energy production and use. Half of the increase in gross national product since the low point in 1974–75 has been in automobiles, residential and suburban construction. Sixty percent of the private investment in industry and transportation has been in energy production facilities or in industries that are major energy users. In 1977 we have seen a return to exponential growth in every kind of energy consumption except natural gas.

Second, inflation is itself concentrated in these sectors and both wholesale and consumer prices have risen most strongly in energy and in goods and services dependent on energy for manufacturing or consumption.

Third, unemployment, or perhaps I might say disemployment, has been greatest in these same activities. Those manufacturing sectors which are most energy intensive have seen the greatest loss of employment since 1973.

Finally, 1973 real median family income has essentially been unchanged. I believe for black families it is somewhat lower than in 1973.

My opinion is that the paradox of unemployment and recovery is in part related to energy production and use throughout the country. Inexpensive domestic energy sources are no longer widely available, and our ability to make use of inexpensive foreign sources of energy has been permanently altered. I think those statistics point to an indication of future strain on the economy which I think we all ought to give some thought to.

In my discussion this morning I want to focus on a single problem which is particularly related to those contradictory statistics. That is, the influence of our corporate and personal tax codes as they relate to energy consumption, energy prices, energy use, and employment.

Let's begin by noting that energy production industries are simply the most capital intensive industries in the economy. For example, gas and electric utilities will have on the order of $300,000 of investment per employee. Petroleum refining companies had $200,000, and mining and crude oil production, $115,000. The average for all industries taken from the same largest group of corporations was $40,000. So the three most capital intensive manufacturing industries that we have are energy industries. How are they affected by the principal tax structures?

Basically, with existing provisions for accelerated depreciation and the investment tax credit, there is no longer any net Federal-State income tax liability for revenue generated from the investment. In other words, if you were to take the credits which accumulate in the early years of a project's operation and put those credits in an account, and pay the taxes which accrue in later years, that account at the end of 30 years would end with a positive balance. That is essentially an abstract, theoretical finding, but I think we can see clear evidence that this is taking place for real corporations operating at the present time.

For example, Pacific Gas and Electric in California received a net refund in 1975 and 1976 for those very reasons. Southern California Edison will receive a net refund in 1977. In New York the plans of utilities in the State would coordinate and merge their construction plans based in part upon the desire to so allocate those tax credits that no utility in the State of New York will have a net income tax liability for the next 20 years. All of this is wholly legal and in fact there is a strong incentive to do so.

The executives and directors of utilities have an obligation both to their stockholders and their customers to use these tax provisions to minimize their tax burden. But I am concerned not about the motivation to do so but the economic implications for the economy and for the country. One of the problems which this causes is a serious underpricing of conventional energy resources thereby reducing the demand for renewable resources and for employment.

I would like to illustrate this point by referring you to table 2 of my prepared statement which has been distributed to you. This table summarizes an analysis of the corporate and personal income tax provisions which apply to energy production and consumption in California. In other words, for homeowners the interest expense on a heating system have also been considered, and local property taxes, and so on.

The first row shows costs in an environment in which there are no special deductions of any kind. Solar heating would be either competitive with or slightly less expensive than gas from Alaska—liquefied natural gas—or nuclear power as a source of home heating.

But when we look to the fourth row, when we are considering the present tax environment of energy sources, we see that the actual prices which homeowners pay are now such that solar heating is more costly. An important conclusion is that on a full-cost basis solar heating is competitive in Southern California. Yet any homeowner who would choose to install it would be clearly sacrificing a significant amount because the tax subsidies completely reverse the result of solar heating being preferable.

There is a similar kind of effect with respect to employment. Note, for example, that the social insurance cost incurred by taxes, not only social security but life insurance costs and so on, will add 30 percent to the wage payments an employer must make for each employee.

The cost of capital is reduced roughly about a third by the corporate tax subsidies cited previously. So the net effect is that labor is made more expensive and capital less expensive.

Available statistics on income distribution of the effect of these tax provisions are summarized in a later table. For the seven items which bear directly on the tax provisions, it is clear that they are disproportionately beneficial to upper income groups. Those persons having incomes greater than $50,000 received on the average $1,100 in reduced taxes. Those persons having incomes less than $20,000 received $10 in reduced taxes.

Senator KENNEDY. I would like you to get through your presentation, but can you tell me how that works?

How do you figure that one out? Maybe it is better off to continue. Maybe you can flag that and continue.

Mr. CHAPMAN. It is shown in table 6. This is a direct excerpt from the Treasury Department's statistics on the income distribution effect of income taxes.

The nature of the present tax proposals which are being presently considered are such that they will further distort the prices paid for finite and renewable energy, further distort the relative costs of labor and capital. Social security taxes increased 11 percent and are expected to increase 31 percent next year.

The kind of changes in the corporate tax code which you are considering include a reduction in the overall rate, and a further increase in the investment tax credit. The end result for the most capital intensive of industries which are specifically utilities and petroleum corporations is, in my opinion, essentially an introduction of a negative income tax program for these industries.

The kinds of reasons why these programs have been promoted is because they have real shortrun gains in terms of employment, building construction, and factory equipment manufacture. The income and that investment associated with construction and equipment manufacturing brings expansion to other kinds of business and consumer activities. This gain is very real.

I wish to emphasize to you that there is a very serious distortion in the long run which arises from these distortions of prices paid for energy, labor, and capital. Other witnesses on this panel discuss the relative employment requirements associated with the most capital-intensive kinds of energy technology compared to renewable technologies and conservation technologies.

I make some brief reference to relative employment in solar energy. My own statement summarizing other work concluded that the employment associated with solar heating in southern California is four times that associated with home heating through electricity.

In my own opinion, we should attempt to look at the requirements which are associated with full employment energy policy. It is necessary to permit and encourage growth in economic activities which would be clearly competitive with existing types of energy production and use, thereby resulting in lesser use of our energy resources, and increased use of less costly renewable resources and labor.

The kind of specific policies which may go in that direction I attempted to make some brief reference to. I think they include rail transportation. I think they include solar heating. I think they include either a revocation of the existing capital subsidies and pricing subsidies or else, and less desirably, an introduction of offsetting subsidies both to renewable energy resources as well as to employment.

[The prepared statement of Mr. Chapman follows:]

PREPARED STATEMENT OF DUANE CHAPMAN

Taxation, Energy Use, and Employment

SUMMARY

1. Present corporate income tax deductions and credits available to gas and electric utilities result in a negative or zero income tax for new investment.

2. Pricing subsidies to new high cost conventional energy sources encourage the inefficient growth in demand for such sources.

3. At present, the anticipated full cost of solar heating in Southern California is equivalent to, or less than, the cost of liquefied natural gas heating or nuclear powered electrical heating. However, present tax and pricing subsidies distort market prices so that new gas heating appears to be less costly.

4. Growth in solar heating and in public transportation would have net positive impact on employment and reduce inflationary pressure.

5. Social insurance costs and capital tax subsidies interact to make labor more costly and capital and energy less costly to business. The result is an inefficient use of excessive capital and energy and insufficient levels of employment.

6. Capital and energy tax subsidies are received primarily by persons with incomes in excess of $50,000.

7. The present business recovery is conventional in the sense that it is characterized by resumed exponential growth in energy consumption, increased expenditures on automobiles and residences, and investment in energy supply and energy intensive industries. Future adjustment is made more difficult.

8. Energy policies which would encourage full employment and renewable resource use include: revocation of existing capital tax subsidies; solar energy and employment tax credits; incremental cost rate schedules by utilities; energy excise taxes; and Federal activity in rail construction and operation.

1. Utilities and the end of tax liability

Under current provisions of the Internal Revenue Code, it appears that—in a present worth context—no electric or gas utility need anticipate a positive Federal/State income tax liability on revenue from new investment. Present deductions for interest expense, accelerated depreciation, and the investment tax credit appear sufficient to wholly offset the nominal 48 percent tax rate on net income in excess of $50,000.

A utility may raise 50 percent–55 percent of its new capital in debt. The interest expense deduction on debt is sizeable in early years of new plant operation.

Accelerated depreciation in an economic sense has two components. First, the tax life of a property may be considerably less than its actual expected life. For example, a nuclear power plant is expected to operate for 30 or 35 years, but its life for tax purposes may be 16 years. Depreciation methods such as double declining balance may double the rate of annual depreciation. Taken together, the short tax life and the accelerated depreciation methods provide significant deductions in early years. For example, normal straight line depreciation for a 30 year life would result in a first year's depreciation of 3.2 percent; accelerated depreciation provides a first year's deduction of 12.5 percent.

Normal straight line depreciation is usually used by companies and regulatory commissions as the basis for determining rates and profitability. However, for tax purposes, special accelerated depreciation accounting is appropriate.

The investment tax credit provides 10 percent or 11 percent of the value of a new investment as a direct credit against taxes.

Table 1, "Capital Tax Subsidies," illustrates the economic significance of these tax provisions. With no deductions or credits, a utility would use a 25 percent annual fixed rate on capital investment including an income tax component of 9.1 percent. The average charge to customers would be 1.7¢/KWH for income taxes. However, interest deductions lower this tax charge to 1¢/KWH, and accelerated depreciation and the investment tax credit eliminate the tax requirement.

If nuclear power were to cost 8¢/KWH delivered to the customer, interest deductions reduce this to 7.3¢/KWH, and the other capital subsidies reduce the price to 7¢/KWH.

Tax changes currently under consideration will apparently permit a negative income tax to be established for revenue from new investment. The last entry in Table 1 shows the possible effect of lowering the corporate tax rate to 44 percent, raising the investment tax credit to 12 percent, and excluding dividend payments from taxable income. The result appears to be that each kilowatt hour sold would lead to a net refund of 7/10 of a cent.

For this negative income tax to have maximum benefit, it needs to be applied to earned income from other sources. For example, an electric utility can shelter income from existing plants by claiming the credits and deductions arising from new plants.

A gas utility which does not have a construction program may be a valuable subsidiary of another company which generates tax losses in other areas such as real estate and agriculture (see "Report on Income Taxes Southern California Gas Company . . .").

It should be emphasized that these tax accounting methods are wholly lawful, and must be followed at present if the company is to provide minimum cost service to customers and minimum tax liability to share holders.

2. Taxing present customers for new uses

Average cost pricing is a general principle of utility and regulatory commission rate making although it is receiving increasing scrutiny by companies and commissions. Basically, it means that the high cost of new nuclear power, or of liquefied natural gas (LNG) from Alaska, is "averaged in" with low cost hydropower, or existing natural gas, or other energy sources.

Historically this promoted lower rates since prior to 1973, average cost pricing used the savings from low cost new plans and supplies to offset older, higher cost energy sources. However, in 1978 this principle provides a substantial subsidy to new, high cost energy.

Suppose with existing capital subsidies it would cost $4.60/million BTU to deliver 148 trillion BTU per year of LNG to Southern California customers. If this is "rolled in" with 810 trillion BTU of gas with a cost of $2/million BTU, then the $2.40/million BTU charged for all gas will mean that the Alaskan gas users receive a $2.20 subsidy on each million BTU.

The solution to this dilemma probably lies through some form of incremental cost rate schedule, and is generally applicable both to gas and electric utilities.

Average cost pricing also appears to be generally characterized of the petroleum industry where high cost oil from Alaska and the Middle East is "averaged in" with lower cost "old" domestic oil.

In each industry—electricity, natural gas, petroleum—average cost pricing and capital tax subsidies interact to stimulate growth in use by bringing about artificially low product prices.

Since present market energy prices are artificially lowered, these tax policies act to inhibit growth in renewable energy resource use.

3. Solar heating: Market cost and social cost

In Southern California today, it appears that solar space and water heating will be competitive with, or less expensive than, the unsubsidized costs of Alaskan gas or nuclear power which would be available in 1985. The major assumptions are (1) a cost of $5,000 for solar equipment and other design features on a new home, (2) nuclear power costing $1,000 per KW, and (3) capital cost for Alaskan gas for all facilities (including distribution) of $3.3 billion for 148 trillion BTU per year.

All values are in 1977 dollars.

The results are summarized in Table 2, "Annual Home Heating Costs." On a total cost basis without subsidies, solar heating shows a cost of $725 per year. This is competitive with Alaskan gas at $775, and nuclear powered home heating at $1,325.

However, the present system of tax and price subsidies result in a market situation where solar heating would cost $150 more per year than heating with Alaskan gas. The tax subsidies considered in this analysis include the California solar tax credit, the various personal income tax deductions as appropriate, and the corporate capital tax subsidies of accelerated depreciation, the investment tax credit, and Interest Expense deductions as discussed above.

The analysis is tentative in the sense that further review may revise particular numerical assumptions. However, I am certain that the qualitative conclusion reached here is correct: present tax and price subsidies promote the use of existing finite energy sources and retard growth in use in renewable energy sources in general and solar energy in particular.

4. Energy conservation and employment

Current research programs sponsored by the Department of Energy and elsewhere are deficient in their development of specific data on employment requirements for new energy technologies and conservation. While it is admittedly difficult to prepare employment analyses for those technologies which are presently nonexistent, such research is nevertheless essential in gauging the reaction of the national economy to growth in these new economic activities.

Table 3, "Employment, Electric Home Heating, and Solar Energy," summarizes estimates of employment associated with solar energy. It will be noted that providing home heating by solar energy appears to require more than four times the labor involved in the direct production of energy through coal mining and power generation. It seems unlikely to me that these statistics are reliably accurate. Actual employment arising from solar energy and power generation may be many multiples greater than the values shown here. The general point, however, seems correct: the use of solar energy resources probably requires significantly more employment than the finite energy technologies that it will displace.

Similar findings with respect to public transportation are reported by Bruce Hannon (see Table 4, "Employment Effects of Public Transportation Use"). As Hannon may indicate elsewhere in these proceedings, inter-city rail transportation and construction will reduce energy use per passenger mile and per ton freight mile, and increase national employment.

These two illustrations—solar heating and public transportation—show how the economy can adapt to present circumstances by securing growth which reduces energy use and increases employment.

Aggregate economic analyses of employment and energy use show similar findings. Ernst Berndt and David Wood reviewed their own and other studies (26 in total) for our CONAES Demand Panel, and they generally report energy-labor substitutability in the econometric investigation of actual data. In their own work, they had found energy and labor to be substitutable in U.S. manufacturing.

Ellen Hornig examined New York Manufacturing in the 1964–73 period, and observed that growth in electricity use reflected the substitution of electrical machinery and equipment for labor and for fossil fuel processes.

This kind of aggregate analysis in general supports the conclusions noted above: policies which accelerate energy use increase unemployment in the long run, and policies which promote growth in conservation, solar energy, renewable resource use, and public transportation will increase employment.

5. Wage penalties and capital/energy subsidies

We have seen that present tax policy subsidizes conventional energy prices to a degree sufficient to dominate the present market choice between solar heating and utility gas heating for future use. While the total cost of solar heating appears to be competitive with or less than that of Alaskan gas, tax and pricing subsidies reverse this preference.

We noted that electric and gas utilities need not anticipate a net Federal or State income tax liability on revenue from new investment.

A similar distortion in market signals is taking place with respect to the relative costs of labor and capital. Labor is made more expensive by the tax system and capital, less expensive. Table 5, "Tax Impact on Relative Labor, Energy and Capital Costs" illustrates how social insurance costs and capital tax subsidies may make a capital intensive process less costly to an employer than the labor intensive process it displaces. In this illustration, the capital intensive process is 9 percent more costly without capital subsidies or employment taxes. With the present tax system, the labor intensive process becomes 31 percent more costly.

The long run economic effect is to make labor appear more costly and capital less costly, thereby causing a substitution of capital for labor.

6. Equity and income distribution

It is apparent that the tax subsidies discussed here are disproportionately received by upper income groups. The Table "Tax Expenditures" shows the distribution of $3 billion in such benefits for seven capital tax subsidies and provisions specific to energy industries. The average return in the $0–$20,000 income class received $10 in such tax reduction benefits; in the $50,000 and above class, the average was $1,064 in reduced taxes.

These statistics apply only to Federal personal income tax expenditures. The seven items shown here account for $10 billion in corporate tax expenditures of a total of $23 billion in last year's Budget Special Analysis. It seems unlikely that the corporate tax expenditures would have a more progressive distribution than that of the personal tax expenditures for the same items.

To summarize the points made thus far, the present tax environment bearing upon energy production and use has these characteristics: (1) there is no net Federal-State income tax liability for revenue from new utility investment in electric or gas production facilities. (2) The true economic cost of solar heating in Southern California is either competitive with, or less than the cost of gas heating using Alaskan or other new gas and less expensive than electric heating using nuclear power. (3) Tax and pricing subsidies reverse this ordering in actual market costs with Alaskan gas being made less costly to the homeowner. (4) Energy conservation, solar heating, and public transportation would increase employment while reducing the need for finite energy consumptions. (5) The tax environment penalizes labor through social insurance wage taxes and subsidies capital and energy. (6) These tax subsidies are received almost wholly by upper income classes.

7. Macroeconomic implications

The absence of necessary growth in solar heating, renewable resource use employment, and public transportation has an inflationary impact in three ways.

First, tax subsidies result in a higher general price level. Utilities are the most capital intensive manufacturing industry, followed by petroleum. As these industries approach the position of zero tax liability, the tax burden on other business rises. The product prices of these less capital intensive industries rise to reflect their greater tax burden, thereby contributing to inflation in these sectors.

Second, continued exponential growth in use of conventional energy resources rather than in their substitutes contributes direcly to inflation in energy products and in the goods and services which are energy intensive. In general, insulation is less expensive than electricity or fuel use, public transportation on a total cost basis is less expensive than automobile or plane use, solar energy is becoming less expensive than heating with new gas or electricity, and on a total economic cost basis, we may assume that many labor intensive processes are less costly than capital intensive processes. The absence of growth in these needed activities while conventional energy prices rise causes unnecessary inflation.

In 1977, energy demand returned to previous patterns of exponential growth in petroleum (6 percent), electricity (6 percent), and coal (8 percent). Natural gas use increased 1 percent, while total energy consumption rose 4 percent. Continuation of this pattern will mean continued inflationary pressures.

Third, the absence of sufficient growth in new and renewable technologies employment, and conservation is inflationary in the sense that the economy does not adopt the most efficient methods of providing goods and services, thereby lowering average real income. Individual and corporate decisions made on the basis of market prices which do not reflect real economic costs result in inefficiency both in production and consumption.

The conventional approach to inflation has a more aggregate perspective, generally viewing inflation as influenced by past inflation, productivity, unemployment, and wage rigidity. The implication of this conventional approach is that energy-induced inflation must be contained by unemployment and other policies.

In my opinion, the desired policies are those which promote efficient growth in new activities which are competitive with conventional energy products and with energy intensive goods and services. This provides a method of reducing inflation through increased employment.

Stimulation of business investment has may short run economic arguments in its favor. These are (1) increased employment in construction and capital equipment manufacture, (2) multiplied gains in employment and income as the effect of greater investment activity spreads to increased personal consumption and business spending, (3) greater capacity for production, and (4) increased productivity in the sense of Greater output per employee.

However, in the long run, the tax policies discussed here lead to less employment and greater energy use.

This presents a serious conflict between short run and long run economic goals. In the future, we wish to have lesser conventional energy use or lesser growth in energy use, greater employment, and increased use of conservation and renewable energy and materials. But the economic policies employed in the short run make the long run goals more difficult to achieve.

"Energy Conservation, Income, and Employment" (submitted to the Committee as an Appendix to this testimony) outlines some of the major characteristics of the present business recovery. Certain points made there are relevant, and revised with current data, emphasize the relationship of the recovery to energy use. With respect to the increase in non-inventory GNP since the low point of the 1974–75 winter, 48 percent of the current increase is in automobile sales and residential construction and services. Considering automobiles to be national investment in transportation, 61 percent of current private investment in industry and transportation is in energy intensive sectors. Investment is highest in automobiles, electric utilities, and petroleum. There is no apparent change in use of public transportation: intercity train and bus travel were less in 1976 than in 1974.

From mid-1973 to mid-1977, employment losses were concentrated in energy intensive activities: manufacturing production workers, particularly metals, automobile and transportation equipment, textiles, and electrical equipment; agriculture; and construction. Employment gains were concentrated in services, self-employment, finance and real estate, and trade.

Taken together with renewed exponential growth in energy consumption, these data lend themselves to the interpretation that the present busines recovery is conventional in that it is based upon growth in energy intensive activities. Yet the disemployment in energy related sectors suggests that at its peak the present recovery will have greater unemployment than has been customary.

In summary, by accelerating energy use and by increasing national investment in energy intensive sectors, the current business cycle makes future adaptation more difficult.

8. Current tax proposals

The maximum social security tax contribution rose 11 percent this year and is scheduled to rise 31 percent next year.

Current corporate income tax changes being considered include a reduction in the general rate, an increase in the investment tax credit, and dividend exclusion from taxable income.

In my opinion the long run consequences of these changes are negative. I would expect a further movement towards negative income tax liability by utility and petroleum companies, a positive stimulus to growth in conventional energy use, a negative impact on employment, and a negative effect upon growth in solar energy, public transportation, and conservation. In the short run, there would be gains in employment and income induced by increased construction and capital equipment manufacturing.

The obvious difficulty is that these tax provisions attempt to continue the present growth by strengthening the economic incentives for energy use and capital relative to labor, and provide strength for renewed exponential growth in energy consumption.

9. Conclusion: Full employment energy policy

This interpretation leads to support of the following policies:

A. Gradual revocation of existing capital tax subsidies and employment penalties. This would increase incentives for solar and renewable energy use, employment, conservation, and public transportation.

B. Federal solar energy tax credits and employment credits. This would be desirable to offset the subsidies to conventional energy and to capital.

C. Federal and State action to end pricing subsidies to new high cost energy sources. Incremental cost rate schedules are appropriate for utilities. A Federal excise tax on energy consumption merits consideration. This would reduce the inefficient demand for high cost energy.

D. Increased research on the employment and conservation aspects of renewable energy technologies.

E. A strong Federal presence in rail construction and operation.

In my opinion, there are no innate physical or economic constraints to inhibit development of an economy with greater employment, lesser energy use, increased renewable resource use, and an equivalent or higher living standard. The problem, as I see it, is that present tax, energy, and economic policy attempts to guide the flow and level of economic activity within the present structure of the economy. But policy should be directed to the purpose of encouraging the structure to adapt to new reality.

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TABLE 1.—CAPITAL TAX SUBSIDIES

	Utility fixed charge rate on capital	Federal and State income tax component in fixed charge rate	Federal and State income tax charge, c/kWh
I. No subsidies	0.250	0.091	1.7
II. Interest deductions only	.209	.050	1.0
III. Present subsidies	.159	(−.004)	−0
IV. Proposed additional subsidies	.159	(−.038)	−.7

In some circumstances, negative liability results in net refunds in cases III and IV. Present subsidies considered were accelerated depreciation and the investment tax credit.

Proposed tax changes considered were reduction in the corporate income tax rate to 44 percent on profit exceeding $50,000, an investment tax credit rate of 12 percent, and a dividend exclusion equal to 3 percent of utility plant.

The analysis uses the Gulbrand-Leung levelized cost method, and assumes a future 1985 cost of $1,000/KW for generating plant, transmission, and distribution facilities, an 11 percent rate of return on investment, a 9 percent State income tax rate, a 60 percent capacity factor, and a 30 year life. See "Taxation and Solar Heating."

TABLE 2.—PROJECTED ANNUAL HOME HEATING COSTS, 1985, IN 1976 DOLLARS PER YEAR, LOS ANGELES

	Type of heating		
	Solar	Alaskan gas	Nuclear power
Tax and pricing policy:			
1. Social cost: No subsidies	$725	$775	$1,325
2. Present tax subsidies including solar, no pricing subsidy	500	525	1,000
3. Interest and property tax deductions, pricing subsidies, solar credit	500	375	775
4. Market cost: Present tax and pricing subsidies	500	350	750

Note: See "Taxation and Solar Heating."

TABLE 3.—EMPLOYMENT, ELECTRIC HOME HEATING, AND SOLAR ENERGY

	Employment (person-years), heating energy for 1,000,000 homes in Los Angeles				
	Installation	Manufacturing	Distribution	Total	Total, average over 20 years
1. Solar water and space heating:					
(a) California Energy Commission	45,500		91,000	136,500	6,825
(b) California Public Policy Center	79,000	27,600	26,650	133,250	6,663

	Construction			
	Total	Average over 30 years	Operations per year	Total, average over 30 years
2. Electric water and space heating:				
(a) Powerplant	5,775	193	228	421
(b) Western strip mine coal	425	14	264	278
(c) Rail coal transport	425	14	107	121
(d) Electricity transmission	1,075	36	1	37
(e) Electricity distribution	3,000	100	385	485
(f) Turbine, generator manufacturing	3,650	121	0	121
Total	14,350	478	984	1,462

Note: The employment data on electricity production are adapted from an OTA analysis. The major assumptions used here are 100 percent capacity utilization during the winter and generation of 10,000/kWh for heating each house. Actual system lives are assumed to 20 years for the home solar system and 30 years for the power system. Apparently excluded are labor in home electric heating and water heating equipment, both in the electric case and as "backup" heating in the solar case.

Table 4. Employment Effects of Public Transportation Use (net increases in employment per quadrillion BTU reduction in energy consumption, 1974 data)

Change:	*Net employment gain*
1. Inter-city train use replacing	
A. Plane travel	930,000
B. Car travel	700,000
C. Owner-operator truck freight	675,000
2. Rail and mass transit construction replacing highway construction	30,000

Note: Net employment effects count the lost employment in the displaced activity and its supplier industries as well as the gain from the increased activity. Gross National Product is assumed to be unaffected. These data are taken directly from Bruce Hannon's "Energy, Labor, and the Conserver Society."

TABLE 5.—TAX IMPACT ON RELATIVE LABOR, ENERGY, AND CAPITAL COSTS: AN ILLUSTRATION

	Method A: Labor intensive	Method B: Capital intensive
I. Labor, energy, capital, no subsidies, annual basis:		
Number of workers	3	1
Electricity used [kWh]	0	2,500
Machine cost, 25-year life	0	$200,000
Wage rate	$15,000	$15,000
Social insurance benefit rate [percent]	30	30
Interest rate [percent]	9	9
Corporate tax rate [percent]	48	48
User cost of capital, per year [percent]	19.6	19.6
Electricity cost [¢/kWh]	2	2
Labor cost with benefits	$58,500	$19,500
Capital cost	0	39,200
Electricity cost	0	5,000
Total cost	58,500	63,700
II. Present capital tax subsidies, per year		
Labor cost with benefits	58,500	19,500
Capital cost [11.1 percent]	0	22,200
Electricity cost [1.25¢ /kWh]	0	3,125
Total cost	58,500	44,825

Note: This illustration is taken from "Energy Conservation, Employment and Income."

TABLE 6.—TAX EXPENDITURES, FISCAL YEAR 1977, BY INCOME CLASS

[Dollar amounts in millions]

Income class	Number of returns (millions)	Percent of returns	Expensing, exp. and dev.	Percentage depletion	Capital gain, coal royalties	Accel. dep., nonrental
None to $20,000	73.513	83.5	$13	$18	$4	$4
$20,000 to $50,000	13.254	15.1	40	57	11	26
$50,000 plus	1.252	1.4	157	230	30	106
Total	87.999	100.0	210	305	45	140

Income class	Investment credit	Tax life depletion; ADR	Expensing construction interest taxes	Total 7 items	Average per return
0 to $20,000	661	12	8	724	$10
$20,001 to $50,000	800	28	28	990	75
$50,001 and over	614	60	114	1,311	1,064
Total	2,075	100	150	3,025	34

Note: These data are taken directly from "Tax Expenditures Affecting Individuals," U.S. Treasury Department, Feb. 13, 1978. The total amount for 69 items was $84,000,000,000, $26,000,000,000 being in the form of reduced taxes to individuals with incomes over $50,000.

Senator KENNEDY. Thank you, Mr. Chapman. Mr. Hannon.

STATEMENT OF BRUCE HANNON, ASSOCIATE PROFESSOR AND DIRECTOR, ENERGY RESEARCH GROUP, CENTER FOR ADVANCED COMPUTATION, UNIVERSITY OF ILLINOIS

Mr. HANNON. I am Bruce Hannon, associate professor and director of the Energy Research Group at the Center for Advanced Computation, University of Illinois. For the past 9 years my colleagues and I have researched the economics of energy conservation.

In summary, I would say that the twin problems of unemployment and energy scarcity can be solved by true energy conservation. By anticipating the inevitable energy scarcity that is to come we can avoid the tragedy of abrupt energy shortages and the consequent massive unemployment. The scarcity of energy is a fundamental problem for government at all levels, but so is the unemployment problem.

The energy conservation tax rebate program can solve the energy and unemployment problem. Many people believe that it is the best solution. I believe the most important governmental action today is to provide a lasting job, even if it does begin on a low rung of the economic ladder. The energy conservation-employment issue is one of those for which there exists no strongly favoring vested interest group. Nor does the issue rest comfortably in Government.

The Department of Labor and certainly the Department of Energy appear to have no interest in connecting energy conservation with unemployment.

By way of explaining what energy and labor costs mean, I refer you to the chart on the wall or the chart in my prepared statement.

When we calculate energy costs, we are talking about the total energy costs in the system that is used to deliver a particular good or service. If we are talking about making autos, for example, we mean the energy used in the auto assembly plant plus the energy used in the steel plant, plus the energy used for mining the coal to provide the input to the steelmaking plant, and so on, even including the consumption of automobiles by executives of the steel company in the manufacture of steel used for making that car.

We sum all of these inputs and we do the same for labor. Then we can compare the energy saved and employment created by substituting a passenger mile by automobile for one by train, in for example, intercity travel. Looking at the third line you see that car-to-train substitutions in intercity operations yields a net total change of about 700,000 new jobs per quadrillion Btu. This means that in the switch to trains, not only would you generally reduce energy use, but also increase employment. You would also generally save money which would be spent on something else. That something else will demand energy and provide jobs and these changes must be added to the changes in energy use and job demands created within the transportation industry to bring the economy back to equilibrium. The next effect on the whole economy is to create 700,000 new jobs per quad of energy saved.

I also note that when new highway construction moneys are transferred to health insurance the net economic effect is 640,000 new jobs per quad of energy saved. There are more well-studied individual changes. Changing from throwaways to refillable beverage containers creates on balance about 750,000 new jobs per quad of energy saved. When we look at the details of that change, we find that energy is saved and the number of jobs increased within the container industry and the supporting industries. The change to refillables would free up about \$1.5 billion in consumer savings which would be spent on other general forms of personal consumption. When the dollar savings are spent about half of the original energy saving is used to provide for this alternative consumption. More jobs—of a general kind—are needed to provide for this increase in general consumption and those jobs are added to the jobs change within the industry that supply the beverages. The net result of the shift to refillables is about 750,000 new jobs per quad of energy saved.

We also find that within the industries that supply these beverages, there is a diminution of average wages and increased capital investment. This point is most important.

Another interesting study is the one on the increase of home insulation in existing attics. We found that to bring existing housing stock to the optimium level would take 400,000 man-years of effort, both in the production of insulation and in the installation of it. However, after that initial construction effort there is also a permanent change in energy and employment demand, so less money would be spent on energy and more on general personal consumption, and that gives a net figure of 15,000 new jobs per quad of energy saved. This example shows that the major job change occurs during the construction phase of the program.

We can, however, also find changes which produce increases in energy use and decreases in the number of jobs. For an individual consumer who decides to change from beef to soybeans as a source of protein, the total effect is a decrease in employment of 720,000 jobs for every extra quad of energy used. The concerned individual and the governmental policymaker can obviously get into trouble by making individual changes.

We can avoid this apparently pernicious complexity of the economy by what should be an easy governmental policy.

I urge the Government to tax energy as it moves from the ground on a Btu basis and let the effect of that tax filter through the economy giving the correct economic signals as it goes. The revenues generated by the energy conservation tax must be rebated to the individual consumer to compensate them for the loss in personal income caused by the tax.

The effect of the tax would be to increase the cost of energy used by all consumers and to increase the cost of producing highly energy intensive goods more than with lower energy intensive goods. The tax would cause consumers to switch from high energy intensive goods—the purchase of which has low job intensity to low energy intensive ones, which generally have high labor intensity. The tax would also encourage industrial producers to substitute labor for energy in the production process. Both of these reactions to the energy conservation tax would increase employment while saving energy.

It is very important that we understand the effect of rebating the tax and how that tax can be rebated progressively, regressively or in a neutral way. From our studies, we have shown that total energy use and income are directly proportional. That is, a family earning $30,000 per year uses about twice as much energy directly and indirectly, as a family earning $15,000.

So the proposed energy tax filtering through the economy, impacts the consumer in proportion to their income.

To be totally neutral, the tax revenues should be rebated proportional to income. One could be very progressive and rebate the revenues on a per capita basis. The tax might also be used specifically to reward those industries, commercial establishments, and individuals, who can demonstrate effective energy conservation.

In general, this tax would tend to create energy conservation and increase employment, reduce wages below what we expect them to rise to, tend to redistribute jobs away from the urban areas and tend to create jobs on the first rung of the economic ladder. Rebating the tax to individual consumers makes us all part-owners in the Nation's energy resources.

[The prepared statement of Mr. Hannon follows:]

PREPARED STATEMENT OF BRUCE HANNON

Conserving Energy While Also Increasing Employment

In 1949, the renowned English philosopher and mathematician, Bertrand Russell, in a lecture entitled, "Authority and the Individual," said that government had only three necessary functions: the provision of security; the establishment of justice; and the conservation of non-renewable resources, particularly energy. It should be no surprise that a man with such insight would foresee the present energy crisis. What is surprising is that nearly 30 years later, the federal government still has not really adopted a policy of energy conservation. Perhaps, though, such a policy can finally be realized when coupled with the idea of increasing employment as well as conserving energy.

Even though the energy picture is clouded by inflation and urgings for voluntary conservation, it seems that true energy conservation will become a way of life in the United States only if the price of energy rises in relation to the price of labor (wages) and the price of capital (interest rates). From such a relative price increase, one can easily predict that labor and capital will be substituted for energy, by producers and by consumers. Such an increased participation in the production of goods and services would mean that on the average, real wages and interest rates would decrease in the long term, while returns to energy suppliers would increase. The Gross National Product should not decrease significantly, however, until the supply of unemployed labor and capital is exhausted. Then only the rather rare energy labor and capital-saving technological changes could maintain income. Such an outcome is not bleak when compared to the alternative of ignoring increasing energy scarcity. Doing so will produce accelerating inflation, increasing inequity between rich and poor and rising unemployment.

The energy conservaton policy of the government need not be more complex than a tax on the basis of energy content in raw materials (coal, natural gas, crude oil, hydropower, uranium) at the point where the energy moves from the ground. The effect of an energy tax would be to:

Increase the cost of energy used directly by consumers.

Increase the cost of producing energy-intensive goods more than that of those with a low energy intensity. Therefore, the tax would have the following general effects on job creation:

Cause consumers to switch from energy-intensive goods (most of which have a low labor intensity) to goods with the opposite characteristics.

Cause producers to tend to substitute labor for energy in the production processes.

The tax revenue could then be distributed to consumers in proportion to after-tax income (including income transfers). Research by the Energy Research Group has shown that the levels of total energy demand and income are proportional, i.e., double the income, double the total energy use per household, approximately. Through this energy-conservation-tax/rebate plan, the government, in effect, anticipates the increasing energy scarcity and compensates wage-earners and capital holders in approximate proportion to the disadvantage caused by the higher prices for energy. Such a plan is an even-handed treatment of all citizens. A major requisite of the plan is that it be implemented very gradually, over a period of no less than five years, to cushion the effect of shifting job patterns and to provide an opportunity for public understanding. For a more complete explanation of the tax-rebate effects, see references. In addition, we are now studying the relationships between possible tax levels and potential energy savings. We would be happy to supply the result of this research as it becomes available.

In effect, the energy-conservation-tax/rebate plan makes all consumers function as part owners of America's energy supply. The plan also makes us all become energy conservers and inadvertent job producers.

The government could also use the tax to subsidize the initial capital requirements of energy-conserving changes in the industrial, commercial, and household sectors of the economy. The energy tax could also be used to encourage full employment. An alternative to direct government spending of the tax would be an offsetting tax reduction elsewhere, which would also encourage the productivity of energy and increase employment. Investment-tax credit reductions and payroll tax reductions are examples.

The alternate energy policies are to continue past trends of regulating low prices, or to deregulate energy prices. The latter alternative has the possible advantage that higher returns to the energy companies may call forth greater energy supplies, but the disadvantage that there is no compensation for the resulting inflation.

There are significant energy and labor impacts that would be produced by initial changes in energy-conserving consumption which could be made without imposing the tax. The following analysis is intended to set forth the opportunities and pitfalls of individual consumer changes or of governmentally regulated changes, no matter how well-intentioned these may be.

The total energy and employment content of a passenger-mile of automobile or rail transport can be compared to the relative dollar costs, for example. Changes from an energy-intensive transport mode to a more energy-efficient one would produce a net change in total energy and employment use and a net dollar savings. This "extra" income could be spent on other things which, in turn, demand energy and employment. These additions should be combined with the initial energy and employment changes to produce an approximate equilibrium in the set of demand changes.

We have examined hundreds of specific consumer decisions and evaluated their dollar, energy, and employment demands. By comparing choices involving high energy usage with lower energy-using alternatives and by incorporating the respending effects, the net energy and employment changes caused by the substitution can be determined. All of the changes proposed would reduce energy use before the respending effects were included. Taking the net change in employment demand and dividing that by the net change in energy demand produces an indication of the job potential per unit of energy saved (or of new energy) for each conservation project.

The accompanying table lists selected activities in order by the decreasing number of new jobs created per unit of energy saved. The options presented cover nearly an entire ten-fold range in the number of new jobs created per quad (quadrillion B.t.u.) of energy saved. Given that the present U.S. energy use is about 80 quad and the irreducible level of unemployment is approximately 4 million persons, full employment would be reached with energy use reduced by approximately 5 to 10 percent through implementation of the first category of changes in the table.

This table contains the net total employment change per quadrillion B.t.u. of net total energy change. The numbers in this table are calculated as follows: for each unit of service, for example a passenger-mile, the differences of the direct and indirect energy and employment demands of an activity and its alternative are calculated; to these differences are added the direct and indirect energy and employment caused by the expenditure of any dollar savings on average personal consumption; a ratio of the net employment to the net energy change is then formed and normalized to one quad of energy.

Changes to increase employment and decrease energy use (U.S. economy; 1974)

Changing from:	New jobs per quadrillion new B.t.u. (saved) (940,000)
Plane to train (intercity)	930, 000
Throwaway to refillable beverage containers	750, 000
Car to train (intercity)	700, 000
Owner-operator truck to class 1 freight train	675, 000
New highway construction to health insurance (federal)	640, 000
Car to bus (intercity)	330, 000
Car to bus (urban)	210, 000
New highway construction to personal consumption	200, 000
Car to bicycle	200, 000
Plane to car	160, 000
Plane to bus	140, 000
Electric to gas stove	160, 000
Electric to gas water heater	120, 000
Electric commuter to car	110, 000
Electric to gas clothes dryer	100, 000
Frost-free to conventional refrigerator	60, 000
Plush (25 appliances) to moderately-equipped (16 appliances) kitchen	30, 000
New highway construction to railroad and mass transit construction	30, 000
Present to increased home (oil heat) insulation	15, 000
Moderate to spartan (4-appliance) kitchen	10, 000

Changes to increase employment and increase energy use (Average U.S. Economy: 1950–1973)

	Jobs gained per quadrillion B.t.u. lost (used) (1,620,000)
Changing from electric commuter to bus	530, 000

Changes to decrease employment and decrease energy use

Changing from:	Jobs lost per quadrillion new B.t.u. (saved)
Black and white TV to radio	35, 000
Present to new electricity supplies	75, 000
Bus to bicycle	330, 000
Car to motorbicycle	430, 000
Color TV to black and white TV	1, 750, 000

Changes to decrease employment and ultimately increase energy use

Changing from:	Jobs lost per quadrillion B.t.u. lost (used)
Beef protein to textured soy protein	720, 000
Beef protein to direct bean consumption	860, 000
Beef protein to complete soybean meat analog	970, 000
Class 1 truck to container train	13, 600, 000

The viability of this point of view is essentially supported by the aggregate behavior of the U.S. economy in 1974. New jobs were gained at the rate of 940,000 per quad of reduction in energy demand. During 1974, real compensation per man-hour, adjusted for inflation, declined 1.6 percent, the real Gross National Product per capita dropped 2.9 percent, and total energy use dropped about 2.1 percent. This 1974 result may be too dramatic for useful comparison however, for in 1975 total employment declined about 1 percent, although total energy use also declined much faster (2.5 percent).

In the first section of the table, please note that adding home insulation increases employment throughout the economy at the rate of 15,000 jobs per quad of energy saved. This does not include the jobs required to install the added insulation. In a separate and more detailed study, we found that installing ceiling insulation in all existing U.S. homes to the economic optimum thickness would require about 400,000 man-years of effort and save about two-thirds of one percent of the total energy use in the United States. Of course, these jobs do not exist once the installation is complete, a phenomenon typical of all construction projects, but the process would be an extended one, covering several years.

A well-studied example in this first category is the refillable vs. the throwaway beverage container issue. If the country were to shift entirely from throwaway to refillable beverage containers, energy demand would be reduced, employment would be increased (although the average wage might be reduced), capital stock would be increased, litter would be reduced and material flows (steel, aluminum, and glass) would be decreased. If the shift were to occur slowly, say over a three-year period, our research shows those industries which would lose employment would find that the normal attrition rate of their labor force would furnish the needed reduction in employment.

This table contains only one example of increasing employment coupled with increasing energy use. The most interesting data point in this category is the rate at which the U.S. economy increased employment and energy use during the period 1950–1973. During those years, real compensation on the average per man-hour rose by 8.4 cents per year (1967, base year) and real Gross National Product per capita rose at an annual rate of 3.6 percent. Rising wages caused the substitution of energy for labor. Unemployment was prevented by increasing economic growth and by reducing the work time per worker. Both economic growth and energy use were driven by wages, which were rising in relation to energy prices. The same effect was true for capital. Low-priced energy has tended to be substituted for relatively high-priced capital since the early 1950's.

Another category of consumer options contains activities in which jobs are lost while energy is conserved (or while the supply of energy is increased). Most notable among these options is the increase in electricity generation. Our studies show that approximately 75,000 jobs are lost over the entire economy, in the short run at least, for each new quad of primary energy transformed into electricity. This happens because in an equilibrium economy, the decision to purchase electricity requires a reduction in spending somewhere else. This spending reduction means a reduction in the demand for labor which exceeds the number of jobs involved, directly and indirectly, in the production of electricity.

The bottom section of the table includes those options which actually cause a job loss even though energy use would be increased. The change from beef to vegetable protein would reduce energy consumption significantly, but the equilibrium effects of respending the large dollar savings would cause total energy consumption to rise.

All of the activities in the table were thought of as happening alone, with an otherwise current or modern economy. But if we consider them as occurring under pressure from an energy tax, the energy cost of dollar savings that are respent in the average way would decrease with time. Conversely, the labor content of the average personal consumption dollar would tend to increase. This circumstance would tend to reduce the effects of the paradox given in the protein example and further enhance the job-producing and energy-saving qualities of the first set of activities shown in the table.

The accuracy of the numbers in the table is open to some question because of the great quantities of data used and the inherent limitations of the economic models involved. We believe, however, that the numbers are in the correct categories, even though there might be some errors in individual entries.

In summary, the twin problems of unemployment and energy scarcity can be solved by true energy conservation. By anticipating the inevitable energy scarcity that is to come, we can avoid the tragedy of abrupt energy shortages and the consequent massive unemployment.

The scarcity of energy, as Russell has said, is a fundamental problem for government at all levels. But so is the unemployment problem. The most important action is to provide a lasting job, even if it does begin on a low rung of the economic ladder.

The energy-conservation-tax/rebate program can solve the energy and unemployment problems. Many believe that it is the best solution. The issue is one of those for which there exists no strongly favoring vested interest group. Nor does the issue rest comfortably in government. The Department of Labor and certainly the Department of Energy appear to have no interest in connecting energy conservation with unemployment.

To me it provides a significant test of the ability of a democracy to survive the crises produced when a fundamental resource becomes scarce. We shall all be measured, I believe, by how well we respond.

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Senator KENNEDY. Thank you, Mr. Hannon. Mr. Benson, can you give us the basis of your assumption to determine that solar energy, and also in the area of conservation as well as nuclear—I think it is a general kind of assumption about the enormous cost and expense of what we now know about solar energy. And what kind of projections are you using and how realistic are they in terms of your cost analysis?

Mr. BENSON. I will go through that quickly. We assume a 1,500 square foot home, roughly three bedrooms, a climate similar to Long Island. In insulating the walls we used 1,900 square feet of insulation, increased the insulation roughly from zero to about 3 inches of foam. The cost would be $890 to the homeowner for insulating the walls and would result in about 26 million Btu's being saved each year per home. Insulating the attic we calculated an increase from 2½ inches to 12 inches of insulation, 1,000 square feet——

Senator MCCLURE. Could I interrupt you? How did you arrive at the cost of $890 of installation?

Mr. BENSON. We contracted with an engineering firm which has a great deal of experience in this area.

Senator MCCLURE. Did they go out and ask for a bid from an insulating company?

Mr. BENSON. Basically.

Senator MCCLURE. The prices in Long Island are a lot lower than in the Washington, D.C., area. I don't know that anyone would do that for twice the cost here. It may be true up there.

Mr. BENSON. That is what we are finding.

Senator MCCLURE. I hope we can get some of those contractors to move down here.

Mr. BENSON. Insulating the attic consists of 1,000 square feet of insulating increasing from 2½ inches to 12 inches at a cost of $470.

Senator KENNEDY. Does this include the labor or material?

Mr. BENSON. Both, for installation we calculated 38 hours of labor.

Senator KENNEDY. Union scale or nonunion scale?

Mr. BENSON. I believe that is union scale. I don't have the exact number but the breakdown is $470 for labor, $420 for material. For the attic, $296 for installation, $172 for materials, for a saving of 10 million Btu's per year.

Senator KENNEDY. What kind of insulation are you talking about?

Mr. BENSON. In the attic it is fiberglass.

Senator MCCLURE. You must have gotten those prices before the price increases.

Mr. BENSON. We tried to make this as accurate as we could, and we are constantly checking and rechecking. We have been criticized for saying $900. People have said, "who would spend $900 to insulate their homes"? Storm windows, $100 for installation, $225 for materials—that is 9 windows. That comes to $32 a window. I believe that is reasonable.

I had my windows put on for $25 apiece. This is $32.50 so that is reasonable. The savings is 14 million Btu's per year.

Senator MCCLURE. I hope the Washington Post is listening to this and I hope they will get those ripoff artists.

Mr. BENSON. I agree with you that we don't need any more ripoffs.

Senator KENNEDY. Do you live in Washington?

Mr. BENSON. Yes.

Senator KENNEDY. That is where you got your windows?

Mr. BENSON. As a matter of fact, it was a door-to-door salesman. Solar hot water system is 48 square feet of flat plate collector with 60 hours of labor to install, $1,315 for materials, for a total cost of $2,136 to produce about 11 million Btu's per year. We also figured that about 3 percent depreciation and maintenance which comes out to about 5 hours a year to maintain the solar hot water system. The normal cost of this system is about $2,000. We are closer to $2,200.

Senator KENNEDY. You are talking about water and heating as well?

Mr. BENSON. In addition to hot water, yes. We have three solar measures.

Senator KENNEDY. That is not space heating?

Mr. BENSON. As a matter of fact, you find that conservation—by the time you put in all that needs to be done, the solar flat plate collectors that are being pushed by DOE are not economical because you save so much on energy through conservation that the solar flat plate collectors really are not economical. That is the major error in the solar heating and cooling demonstration program; this push of the most technically sophisticated type of a system. We need to get the NASA people out of control of that program and get people who understand simplicity and cost effectiveness and not just sophistication.

Senator MCCLURE. Not that the collector system is not efficient but the economic efficiency of conservation is greater.

Mr. BENSON. You always want to insulate before you go to active solar energy systems.

I would like to very strongly make this point. It does not make sense to put active solar energy systems on new homes and new buildings. New homes and buildings should be designed in such a way that they are fully energy conservative with passive solar systems absorbing some light through the windows, heating the walls, with no moving parts, no extra equipment, and no extra cost for constructing that building. The active solar systems should only be retrofitted onto existing buildings.

To answer the question, labor for insulating the walls is $12.50 an hour. That is close to union scale.

Nucelar powerplants are twin 1150 megawatt pressurized water reactors. They are very similar in design to the Millstone III unit that is being installed now. The cost is $2.76 billion for plant design and construction. This is taken from utility companies, as are the labor figures. We have included 20 percent reserve margin, which gives us another $0.65 billion. We have included $0.37 billion cost of transmission, $0.56 billion for operation and maintenance of the plant, transmission and distribution system over a 30-year period, $0.65 billion for utility companies' administrative overhead cost——

Senator KENNEDY. Will you submit all of that?

Mr. BENSON. That is in my prepared statement; it is all summarized.

Senator KENNEDY. I would like to ask one more question quickly.

Mr. Chapman, could you explain your chart in terms of analyzing the tax differences and supports for these different utilities? Can you just develop that for a few minutes?

Mr. CHAPMAN. The kind of approach by which projected costs are analyzed is called levelized or annualized cost. The variations in time distribution of different costs and revenues are put on a present worth or on an annual equivalent basis. The particular cost methodology which I used here——

Senator KENNEDY. Is this part of the same table?

Mr. CHAPMAN. Yes. For the utilities it is based on a method developed by two engineering economists with Southern California Edison and the Bechtel Corp., a major supplier of electric generating equipment. The characteristic which this approach has is that it takes the tax credits, takes the present worth value, so to speak, then amortizes them over the life of the project.

For example, a nuclear power plant is expected to operate for 30 to 35 years and has a tax life of 16 years. Accelerating appreciation provides double the minimum straight line. So when the utility is reporting depreciation to its stockholders it uses a straight line depreciation. But for tax purposes to the Internal Revenue Service it will in its first year report more than four times that depreciation. The result is a net accumulation of credits during the first year of operation so that utilities need not pay net Federal or State income tax on their investment.

When that is applied to the expected cost of nuclear powerplants or new gas plants, the result is to greatly reduce what otherwise would be the legitimate cost which customers would pay for gas and electricity. And as a consequence, the net effect of these provisions is to greatly stimulate the use of natural gas and nuclear power to a significantly greater degree than would otherwise be the case if these tax subsidies didn't exist.

Senator McCLURE. Mr. Hannon, you talk about a tax policy to stimulate conservation by raising the cost of power, the cost of energy, not only allowing the market to increase the cost but also to artificially or additionally increase cost by direct tax policy. Is that correct?

Mr. HANNON. Yes. The tax is an anticipatory policy, although normal energy scarcity would be reflected in market price rises, regulatory policy may inhibit the price rise. Also we do know that the market did not anticipate the sudden quadrupling of energy costs in 1973. It is this suddenness I propose to anticipate with the tax.

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Senator McClure. So yours would be a positive program of increasing costs in order to stimulate conservation through increased costs?

Mr. Hannon. That is correct.

Senator McClure. And then as I understand, that is coupled with a tax rebate schedule which would be devised in many of several different ways?

Mr. Hannon. That is correct.

Senator McClure. I think you also made the point that income levels and energy consumption were almost parallel, but as income goes up energy consumption goes up in almost exactly the same proportions.

Mr. Hannon. I didn't make a dynamic prediction. I was referring to the distribution of income at a particular time in the economy.

Senator McClure. But I think you used the example that a person with $30,000 income uses approximately twice the energy of a person or household with $15,000 a year.

Mr. Hannon. Yes.

Senator McClure. Would it not be true that if there were a rebate of taxes raised, the person who had the $30,000 income would have paid twice as much for the energy? They would get less back in rebate and, therefore, their cost of energy under this plan would be very much greater than would be the people at the lower end.

Mr. Hannon. The idea of rebating the tax to a proportion of income is used so one can find a neutral position with regard to changing the equity of——

Senator McClure. It isn't neutral if it takes away from one and gives to another.

Mr. Hannon. The idea is not to do that. I don't think I made it quite clear. What I am saying is to rebate according to income would be to compensate the person making $30,000 twice as much as the person with a $15,000 income.

Senator McClure. You compensate in the rebate but you have also taken away in the taxing procedure.

Mr. Hannon. And that is why I call it neutral.

Senator McClure. No. I don't understand that to be your proposal because you would have taxed them at one level and rebated at another, inversely.

Mr. Hannon. No.

Senator McClure. Maybe I didn't understand your proposal.

Mr. Hannon. The tax is placed on coal and uranium from the mine, oil and gas from the wellhead, and electricity from the hydroplant. That is all. The tax would work its way through the economy——

Senator McClure. Presumably for your example it works perfectly and equally at all modes.

Mr. Hannon. The net effect is that the tax would come through the production process proportional to income. This happens because people use energy, directly and indirectly, in direct proportion to their income.

Senator McClure. That is right. With a household with $30,000 a year income they would pay those taxes twice as much as the household with income of $15,000 per year.

Mr. HANNON. That is right. And the rebate, if it were to be neutral, would rebate twice as much to the $30,000 household as to the $15,000 household.

Senator MCCLURE. I didn't understand you had said that.

In order to be neutral the rebate would be in proportion to either income or energy consumption?

Mr. HANNON. That is right. It would be the same.

Senator MCCLURE. It worked on a paid basis and it would then not be neutral?

Mr. HANNON. On a per capita basis it would be very progressive.

Senator MCCLURE. Mr. Schlesinger would like that because he has 10 children.

Senator KENNEDY. What is wrong with that?

Senator MCCLURE. There is nothing wrong with it, but that is a matter that until recently was of individual choice. There are those who wish to change that.

I have not understood you to indicate a neutral system would rebate in proportion to income, or in proportion to energy consumption. I am not sure I have been able to fully assimilate all of the questions that have been raised in the statements this morning.

One of the questions we have had before the Budget Committee in the last couple of years in particular, has been the effect of taxation and the tax expenditure side of the Federal budget, which is not a budgeted item and not even considered, generally speaking, in terms of allocating priorities. We don't make policy after having looked at the tax expenditure question.

We have some problems with the Senate Finance Committee, that they don't want tax expenditures brought under the budget process because they have greater latitude and that may be one reason why tax expenditures have grown, because the cost is hidden. The expenditures of Federal money is not exposed in the same way that it is where there is a direct appropriation of the money, first collected and then rebated.

So we have much more to be done in the area of tax expenditures as far as the creation of the budget, if the budget is to be a tool of policy.

Mr. Chairman, there are so many questions that I would like to go into I suspect we would be here all day. I think rather than start I will reserve them.

Senator KENNEDY. As I understand, and I agree with Senator McClure as far as the tax expenditure aspect and the basic reluctance of the Members of Congress to deal with that in the way we deal with direct expenditures. That has been growing substantially higher than direct appropriations.

I may make a casual observation that it is incredible to me that we would be willing to empty the Federal treasury in terms of tax expenditures when we absolutely refuse in terms of direct appropriations. We have seen this instance after instance. I think the testimony this morning has brought that up in a related way in your analysis of taxing policy and how it has really sheltered the real cost as far as competitive sources of energy. Mr. Chapman has brought that up.

I look forward to reviewing those parts of your testimony on that issue.

I think one of the central themes, although each of you approach it obviously from a somewhat different point of view, is the central analysis that you have done in terms of looking at whole system analysis on energy both in terms of its cost and its real cost, both from the consumer and the general taxpayer point of view, and relating this very closely to the issue of employment. And you also recognize what I think has been very important and significant, and that is the need for the creation of alternative sources of energy, whether it be in terms of conservation or in terms of alternative energy resources. I think the fact remains, in terms of your presentation, we obviously need a good deal more careful and reasoned analysis because these are new findings. And it is something I, for one, have not seen either the administration approach in energy policy with this kind of analysis.

Just assuming the accuracy, and obviously we would in terms of your approach, the fact is that there has not been the kind of careful analysis in the development of our national energy program that you have given in a rather precise and exact way to the Long Island situation, to the impact in southern California, or on the question of jobs in general.

I think what this testimony means to me is that you can clearly provide the needed national goals in terms of energy and can do that more effectively in terms of employment. We haven't gotten into the question of the careful analysis of the environmental factors, and that is obviously related to the question.

By doing the kind of review from a national perspective that you people have done in a very precise way, that is something I gather from what you have testified here this morning we need. We ought to expect our policy developers to do this kind of analysis to permit us to make an informed and intelligent choice. We may come out with another view. We may reach different conclusions. That is what the electoral process is all about.

Would that be a fair comment? I would be interested in any views you may give us to energy policy developers as well as to our appropriate legislative committees. We are not a legislative committee. We are trying to review the growth, the macroeconomic considerations. That is pretty broad and general but there is no place in the Congress that those issues are reviewed outside of this committee.

What can you tell us? What should be the lessons? What are the lessons that we ought to take from it and what should we, as Members of Congress, be asking our policymakers to do to try and give our national energy policy the kind of attention that you have given to a very important slice of this issue?

Mr. Benson. I was with ERDA for 2 years under the Ford administration and left precisely because I could not do these types of studies. I tried and ran into problems in getting the results out.

I feel with Mr. Alm and people like Clark Bullard in the new administration that there will be more of an emphasis on open, honest analysis, a broad view of things. It is important to look at the whole system and not just at the economics, but the related social impacts, the environmental impacts, all types of considerations from mining the material all the way through to the end use and over the long term.

For example, we have used the document from the Bureau of Labor Statistics that consist of projections of the structure of the economy in 1980 and 1985. We are really struck by looking at these projections to see that the employment per dollar invested was actually projected about half of what it is today. What that means is that we have today's trends and continue them on out into the future, putting an emphasis on increased "labor productivity."

What this means is that business, by its very nature, has to treat everything that it does on a cost-benefit analysis. That is the bottom line. Will it make a profit? Labor, salaries, wages, are always reviewed as a cost and therefore employment is something to be minimized. Business has asked for and received many incentives to lower its cost for labor. This is something that needs to be examined.

When we look at these projections by the Bureau of Labor Statistics, is shows that labor intensity will only be half what it is in 1980 to 1985 compared to what it is today. What does that mean in terms of employment? I believe we are not going to have much growth on a global scale. We are running out of resources and we have to consider a more labor intensive economy. We have to consider fundamental changes within the structure of the economy. That should not be viewed as a bad occurrence. If we go about it with foresight and planning, it can work out well. If we try to maintain the status quo and continue to wear blinders, I think we are in for some very, very rude and disruptive changes.

Senator McClure. What you are saying is a relative share of the market in regard to capital or energy or resources must decline relative to the share of labor; is that not correct?

Mr. Benson. I am saying that since fewer materials and resources will be available to us we have to substitute labor back in and displace capital and energy, because they will be increasingly less available to us.

Senator McClure. What has been the growth over the last several years? If we look at 20 years ago, what is the relative job per unit of output compared to today?

Mr. Benson. I would like to let Bruce answer that after I make one comment. A lot of people say it is back to the plow or back to the caves if we don't continue growth and if we don't continue our energy consumption and so on. The answer is, can you visualize a society that uses only half as much energy per capita? Since 1963 things have really not changed that much except we are using and wasting more energy.

Senator McClure. Per capita consumption of energy in 1963 was half as much as today?

Mr. Hannon. I do remember that per capita consumption in 1970 was about 50 percent greater than 1950, if that is of any help. I don't recall those figures, but I can answer the question that you had earlier. I refer to the chart in my prepared statement.

What I am talking about, with regard to labor, energy, and capital use, hinges on the relative rise in the price of these things, the interest rate on industrial bonds, manufacturing wages, and the industrial price of energy. Let's compare the average industrial wage and the price of electricity—the energy most are ready to substitute for labor. Comparing these ratios historically, we find the economic pressures that are sufficient to cause a substitution one way or the other—as I have shown in my paper, "Energy, Labor and the Conserver Society."

Until 1973 these ratios reflected the pressure to substitute energy for labor and energy for capital. You can find examples of these substitutions throughout the economy. But from 1973 these ratios turned around meaning the pressure was reversed; capital and labor are being substituted for energy.

Senator McClure. So the relative cost of consuming more goods or services in the future would be made more of a labor cost and less of an energy——

Mr. Hannon. That is right. And perhaps more of capital—it is a very difficult question. Perhaps more of capital, at least in the long run.

Senator McClure. There has been quite a little said about tax incentives for labor. There is also some double taxation of capital in our system, too. There are some tax loopholes, tax incentives to the tax reduction side, but also some disincentives on the side of the tax as an equivalent for capital. You have not only that chart but a larger chart in your prepared statement.

Are you suggesting that these are things which ought to be done, or just a way of measuring the effect of choices which we might make?

Mr. Hannon. The latter. I want to add a comment to Senator Kennedy's question. I have performed energy research when it was sponsored by the NSF, the FEA, the ERDA and now DOE. I have seen a tremendous organizational change and tremendous change in government personnel since 1970 and find very little policy set. I would say they have two basic problems. One is they tend to concentrate research on industrial problems. There is very little trans-industrial research work being done.

They will fund research, for example, to design a third lobe for a two-lobe clock thermostat but Honeywell could do it far better than the government. The research in energy conservation tends to look at how a given industry could save energy. But I know that as precisely what industry does best. They should stop this sort of research funding and begin what I call transindustrial research.

For example, the steel scrap industry is not considered as part of the steel industry. Studies should be done which view the steel and scrap as a whole but the steel industry won't do it by themselves. With such a research view, the optimal decision for society as a whole can be delineated rather than one for a single industry.

The main research vehicle which DOE uses today is the Request For Proposal or RFP. An energy researcher in my position finds that most of the research ideas which will be funded are ideas which government bureaucrats develop. They then issue an RFP but I have never answered one of them. I have always approached the government with my own ideas, what they call unsolicited proposals. They have great difficulty with the unsolicited proposal concept because it is generally running counter to what they prefer to have done at that time. I have spent up to 3 years convincing them of a certain idea, for example exploring the relationship between jobs and energy, or how taxes or higher priced energy will affect people at various income levels. I find to my great frustration that they toy with the idea for about 3 years, and then fund someone else without my knowing about it—the worst of all possible acts. These are to my major problems with the energy research agencies.

Senator KENNEDY. Mr. Chapman, what should we demand of our energy policy developers?

Mr. CHAPMAN. I can recall in 1971 first learning of Bruce's work and thinking it was very foolish for them to undertake it. I don't know if Bruce is aware of that. Certainly I was the foolish one in that respect, in that their work has achieved a great amount of respect and is the largest single source of useful and original research on employment and energy.

I think if Bruce is correct in indicating that he has substantial difficulty in obtaining research support for his imaginative and original work, this stands by itself in a criticism of the way in which research funds are administered.

On the larger point, my personal opinion is that there is no permanent barrier in technology or resources to prohibit both growth in employment, growth in activities which would reduce energy related inflation, and growth in activities which would reduce our current exponential growth in finite energy resources.

I think one of the reasons why we don't consider doing this is because our conventional thinking and macroeconomic studies basically operate within a given structure. They assume explicitly, or unconsciously and implicitly, that the economy should rise or fall on cycles of automobiles, suburban housing, investment in energy production facilities, etc. Yet, I think the nature of the problem is not how to stimulate through monetary and expenditure policy the rise and fall of these activities. I think rather the broad question that you have to consider is how to alter the structure itself so that needed growth and new activities can take place.

Senator MCCLURE. Do I understand you to say that the economic surge built around automobiles and suburban housing and things of that nature ought to be modified to manufacture different kinds of automobiles and perhaps fewer of them and build smaller houses and build them better and divert some of the money we are putting into Detroit to the diffused housing market?

Mr. CHAPMAN. I think the table looking down upon us is characterized by transportation changes in its upper levels, including throwaway bottles. I think that indicates one of the major kinds of structural changes we must have.

Senator MCCLURE. We have to change the aspirations of our people, too. They have to want smaller cars instead of bigger ones. They have to want fewer instead of more. They have to stop striving for a large, separate home in the suburbs in exchange for a smaller garden apartment, condominium, or a townhouse.

Mr. CHAPMAN. I am not quite sure that I follow everyone of your comparisons, but I think the general thrust of what you are saying is something I agree with. I believe we all have gotten accustomed to using a car for immediate transportation to anywhere in America and have gotten used to the feeling that we ought to be able to walk outside and go 3,000 miles.

Senator McClure. We have to stop our kids from going to Vermont for a ski weekend.

Mr. Hannon. Perhaps there is another way to do it.

Senator Kennedy. Just stop in Massachusetts and not drive to Vermont. It is very interesting, and obviously you have all done a lot of thinking about something that the country will have to pay more attention to. It has been very valuable to me. I want to thank you.

The subcommittee stands recessed until tomorrow.

[Whereupon, at 12:30 p.m., the subcommittee recessed, to reconvene at 9 a.m., Thursday, March 16, 1978.]

CREATING JOBS THROUGH ENERGY POLICY

THURSDAY, MARCH 16, 1978

Congress of the United States,
Subcommittee on Energy
of the Joint Economic Committee,
Washington, D.C.

The subcommittee met, pursuant to recess, at 9:12 a.m., in room 5110, Dirksen Senate Office Building, Hon. Edward M. Kennedy (chairman of the subcommittee) presiding.

Present: Senators Kennedy, McGovern, and Javits.

Also present: Jerry Brady, subcommittee professional staff member; Deborah Norelli Matz, professional staff member; Mark Borchelt, administrative assistant; and Charles H. Bradford, Stephen J. Entin, and Mark R. Policinski, minority professional staff members.

Opening Statement of Senator Kennedy, Chairman

Senator Kennedy. The subcommittee will come to order.

Yesterday this subcommittee heard testimony which was so challenging that I believe both the Congress and the administration must respond to it when considering energy, employment, and tax policy. Let me review the highlights for you.

First, it became clear that in writing the National Energy Plan the Department of Energy did not calculate the employment impact of its decisions, except by consulting one macroeconomic model.

Second, the Department still does not have this capacity and has not worked closely with the Department of Labor in making its decisions.

Third, too little attention has been paid to the potential for creating jobs among our most disadvantaged citizens, particularly minorities, through conservation efforts in the cities or alternative energy systems.

Fourth, our tax system has been so constructed that utilities frequently pay no taxes at all, and even receive a kind of negative tax for constructing new energy production systems.

Fifth, the 1,000 largest companies in this country—which use over 80 percent of the investment tax credit and well over half of industrial energy—created only 75,000 new jobs in 8 years. The other 6 million businesses created 9.5 million jobs.

Sixth, because of subsidies to energy and capital, we have consistently disadvantaged labor and reduced the number of jobs available. We have made capital less expensive and labor more expensive, creating unemployment.

Seventh, because of subsidies to utilities, solar energy is put at a disadvantage. Nonetheless solar hot water heating and improved housing construction would create three times more jobs in Long Island and four times more jobs in California, according to the testimony of our witnesses.

Eighth, conservation is the best job creator of all, outperforming all other energy measures by a margin of 3 to 1, considering both direct and indirect employment.

Finally, we heard that, over the long run, conservation and alternative energy would place tens of billions of dollars in the hands of consumers, driving the economy through consumer spending instead of trickle-down economics which places control at the top.

As you can see the recommendations from yesterday's testimony frequently runs contrary to conventional wisdom and established practice. While no doubt we will hear other opinions, and the final figures may vary somewhat, there is no doubt in my mind these hearings are on the right track. Our witnesses have brought the employment issue clearly into energy decisions. Their testimony exposes, once again, the folly of a tax system which subsidizing utilities and the biggest businesses which promise jobs but do not deliver.

Yesterday, we heard from the economists who provided the empirical basis and the forecasts for job creation in the future. We heard from the Department of Energy which promised to improve its record.

Today, we will hear from the Secretary of Labor, from the cities, from the States and from the leaders of organized labor. Our witnesses today are all practical. We will look to them for guidance on how to bring energy and employment together to create full employment and a full and sufficient supply of energy.

There has been a change in schedule. We advanced the hearings to 9 o'clock. We will still hear from Secretary Marshall at approximately 9:30. We will hear from Mr. Wilson Clark from the State of California now.

Mr. Clark is an early pioneer in the environmental movement. He is cofounder of the Environmental Policy Center. His book, "Energy for Survival," is an encyclopedia on saving energy in today's environment, and he is California's new leader in ways to save energy. And he serves as assistant to Governor Brown for issues and planning.

STATEMENT OF WILSON CLARK, ASSISTANT TO THE GOVERNOR FOR ISSUES AND PLANNING, STATE OF CALIFORNIA, ACCOMPANIED BY SIM VAN DER RYN, STATE ARCHITECT

Mr. Clark. Thank you, Senator.

I would like to introduce Sim Van der Ryn, the State architect who has accompanied me today.

Briefly, I brought along copies of a description of California's State buildings, designed by Sim Van der Ryn. Some of the most progressive solar techniques have been used, yet to be matched by any programs in the Nation in terms of public building energy standards.

These buildings are 50 percent better than any current standards now in effect, and effectively serve as a model for the development of new sources of energy and conservation techniques.

We are very interested in the applications for employment from the use of solar energy. In my prepared statement, I state that one of the great fallacies of economic thinking over the past century has been that our economy has been directly tied to an ever-increasing rate of energy growth. Since the Arab oil boycott——

Senator KENNEDY. That is a very good point to expand upon, because we hear that frequently, and on this subcommittee as well.

Mr. CLARK. Conventional wisdom has stated that if we expand our energy growth rate at 7 to 10 percent a year we will have substantial economic growth. The problem with that theory is that you begin to run out of several factors. One is capital; one is land; one is the clean environment in which to continue growth in.

Senator KENNEDY. What is the reverse side of that? Could we have growth without the continued expansion in a significant way?

Mr. CLARK. We think so.

In California, to use the data that has been developed, which I have in my testimony, since the Arab oil boycott we have experienced a very high rate of economic growth in the State. Unlike the Nation, where you use a GNP indicator, in the State of California we use a personal income increase indicator.

In 1977, for example, the rate of personal income went up 12.5 percent. That was a great increase; it was a boom year.

Almost 500,000 new jobs were created in California last year, yet energy growth has been quite low compared to the pre-Arab oil boycott days.

In fact, electrical energy growth increased 3.1 percent. We have seen that rate of lower growth since the boycott, yet a very high rate of economic growth.

This tends to indicate that we can have economic growth without increasing energy growth, at least at the preoil-boycott-trend rates.

I might also point out here that in my own work I have found that the increases in energy growth have very real limits. We will begin to reach them by the end of this century. Therefore, it is important to keep the perspective of economic growth and energy growth in mind. If we continue to expand energy consumption over the next 50 years at the rate of increase of the electrical industry in the 1960's decade, we will find very real limits within 30 years on the siting of power facilities.

Nevertheless, I think it is incumbent upon not only the Nation but all of the States, and other agencies of Government, to press for increases in energy efficiency, and for new trends in policy that will lead to economic growth without that kind of increase in energy.

We find that in California the job implications of our energy policies are most directly related to those policies that encourage energy conservation and some of the new renewable resources of energy.

For example, in conservation related investments, we can supply energy at one-tenth the projected marginal costs of new sources of very expensive energy, such as the centralized distribution of liquified natural gas, or of nuclear power, or of coal.

By supplying energy that is one-tenth of the cost of these sources, more income from consumers is realized in the economy, and thereby indirectly creates more opportunities for economic growth and job potential. Consider the direct impact of the jobs that are related to energy sources.

I have listed in my prepared statement some of the measures that we are planning in the State of California. As you are aware, California has in effect building standards for both residential and nonresidential buildings. We have a number of progressive practices that were initiated and pioneered in the State, including things, Senator, such as the lifeline rates established by the State's public utilities commission. We are moving in conservation areas in the future that include utility voltage reduction; that include large-scale building audits and solar energy in buildings.

We think the measures proposed already by the State of California, have the potential to reduce approximately 20 percent of our electricity demand in 1985, and also, about 20 percent of our natural gas demand in 1980.

Senator KENNEDY. How much more expensive were these requirements?

Mr. CLARK. Were the conservation measures? The conservation measures we have found to date have an average payback, if you use conventional economic terms, anywhere from 6 months to some of the more expensive measures such as solar energy, to somewhere around, in some cases, 7 to 10, and in large installations, 15 years.

Unfortunately, the way that we look at economics today, we do not take into consideration life cycle costing. Therefore, when we are comparing in economic terms an investment that may payback very quickly, we are using the very cheap subsidized fuel of today to try to project the world tomorrow. What we should look at are higher marginal costs in fuel.

I point out, incidentally, in the prepared statement, that the conservation investments that we are looking at in the State have rates of return that range from 7 percent to 65 percent.

There really is no way that you or I as individuals could get a savings account that would get us any kind of return like the types of conservation investments that we are projecting. We believe that conservation could also contribute directly to labor intensity in the economy through the manufacture of new equipment, more efficient appliances, the installation and retrofit of our homes and buildings, and the development of new products and services.

I would like to reiterate your comment of the morning in looking at the job implications of many of these measures. I would just point out that we do not have access to data that would indicate how many jobs are created by the conservation measures excepting a few specific programs such as consumer appliance standards. These are unique to the State of California, although proposed federally.

We find for these standards alone, in the State, we would have 1,300 direct jobs beginning in 1985. This is only one out of a large number of proposed State conservation programs.

We found that installation retrofit——

Senator KENNEDY. Would you hold for just a moment, Mr. Clark?

Mr. CLARK. Yes; certainly.

[A brief recess was taken.]

Senator KENNEDY. All right, Mr. Clark.

Mr. Clark. Yes, I wanted to add to that, one other program we have looked at would create over 2,500 new jobs, and that is an installation retrofit program proposed for the State by a change in the procedures of the public utilities commission. I want to add that in conjunction with the strong conservation effort we believe that State programs in solar energy development will result in a new industry for California, with a concomitant significant employment potential.

A goal developed by the State energy commission is the installation of solar water heating and space conditioning systems in 20 percent of all residential and commercial buildings in California by 1985. This is the equivalent of 1.5 million solar homes in California.

In order to meet this goal, the State has developed a number of concurrent programs including regulatory and testing programs, developed by the energy commission, and that will be underway this year.

We have a "solar task force" established in the State business and transportation agency. It is designed to assist the builders in the State, and also, the solar industry. We have a number of other efforts in the State, including those undertaken by my colleague, Sim Van der Ryn, who established the office of appropriate technology in California, and who is the State architect.

We have other programs in the State government.

Senator Kennedy, I have with me, as you will note in the back of my prepared statement, a copy of the tax form for the California solar energy tax credit.

California has now, as a result of legislation signed by Governor Brown last year, a solar energy tax credit. An individual could take this credit and the credit also can be extended over several years. This is very significant, because it aids a lower income taxpayer. If the solar energy credit were only good on your State income tax for 1 year, it obviously would not be beneficial to lower income individuals, yet we believe through the extension principle in this legislation, it will assist a wider and more diverse range of individuals.

The 55-percent credit is available for a single installation, and there is a 25-percent credit available for larger solar installations developed for multiple-unit housing.

The solar energy credit can also be taken by a home builder. This was done deliberately because we want to accelerate over the 5-year period that this credit will be in effect in California, to the maximum extent possible, the development of new buildings and new homes using solar energy. We are already beginning to see in the State—I have visited locations near Sacramento, and with Governor Brown, I have visited many locations in southern California—where complete subdivisions are now being planned using not only principles of direct collection of solar energy, but also using new architectural designs that passively use the energy of the sun for heating and also use design principles for cooling buildings.

We believe that in the State of California we can take a leadership role that will provide a model for the rest of the Nation. One comment that I would like to make that I do not have in my prepared statement——

Senator Kennedy. What is it going to cost, in terms of revenues; what is the tax expenditures in California?

Mr. CLARK. There was a discussion about this when the tax-credit legislation was debated. We would certainly like to see it used to the maximum extent possible, and the projections that I have seen that look most reasonable, range between $40 to $80 million over this period of time for a very large expansion of solar energy.

We are hoping that individuals will take the credit during this period. We expect to see several hundred thousand installations.

To meet the goal of 1.5 million installations by 1985, we need to gear up an industry that really has not existed since the early 1950's. There were 50,000 solar energy houses in Miami in the early 1950's, tens of thousands of homes in California in the 1930's and 1940's. It was the cheap development of fossil fuel that drove solar energy off the market.

So we find ourselves in a unique position: To get solar energy in use now, we will have to remove the subsidies from other fuels, or provide, as we have in the State of California, a very special subsidy for solar for a period of time. Because as we look out over a 10-year period, we see very expensive energy sources, and we see a competitive market for solar. But today, when we have cheaply subsidized fuel from centralized sources, and when the consumer is really not paying the full costs of that fuel, solar can't compete.

That is why you need the credit.

Senator KENNEDY. Have you analyzed that credit vis-a-vis the Federal tax credit now?

Mr. CLARK. Yes, and we do not think the Federal credit is strong enough. We do not think——

Senator KENNEDY. Your purpose is to equalize it, or to tilt it even further?

Mr. CLARK. Yes. We want to see it used. I would add, Senator, last summer I served on the Office of Technology Assessment review of the "National energy plan." I was on the policy overview committee, and during the week that we met and reported back to you on this plan, we were contacted by the administration and told that Mr. Schlesinger's goal for solar was reduced from 2.5 million homes in the United States to 1.6 million houses. During the OTA review, we were told by the individuals writing the "National energy plan" that they did not believe the credits developed would be sufficient to bring a high level of solar activity.

That was very important to me, and to the planning in California, because we recognized this. If we have a very——

Senator KENNEDY. What has happened to the cost of solar materials, though, out in California? What has been the increased cost of those items?

Mr. CLARK. Surprisingly, the cost increases have not been as great as I would have thought, based on what I was looking at, and what I testified before you several years ago. In 1973, the price of solar collectors were ranging anywhere from $15, $16, $25 per square foot. We are looking at costs in California today that are under $15–$20 per square foot for modern installations. We have a diverse range of manufacturers, and I might add, Senator, that we can see a very direct result of this tax credit in California.

In a survey undertaken of the solar industry, we found last summer less than 150 businesses involved in either manufacturing or sales of solar equipment. By January of this year we had almost doubled that figure, just in the solar businesses. We have businesses coming to California from international locations; we have businesses relocating from the east coast to California in order to take advantage of not only the tax credit, but really the increasing markets for solar.

Senator KENNEDY. Isn't that quite different from the costs of installing insulation, though?

Mr. CLARK. You mean the solar?

Senator KENNEDY. Yes.

Mr. CLARK. Yes.

Senator KENNEDY. If you have stability in terms of the market of solar equipment, it would be changing though, I suppose.

Mr. CLARK. This may happen with solar. With insulation, there has been some real demand in the market. There is great diversity of materials, and very specific problems.

With solar, it is different. This industry really has not existed. It is so new today that we have not yet seen the 2- or 3-year cycles indicating problems that may develop.

Senator KENNEDY. Right.

Mr. CLARK. We are hoping, and one of the key factors in the planning at the State level, incidentally, is to keep this industry as diverse as possible, and prevent the monopolization that you would see if solar energy were simply one more vestige of energy planning by the utilities.

So, we are actively encouraging a very diverse range of businesses.

I have attached to my prepared statement some material for your consideration from the business and transportation agency which explains in some detail the activities that we have undertaken to assist numerous small businesses in solar energy use.

Now, I would also add that this has been something in which Governor Brown has been directly involved. We have held to date two major meetings, one just 3 weeks ago, with the big builders in California, people who are putting in large numbers of new homes. We have held meetings with the solar industry, and with the builders. The Governor has personally asked many California builders to commit this year a minimum of 10 percent of all new construction to solar energy. This gives you an idea of the commitment of the State of California, and the commitment of the Governor, to see that the goals become reality.

I think it is that kind of effort that will have to be undertaken on a national level. We cannot treat solar energy as something to be dismissed.

Secretary Schlesinger was quoted yesterday in the Los Angeles Times as saying that conservation and solar energy were considered "fashionable" in California. It is my considered opinion that given the role of the Department of Energy, when out of a $12.5 billion budget they are spending only $1 million this year in "solar commercialization," and only $3 million out of that budget next year, we are never going to see solar become a reality in this country, because the DOE has a self-fulfilling prophecy not to develop this technology.

And unless the change comes——

Senator KENNEDY. R. & D. is down.

Mr. CLARK. Or we will not have it.

Senator KENNEDY. I know the R. & D. is down as well.

Mr. CLARK. R. & D. is down, but more importantly, we have the real possibility to use conservation and solar energy in this country, but unless we take a very serious attitude toward this industry with this tremendous job potential, we will not have it.

Senator KENNEDY. What has it done for jobs? Have you done any analysis of how this encouragement toward solar has meant more or less jobs, and what is the nature of the type of employment?

Mr. CLARK. Yes. The employment in solar energy has a wide range. To give you an idea, if we were to reach the 1.5 million solar house goal in 1985, in California, we would have an industry that will be selling between $3.5 and $7.5 billion worth of solar collectors.

Now, that means directly $1.5 billion per year in energy savings. You can see from those two figures alone the energy savings are tremendous, and obviously, that is a yearly figure. Project that over 10 years, and you see savings in excess of $10 billion for an expenditure of far less than that.

We see, in other words, that looking at the marginal costs of new energy sources, the solar investment not only pays off economically, but it pays off in the time frame of 1980's in conventional economics.

Now, in terms of jobs, that industry in 1985 will employ 50,000 people. That is more people, Senator, than the entire current employment rolls of all of California's gas and electric utilities.

The reason for this is rather basic. Utility planning to date in the United States has been a very centralized process. It is a high technology industry. Once the initial construction jobs are completed, there is no contribution to a very labor-intensive industry.

Yet, with solar energy, and with conservation, we can create a whole new diversified approach to energy planning.

You will note——

Senator KENNEDY. What is your extrapolation? How do you get 50,000? Just briefly, if you would.

Mr. CLARK. Well, we are looking here at not only manufacturing collectors, but we are taking the numbers of individuals that are needed for rather mundane chores in some senses of bringing one material from one place to another, of locating a new industry, of building the types of buildings that are necessary, bringing equipment into the State, of individuals who are fabricating the collectors, how many are necessary in the sales force to sell the solar equipment, how many are going to maintain the equipment, and so on.

That, by the way, is just a figure for the direct involvement in that industry. If you notice, also in my statement, we have a summary here of a study that has been made available to your staff that indicates on an energy equivalent basis how many more jobs are involved in solar than in combined-cycle oil or nuclear electricity equivalents. These numbers have been translated into electricity simply for the ease of comparing a solar energy investment with a conventional energy investment.

You will see that a 400 megawatt combined-cycle oil plant operating for 20 years generates 1200 man-years of labor. If we take the same amount of energy from the solar equivalent, we have almost 35,000 man-years asociated with delivering that amount of energy in society.

With the nuclear plant of 1900 megawatts, we show almost 37,000 man-years equivalent. Yet with solar, it is 241,000 man-years.

Now, on those energy-job numbers, Senator, it is very hard to compare apples and oranges. I do not want to mislead anybody by stating that we can simply turn a switch on for solar and say, here is the equivalent for another form of electrical generation. That would be misleading.

What is important about solar energy is to look at it not from the perspective of other energy sources, but look at it as an individual new industry. The more solar development we have, the more assists we have in energy supply. In your part of the country it would replace electricity; yet in California, it would replace very expensive new sources of natural gas or LNG. We are replacing not only non-renewable energy and putting more income in consumers pockets in the 1980's, but we are also creating an industry that has an average labor intensity that is more than 10 times that of the energy industry today.

It seems to me there could be no better national investment than this kind of endeavor.

This is what is so perplexing to me, not only professionally, but personally, about the goals that we see from previous national administrations in solar energy. The entire approach has been R. & D., doing paper studies, examining the impact of living after the year 2000. But there has not been a significant effort to move this industry today or even in exploring the employment figures.

We have had problems just getting the job numbers on solar energy, or how many jobs are associated with various competing energy sources. I am not sure where those data should come from. I would think a good start would be the Department of Energy, and if not the Department of Energy, then perhaps the Office of Technology Assessment.

I would like to add that we are not just looking at solar energy in California from the standpoint of solar collectors, but a whole variety of technologies including going further in solar with photovoltaics and wind-generated electricity.

If your staff is interested in speaking with some of the individuals who are moving the solar industry to California, I suggest they contact Joe Dawson with Grumman Energy Systems, who is here today. The Grumman Corp. is an example of a major Eastern corporation that is now relocating its operations in this new energy area in the State of California.

We see a variety of industries moving into the State. Grumman is an example of a company that is diversifying into solar, and also, a corporation that is diversifying into wind generation of electricity.

We are pressing in the State a number of alternative sources of energy that have very high job potential, and one thing that I noted here in the testimony is that the Brown administration, has a proposal now before the legislature in the State of California that would involve significant reforestation of hundreds of thousands of acres of California timber lands in order to revitalize the land by planting trees. We believe that we can get significant energy from waste material from agriculture, from biomass resources, wood wastes, from cogeneration facilities at pulp mills and agricultural locations.

From those sources, we can create over 11 thousand permanent jobs—these are forest industry jobs on the ground—through reforestation; and we will have a related regional employment of 20,000 people from this program alone.

Under proper management—and I stress that because many of the biomass energy schemes that I have seen proposed are things that are called euphemistically energy plantations which would involve environmental despoliation of forest lands for energy.

I stress the point that we are developing a good management plan for reforestation, which may result in the development of between 8- and 16,000 megawatts of electricity energy equivalent from materials that currently are either not used or underutilized today.

A number of other new energy sources we are looking into have great job potential. Our department of water resources is the biggest power user in the State of California, to pump water for the California water project. The department of water resources today is vigorously pursuing technologies including clean coal technology, wind technologies, cogeneration and biomass energy. I want to conclude my statement before you this morning, Senator, by stating that these relationships between energy supply sources and job development have not been looked at critically by our largest institutions, neither in industry nor government.

I am aware of only one large problem undertaken by the Bechtel Corp. It is the only one available.

We are also looking at geothermal development, where in the State we have 20,000 megawatts of potential energy.

Yet we would like to have better job data than we see today for our own planning purposes, so that we can indicate where the needs will be in terms of our local planning. But we do not have it, and it would be very helpful if one of the results of your hearings could be a redirected national effort in this area.

I present in my prepared statement that by increasing energy efficiency and promoting conservation, and supporting renewable energy sources, I think we are looking at a totally new approach to national unemployment. When you expand this vision, energy is not just a solar collector or nuclear powerplant, but is closely linked to the need to revitalize our urban areas—and as you know, the Brown administration has developed a "California urban strategy." As we look at our rural areas and the need to revitalize forest lands, and the need to go to urban areas and rebuild inner cities, this becomes an overall strategy.

These goals are very much related to energy, but even more importantly, they will provide many more jobs than any energy plan currently considered seriously by our large institutions, including the Department of Energy.

Thank you.

[The prepared statement of Mr. Clark, together with the attachments referred to, follows:]

Prepared Statement of Wilson Clark

Thank you, Mr. Chairman, for this opportunity to present to the Committee a viewpoint on this important subject. Governor Brown has identified the development of new energy sources and the creation of new jobs as a major priority of his Administration. To this end, a number of programs have been developed by California state agencies to accelerate and stimulate new energy source development.

A cornerstone of California's energy policy is increased efficiency of energy use and broad energy conservation programs. In the past, a popular theory held that economic growth is directly tied to energy growth. However, recent experience indicates the fallacy of this theory. California, with 10 per cent of the nation's population, experienced a 50 per cent decline from the historical trend of electrical energy growth in 1977. Electrical energy sales increased 3.1 per cent, yet personal income grew 12.5 per cent. In 1977, nearly 500,000 new jobs were created in the California economy. Increasing energy efficiency and conserving non-renewable energy sources contributes to a healthy economy.

A recent report by the California Energy Resources Conservation and Development Commission (Energy Commission) is attached (attachment A).

This report, entitled "Conservation as an Energy Resource," indicates that planned conservation programs in the state have the potential to reduce forecasted 1985 electrical demand by 32 to 39.4 billion kilowatt-hours, and forecasted natural gas demand by 2.4 to 2.8 billion therms. These figures are equivalent to 15–19 percent of the state's electricity demand in that year, and 18–21 per cent of the state's natural gas demand.

The conservation programs described in this report not only reduce energy waste, contribute to new jobs in the economy, but also save consumers hard cash. Based on projected 1985 average costs of energy supply, it is estimated that conservation can "supply" energy at one-fifth the costs of other, conventional supplies. Compared to the marginal costs of suplying new energy, conservation investments provide a unit of conserved energy at less than one-tenth the cost of additional supplies.

The conservation programs are identified in Table VI of the Energy Commission document. The programs include:

Commercial and industrial building audits.
Retrofitting ceiling insulation in residences.
Utility voltage reduction.
Non-residential building standards.
Building standards for homes.
Increasing motor efficiencies.

These conservation programs help to create new jobs in a variety of ways. The conservation programs identified by the Energy Commission represent an excellent consumer investment; rates of return range from 6.9 to 64.3 pecent, far better than a savings account. By saving consumers money, additional funds are released to the economy, and not tied up in capital-intensive centralized energy investments. Conservation contributes to labor-intensive sectors of the economy directly, through the manufacture of more efficient appliances and equipment, insulating and retrofitting homes and buildings, and the development of new products and services.

Although the direct job impacts of the state's conservation policies have not been computed for the full range of measures proposed, initial indications illustrate positive employment effects. For example, the state's consumer appliance standards alone would indirectly create over 1,300 jobs starting in 1985. Insulation retrofit programs in housing (assuming 70 percent penetration) would create over 2,300 new jobs over a five-year period. These are only two programs, out of a larger number of proposed conservation efforts.

In conjunction with strong conservation efforts, state programs in solar energy development will result in a new industry, and significant employment potential. A goal developed by the California Energy Commission is the installation of solar water heating and space-conditioning systems in 20 percent of all residential and commercial buildings in California by 1985. This is the equivalent of 1.5 million homes using solar energy in the state. In order to meet this goal, the state has developed a number of concurrent programs, including regulatory and testing programs developed by the Energy Commission, and a Solar Task Force for builders and industry developed by the Business and Transportation Agency. Other important efforts are underway by the Office of the State Architect, the Office of Appropriate Technology, the State and Consumer Services Agency, the Resources Agency and the Public Utilities Commission.

Last year, Governor Brown supported and signed State Senator Gary Hart's bill, which created a solar energy tax credit. California consumers can now take advantage of a 55 percent tax credit for the installation of solar devices, and a 25 percent credit is available for solar (and conservation) devices in multiple-unit housing. The tax credit can be spread over several years, aiding lower-income taxpayers. In addition it can be taken by builders of new housing, thus contributing to the acceleration of solar energy in new building practices. Attachment B describes the solar tax credit, the activities of the Solar Task Force, and contains the tax form. In addition, I am providing the Committee staff a copy of a proposed report by Dr. Ron Doctor of the California Energy Commission, which describes the results of a joint inquiry on solar energy by the Energy Commission and the Public Utilities Commission.

The installation of 1.5 million solar units by 1985 in California would result in the savings of 300 million cubic feet of natural gas per day, the equivalent in electricity being 15 billion kilowatt-hours per year. This is equivalent to the installation of $3.5 to $7.5 billion worth of solar collectors. Not only would a new industry be created, but consumers would save up to $1.5 billion per year in reduced energy expenditures.

The employment effects of reaching this solar goal are impressive. The manufacturer of collectors, maintenance, installation and sales would result in the employment of 50,000 people year-round. This is more jobs than exist in all of California's gas and electric utilities today.

According to the state's Employment Development Department in a recent draft study, solar installations are most labor-intensive than fossil fuel or nuclear plants. The decentralized development of solar energy is not only more labor-intensive, but this development provides more local and in-state jobs, when compared with central sources of supply of natural gas or electricity. The Department's study contrasted the direct and indirect employment associated with nuclear and combined-cycle oil generation of electricity with a solar "equivalent." The summary results are shown here:

Nuclear 1900 MW plant, 36,268 Man-years (20-year operation).
Solar equivalent, 241,055 Man-years (20-year operation).
Combined-cycle 400 MW plant, 1,237 Man-year (20-year operation).
Solar equivalent, 34,885 Man-years (20-year operation).

This staff document has been made available to the Joint Economic Committee staff. It should be noted that these energy/job "equivalents" have been translated into electricity capacity figures for convenience in understanding the employment implications. Most of the energy displaced by large solar programs would be in the form of natural gas, not electricity. Until large-scale programs for converting solar energy directly into electricity are developed (such as photovoltaic technology) the primary energy savings result in displaced low-grade energy (heat) for water and space heating applications.

The development of California's solar programs will undoubtedly contribute to increased employment in various sectors—not just direct employment in the industry, but also in terms of displacing costly, non-renewable fuels. In addition to direct programs for stimulating the use of solar water and space heating technologies, state agencies are exploring the use of other alternative energy technologies, including biomass energy, wind generation, solar thermal energy, and industrial cogeneration.

Reforestation and biomass energy projects proposed by the Resources Agency would revitalize forest lands in California, as well as provide jobs and new energy supplies from wood wastes and other biological (and thus renewable) residues. The Agency's reforestation efforts would lead to the creation of 11,000 permanent forest industry jobs and related regional employment of 28,000 persons. The Agency projects available supplies of wood and agricultural residues, under proper management, to supply between 8,000 and 16,000 Megawatts of electrical power on a yearly basis. The Department of Water Resources in the Agency is now planning alternative energy technologies to power the state's needs for water pumping. These plans include coal, wind and biomass energy plants.

The relationship between energy supply sources and job development have not been sufficiently identified by federal or state agencies. The studies I mention today represent only the beginning efforts on the part of the State of California in identifying the enormous reservoir of new job opportunities in new energy source development. By increasing energy efficiency, promoting conservation, and supporting renewable energy sources, entirely new answers to unemployment may be found. The challenge before the nation is how best to accelerate the development of these realistic opportunities.

ATTACHMENT A

Conservation as an Energy Resource: Policy Implications for California

SUMMARY

Introduction

This report was prepared in response to a request from the Honorable Leo McCarthy, Speaker of the California Assembly to discuss the potential of conservation to "produce" energy, the advantages of conservation over traditional energy supply sources, the specific conservation programs that are being undertaken in California, and the implications such programs have for the labor market. This report was prepared to assist the California Legislature in resolving energy supply issues in a manner most beneficial to the state, and attempts to explain why the Energy Commission considers energy conservation a viable and less-costly alternative to traditional energy supplies, and what the Commission and others are doing to ensure that energy conservation programs are developed and implemented throughout the state.

Savings

An aggressive and comprehensive energy conservation program for the state of California has, at a minimum, the potential to reduce our 1985 forecasted electrical and natural gas demand by 32 to 39.4 billion kWh's (15–19 percent) and 8 to 10.8 thousand MW's of summer peak electricity (18–25 percent), and by 2.4 to 2.8 billion therms of natural gas (18–21 percent). The conserved energy, in effect, constitutes a source of supply available for use throughout the States economy, and at a lower cost.

For example, by 1985 natural gas could be saved at a cost of about 10 cents per therm, which is one-fourth of the expected price the consumer may have to pay for new gas supplies. Conservation probably cannot offset the total need for added energy supplies, but it should be viewed as part of the supply mix.

The conservation programs outlined in this report reduce energy waste by increasing the efficiency with which we use energy. Rather than curtailing energy use to meet short-term energy shortages, the conservation measures described here are aimed at improving our long-term ability to do better with less, and save money in the process.

Conservation pays. The cumulative effect of energy conservation in the State of California will be to save both energy and money. The magnitude of the annual dollar savings possible from the conservation measures discussed will range between 3.1 to 3.8 billion dollars by 1985 (in 1985 dollars). This is roughly equal to an average annual savings of $140 per California resident.[1]

Cost-Effectiveness

As an alternative to utility expansion, conservation investments are less costly than conventional sources of energy supply. Based on 1985 average costs of energy supply, it would take roughly a five dollar investment in such sources of energy to equal what a one dollar investment in conservation could save. When compared to the marginal cost of supplying energy from increasingly more expensive sources, conservation investments are even more cost-effective, with some conservation investments providing a unit of conserved energy at less than one-tenth the cost of additional supply.

Energy conservation programs promoted by the Commission are cost-effective to the individual consumer, who can obtain an excellent return on investment in conservation measures. Many of the measures which can be undertaken by individuals to conserve energy in their homes have average annual rates of return of between 6.9 percent and 64.3 percent after taxes. This is much better than after-tax earnings on other safe investments. Like a passbook savings account (at 3.83 percent). After the initial investment is recouped, the savings from reduced utility bills continue as "dividends" which are not subject to taxes and which will increase as energy prices rise.

[1] Average electric prices are from Vol. 2 of CERCDC 1977 Biennial Report. Average gas prices are CPUC estimates from Vol. I of their staff report in Case 10342 (LNG terminal) for gas supplied by traditional sources. A 6 percent inflation rate was used. Based on Department of Finance estimates, the population will be 2.44 million people in 1985.

Additional benefits

Since energy conservation measures can reduce energy waste and slow the growth in energy demand, their aggregate effect will be to reduce our need for additional sources of fossil fuels and for new electricity generating facilities. In turn, this reduced need will lead to fewer adverse impacts associated with the provision of additional energy from conventional sources. Implementation of a vigorous, comprehensive conservation program for California will have a beneficial impact on natural resources, the environment, the economy, and utility operation.

Among the objectives which can be achieved through energy conservation are the following:

Positive effects on employment.—The production of energy is highly capital-intensive. Conservation, however, can channel resources into more labor-intensive sectors of the economy—through the manufacturing of more efficient appliances and equipment, insulation and other retrofitting of residential and commercial buildings, and new design concepts to capitalize on energy efficiency. This process will eventually result in an increase in goods, services, and employment using less energy, with the possibility of additional beneficial impacts on employment among the lower-skilled. The indirect impacts of conservation will be even more pronounced acting as a stimulus to the economy by making available capital that would otherwise have been invested in energy supply, and by increasing the disposable income of consumers through a reduction in their energy expenditures.

Reduced capital investment in electricity generation.—The five major utilities are planning to spend over 22 billion dollars to add 14,000 MW of new generation capacity between now and 1985. Including associated transmission and distribution costs, this is equivalent to $1,600 per kilowatt of generating capacity, or roughly $.30 per kilowatt-hour of electric energy (1985 dollars). Conservation programs can displace the need for over half of this planned additional generating capacity at far lower cost.

Reduced dependence on uncertain energy supplies.—New fossil fuel sources are characterized increasingly by the remoteness of their place of origin, the enormous scale and technical complexity of their extraction and transmission, and the acceleration of their costs. These factors lead to a greater risk of supply interruptions and price escalations. In addition, conservation can help reduce our dependence on fuels imported from other countries, beneficially affecting our balance of trade and reducing inflation.

Increase efficiency and cost-effectiveness of utility operations.—Conservation measures can lower utility operating costs by shifting demand from on-peak to off-peak hours, by delaying or avoiding the need for expensive capacity additions, and by allowing retirement or reduced operation of low-efficiency, fossil-fueled generating facilities. Since cost-effective conservation measures save a unit of energy at a less cost than supplying an additional unit, ratepayers will benefit. In addition, energy conservation as a "source of supply" has advantages over conventional central station electric generation or natural gas supply terminals because it is more readily adaptable to changing conditions and unpredictable circumstances, it is more reliable, and it is subject to fewer uncertainties.

Minimization of stress on the environment.—A reduction in energy growth will allow decreases in the negative environmental impacts associated with the extraction, processing, transport, generating and consumption of energy.

Slow-down in the use of non-renewable resources.—By reducing the energy growth rate, conservation measures can help avoid shortages in our fossil fuel resources at the same time as we increase our use of alternative forms of power generation which are non-polluting and make minimal use of finite resources.

The role of energy prices

In the past, energy efficiency was undervalued, due to declining average unit cost for energy. An era of cheap and abundant energy encouraged energy inefficiencies to be built into our way of life. It is now very apparent that our society must reverse this trend and reinstate the wise use of energy as a major consideration in land-use planning, appliance and equipment design, industrial processes, and building design and construction.

Simultaneously, conservation must become the backbone of the energy supply planning process and be compared, step-by-step, with new supply alternatives in terms of resource and capital requirements, environmental and social impacts, and contribution to the diversity and reliability of the supply system. Nevertheless, energy conservation as a supply planning tool is still undervalued by the utility industry, partly because it is a new approach to utility planning, and partly because it is not as readily added to the rate base or as capable of providing a guaranteed return on investment.

Utility pricing structures encourage the undervaluation of conservation by their customers, as well. Currently, customers are not charged for energy based on the cost of supplying additional, "new" energy. Instead, the price of expensive increments of additional energy are averaged in with existing, lower-cost energy. This average-cost pricing tends to distort the allocation of capital away from an optimum balance between investments in new energy supply and in energy conservation, in effect creating a "hidden subsidy" for the continued wasteful and inefficient consumption of energy.

Pricing energy at its incremental, or marginal, cost is one way to eliminate this hidden subsidy. Another way is to use incentives, financed by taxes or utility rates, to encourage customer implementation of conservation measures. A clear case can be made for the ratepayer to bear a portion of the cost of conservation measures.

Consider the following example. When a gas-heated home is insulated, the owner saves an average of about $54 per year (based on an average cost of 18¢ per therm). The gas saved can be sold and used productively elsewhere in the economy. If this amount (300 therms) of gas had to be purchased as an additional source of new supply, it would cost from $126 to $270 (42¢ to 90¢ per therm will be the delivered price of new gas). The difference between these amounts, up to $216 each year, is the benefit to all ratepayers from insulating that one home. Until the house is insulated, this represents, in effect, a "hidden subsidy" being paid to the customer not to insulate, since the residential customer is not paying the full replacement cost of the gas being wasted in the form of excess heat losses from the ceiling. As long as the conservation measure saves a unit of energy at a lower cost than the cost of a unit of additional supply, then conservation is preferable for the customer class as a whole since this cheaper "source" will meet the same ultimate needs for a warm house, hot water, cooking, and so forth.

Usage patterns and trends

The amount of energy that we are using and how we are actually using that energy are two very important elements in the assessment of our current and future energy position. The use of energy, and of electricity in particular, has grown rapidly in California. Total energy use increased by 14 percent from 1968 to 1973, considerably faster than population growth in the same period. During just one year, 1975, energy use in California grew by 4 percent. Historic growth rates, if projected to remain constant for the next two decades, would imply a need for huge commitments of resources and capital to provide the required fuel and generating capacity. The consequences of policies designed to meet a rapidly increasing demand for energy will adversely affect our environment, health, resource base, financial position, and vulnerability to sudden supply interruptions.

The negative environmental impacts associated with the extraction, processing, transport, generation and consumption of energy are well documented. The major impacts are in the areas of air and water pollution, nuclear safety issues and land use, all of which will be aggravated with increased energy production.

Increasing energy demand is bringing California and the rest of the nation face to face with resource scarcity. California consumes about 10 percent of the energy used by the United States as a whole. Like the U.S. California faces major medium to long-term supply problems. Fuels used to generate electricity include natural gas, petroleum, uranium and coal. The first two sources have important properties that make them valuable for uses other than generating electricity or raising steam. Petrochemicals, for example, are used in plastics, pharmaceuticals, and in fertilizers for agriculture. Given technological change, it is conceivable that new and more socially beneficial uses will be discovered for these finite resources.

Despite being a major oil and gas producer, we are highly dependent on supplies from other states and countries, importing almost half the energy used in 1976 from out-of-state.

Although the western states are in a more advantageous position in the short term with respect to oil supply (due to a 'surplus' from the development of Alaskan oil), California faces a projected decline in gas supplies from traditional sources while major new gas supply projects will provide only about 50 percent of California's gas needs through the 1980's and beyond.[2] The new sources of gas

[2] CERCDC, Biennial Report, 1977, Vol. 4, Fossil Fuel Supply Issues, p. 31.

supply for California will differ from traditional resources in that they will be physically more distant from the point of consumption, require greater capital investments, require pipelines and shipping terminals of an unprecedented scale and technology, and entail higher delivered costs.

Coal, which had declined in use in the twentieth century, is once again taking an important role in the nation's energy supply planning. It is our most abundant fossil fuel, but severe environmental and safety impacts are associated with its extraction, processing and combustion.

High-grade uranium ore is in very limited supply world-wide, and at some point in the future uranium fuel costs are likely to skyrocket, affecting both the economics and growth of light water nuclear reactor use. The successful development of the breeder reactor is regarded by some experts as a solution to this problem, because it produces more fuel than it consumes. The breeder program has been subject to much controversy, so it is difficult to estimate if or when this technology will begin to alleviate the depletion and rising costs of uranium.

While water to produce electricity is a renewable resource, additional sites for hydroelectric facilities are no longer available, unless we decide to flood environmentally sensitive and aesthetically valuable areas.

The choices remaining—at least when considering only conventional supply options—are not pleasant ones.

Due to the remoteness, enormous scale, and technical complexity of new sources of energy supply, there is an increased risk of supply interruptions and uncertainties—including fluctuations in the costs of supply. Cost escalations associated with the provision of additional energy are difficult to predict. Last year alone California consumers paid almost $6 billion for natural gas and for electricity, equivalent to a payment of $275 by each person in California.[3] Escalation figures for coal costs are about 6 percent per year. Residual oil for use in power plants may double in price between now and 1985. Uranium to fuel nuclear power plants has more than quintupled in price during the last four years. Gas prices could rise by 420 percent by 1985.[4] In addition to fuel costs, the capital costs associated with new generation may have annual escalation rates as high as 26 percent for nuclear plants and 13 percent for coal units.[5]

In a tight money market, capital can be viewed as a scare resource also. This is of particular relevance to utilities, because the energy industry is very capital-intensive. Traditionally, the energy industry has consumed the largest share of all investment capital in the nation. The Ford Foundation Energy Policy Project estimates have placed the national commitment of capital for new generating facilities at 30 percent of total investable capital between now and the year 2000.

This means that other sectors of the economy will have a decreasing share in investment and growth. It also implies that consumers will be forced to finance expansion of the energy industry through higher energy prices and higher interest rates.

Capital is also needed—though at a much smaller scale—for conservation efforts, so that consumers and businesses can replace inefficient energy uses with better equipment, technology and practices. The commitment of huge amounts of capital to expand energy supply decreases that available for investment in energy conservation, as well as for other valuable purposes like the development of alternative energy technologies. Many of the beneficial impacts derived from energy conservation can also be obtained from the implementation of alternative energy sources, such as solar, wind, biomass and geothermal. The Commission is actively pursuing these options, as well.

Choosing to continue the rapid growth of traditional supply alternatives means foreclosing future options. Conservation allows us to keep these options open, while at the same time meeting at least part of future energy needs at a lower dollar cost, and with less environmental harm. Conservation will also generate at least as many jobs, and reduce or shorten uncertainties in energy supply. The remainder of this paper explores this conservation potential in California, some of the major ways to achieve it, and what it will cost relative to conventional sources of supply.

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[3] Staff estimate based on CPUC and Department of Finance data.
[4] See references b and d of Table IV, p. 28.
[5] I. C. Bupp and R. Treitel, "The Economics of Nuclear Power: DeOmnibus Dubitandum," Harvard Business School, December 1976.

Conservation as a source of energy supply

Energy is not consumed for its own sake, but for the services that it renders to both consumers and to the industrial and agricultural sectors. As used by the Energy Commission, the term "energy conservation" means the elimination or reduction of waste in energy use.[6] By increasing the efficiency with which we use energy, we are able to obtain a greater amount of productivity from a given amount of fuel. Very simply energy conservation can allow us to get the same results, or better, with less energy use.

Operationally, this means that money can be saved in manufacturing, building operations and many other processes by utilizing less fuel to accomplish the same amount of productivity. Conservation does not mean energy curtailments or doing without. In fact, by making the best use of the energy supplies available, conservation can actually forestall the need for gasoline rationing, forced shutdowns of factories, uncomfortably cold homes, and life-style changes associated with "belt tightening."

Wherever there is wasteful use of energy in the economy, energy conservation can reduce or eliminate inefficiencies, permitting energy that was formerly wasted to become available for productive use throughout the economy. Thus, as long as there is wasteful or inefficient energy use anywhere in the economy, energy saved through conservation measures represents a genuine source of energy supply—one which has excellent characteristics of flexibility, reliability, economy and minimal environmental impact.

If there are conservation measures that can save a unit of energy at less cost than new supply, then it makes economic sense to implement these measures before providing new energy from conventional supply sources. The policies of the Energy Commission recognize this clear fact, urging that cost-effective conservation measures be implemented in preference to further depletion of scarce resources or the construction of new power plants.[7] By this means, the essential benefits derived from energy use can be obtained at least cost—both dollar cost, and environmental and social impact. This does not mean that all energy needs in the foreseeable future can be met with conservation, but that conservation should be part—a preferred part—of the supply mix.

Using energy efficiently must become a basic component of our energy consumption patterns, particularly when we consider the future costs of obtaining energy. Not only will energy prices increase, but, as we must drill deeper and transport further, we are expending more and more energy to obtain energy and thereby gaining less and less as a return on our "energy investments"

It is the Commission's policy that conservation become an integral part of the energy supply planning process, so that conservation is compared, step-by-step with other supply alternatives in terms of resource use, capital requirements, net energy, need for transmission systems, environmental and social effects, and contribution to system diversity and reliability.[8] Proposals for additional conventional supply resources are not justified unless they result from just such a comprehensive planning process.

Inefficiencies in present energy use patterns

The reasons for our present inefficient energy use patterns are many. The energy supply industry has just emerged from an era in which technology, economics, regulation, supply arrangements, and politics all pointed in the direction of continued growth in conventional energy supplies. In the past, economies of scale, improvements in energy technology, and the tapping of new oil fields made possible declining average unit costs for energy. Since increased fuel production and sales generally meant lower costs to the utilities and their customers, energy suppliers had the incentive to expand and to encourage more energy consumption by their customers.

In an era of cheap and seemingly inexhaustible energy supplies, it was not considered economically rational to place energy efficiency about "first costs" or other operational costs. Since fuel operating costs were so low, the major costs associated with designing structures, equipment and machinery were the costs of materials and the labor to build them. As a result, a design philosophy developed which sought to minimize these "first costs," rather than any energy inefficiencies. This tendency was, and is, encouraged by the fact that those making the decisions on how to design a building or piece of energy-using equipment

[6] CERCDC. Biennial Report, 1977, Vol. 3, Opportunities for Energy Conservation, p. 16.
[7] *Ibid.*, p. 41.
[8] *Ibid.*, p. 42.

generally do not pay the cost of the energy to operate it; thus they have little incentive to build it efficiently.

This minimal first-cost design philosophy is best illustrated in our current stock of thermally inefficient homes and commercial buildings. Since operating costs were largely ignored in order to reduce construction costs, many of these existing buildings have minimal insulation and inefficient heating and air conditioning equipment.

First costs, however, do not reflect the real cost of the building to the owner or tenant. Initial costs must be considered along with interest, maintenance, and operating costs. When energy was cheap and abundant, consumers were generally poorly informed or didn't care much about the energy and dollar savings which could accumulate from a house built with energy conservation in mind. Since there was little market demand for energy efficient housing, many homes constructed prior to 1960 have little or no attic insulation and no insulation in the walls or under floors.

Energy inefficiency became a way of life to an economy fueled with inexpensive, plentiful energy. In addition to buildings, land-use patterns, transportation systems and industrial equipment all reflected the availability of cheap energy. Now, while the energy picture has changed considerably in a very short time, the patterns of consumption will tend to adjust much more slowly because they are built into our economy and way of life.

The energy supply picture began to change in the late 1960's. Circumstances which had previously favored utility and oil company expansion, based on economies of scale, now began to reverse this trend. The size of individual turbine generators reached an upper limit imposed by the strength of materials used. Simultaneously, concern over environmental problems related to energy generation increased—air and water pollution standards were imposed. The advent of nuclear power imposed fresh problems associated with operating a new power technology. Larger amounts of capital were required for new construction, and the electric utility industry's ability to raise this capital in private security markets diminished.

Within a decade, utility economics has undergone a metamorphosis. For example, electric and gas rate structures had traditionally provided for progressively lower unit prices as a customer's volume increased. This type of "declining block" rate structure assisted the utility industry during its expansionary period by promoting greater energy usage. This income was used to finance large new plants which in turn allowed costs and rates to be further reduced. In the past, utility rates may have reflected declining costs, however, new energy supplies are no longer cheaper than existing supplies; they are more expensive. The replacement cost of natural gas is now more than 70 percent above the average price; for oil the difference is approximately 45 percent; and for electricity, nearly 40 percent. Maintaining price structures that reflect energy costs of the past in an era of increasing costs underprices new energy, gives ocnsumers incorrect price signals, and encourages the inefficient use of energy.

Just as the purchase price of a building or an appliance is usually not indicative of the life-cycle costs of operation or maintenance, the energy price that appears on the consumer's utility bill is often not indicative of the cost to the utility of supplying an amount of power at a given time. Electrical demand, for example, has two dimensions: magnitude and time. The magnitude of energy use is affected by wasteful consumption, such as that caused by an inefficiently-designed air conditioner. The timing of energy use is related to daily or seasonal patterns of consumption, such as the operation of that air conditioner on a hot summer afternoon.

Both the amount of energy that is used and the time that it is used are related to fuel waste and the need for building additional generating capacity. Baseload (minimum energy demand that occurs year-round) is best satisfied by generating equipment which is most economical when run for prolonged periods of time, while peak load (highest power demand) is generally satisfied by equipment which may be less efficient to run, but which is not called upon to operate for long periods, and is cheaper to build.

Thus, because of high peak demands during a relatively few hours per year, the utility must make capital investments in generating facilities which stand idle much of the year, and, when running, waste fuel. The higher costs of operating the relatively inefficient peaking units has never, with the exception of very large commercial/industrial customers, been made evident to the consumer, who has therefore had little knowledge of how the timing of his electricity use affected utility operating costs and the need for constructing additional capacity. Although not as widely recognized, there is a corresponding annual "peak load" problem in the demand for gas.

As energy prices begin to reflect the higher costs of providing additional supplies, consumers will discover that past energy use patterns are too expensive to continue, and many will begin to modify wasteful personal habits, and pay more attention to the energy costs—or energy efficiency—"built into their next new home or appliance. Other countries, faced earlier with higher energy prices and supply problems, have learned to live well with less energy consumption by driving smaller cars, using more mass transit, more insulation and tighter construction (having more efficient industrial processes, and using cogeneration and district heating. Sweden, for example, uses less than two thirds as much energy per capita as the U.S., at a comparable standard of living. Higher efficiency is the single most important reason for the lower energy use in Sweden.[9]

Governmental action can begin to move society in this direction now, to smooth the transition from a cheap-energy economy already in our past, through an economy of limited and expensive energy resources, to an economy based on renewable energy resources. Rapid increases in energy prices could cause severe economic dislocations, but the worst problems of adjustment can be mitigated by energy conservation measures taken now, to reduce energy waste and slow the growth of energy demand. If this is done properly, it will represent an economic bonus rather than a burden.

Costs of conservation relative to conventional supply

Conservation of energy can "produce" a unit of energy at less cost than conventional sources. As illustrated in Table I, conservation measures save energy at a less cost per unit than traditional energy sources, whether supplied at average or marginal cost prices. Such comparisons, however, require consideration of a broader context.

With respect to the individual customer, dollar savings from conservation versus traditional growth in energy consumption reflect the historical, average cost of energy. This undervalues the impact of conserving energy in several ways. First, the price the consumer pays for energy only accounts for the dollar expenses of producing and delivering the energy in a suitable form. The marketplace does not value non-dollar costs, such as environmental, health or national security impacts of producing and delivering the energy. Second, the next increment of energy supply, which could be avoided by implementating the conservation programs, will be more expensive than historical costs. Third, the season and time of day of the savings is also a factor. If the savings occur during the on-peak period, the true cost of on-peak energy is typically greater than average cost. Generally, electric utilities bring their most inefficient, highest operating-cost plants on line to provide the marginal kilowatt-hours required to meet peak demand. Moreover, operating capacity build to meet peak needs may sit idle during off-peak periods, representing a waste of resources and an expense to ratepayers. If the load can be shifted to more closely approach that of off-peak hours, there is potential for retiring the most costly capacity unit currently used, thus reducing average cost and the price of electricity.

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[9] Lee Schipper and Allan J. Lichtenberg, "Efficient Energy Use and Well-Being: The Swedish Example," Science, V. 194, No. 4269, (December 3, 1976).

TABLE I.—COST COMPARISON OF SELECTED CONSERVATION MEASURES/PROGRAMS WITH EQUIVALENT GENERATION

Individual conservation measures, utility or statewide programs	Average annual energy savings: Kilowatthours	Average annual energy savings: Therms	Amount invested by 1985 (1978 dollars)	Costs/lifetime energy savings (1978 dollars)	Average cost of equivalent supply (1978 dollars)	Marginal cost of equivalent supply (1978 dollars)
Insulate an uninsulated single-family home in northern California.	5,000	360	$325 per customer	$0.003 per kWh or $0.045 per therm.	$0.042 per kWh [1] or $0.20 per therm [2].	$0.056 to $0.131per kWh[3] or $0.43 to $0.64 per therm.[4]
Insulate an uninsulated single-family home in southern California.	3,000	215	$290 per customer	$0.005 per kWh or $0.067 per therm.	$0.05 per kWh [1] or $0.20 per therm [2]	$0.056 to $0.131 per kWh [3] or $0.43 to $0.64 per therm.[4]
Difference between an efficient refrigerator and a standard model.	600		$105 per customer	$0.009 per kWh	$0.04 per kWh [5]	$0.056 to $0.131 per kWh.[3]
P.G. & E. commercial/industrial audits	7,000 to 9,300		$25.6×10[6] (utility and customers).	$0.028 to $0.037 per kWh	$0.042 per kWh [1]	$0.056 to $0.131 per kWh.[3]
S.D.G. & E. pool program	115×10[6] (53 MW).		$527,000 (utility and customers).	$0.001 per kWh	$0.052 per kWh [1]	$0.056 to $0.131 per kWh.[3]
Statewide water heater program (insulation and flow control).	410×10[6] to 710×10[6]	220×10[6] to 350×10[6].	$151×10[6] (utility and customers).	$0.003 to $0.004 per kWh or $0.043 to $0.068 per therm.	$0.04 per kWh [5] or $0.35 per therm.	$0.056 to $0.131 per kWh [3] or $0.43 to $0.64 per therm.[4]

[1] Forecast average 1985 prices are from ERCDC's biennial report, vol. 2, p. 64, and converted to 1978 dollars using (1.1434) times (1976 dollars).

[2] Average residential gas prices are from table V of this report.

[3] Marginal electric prices are from "Comparative Cost Analysis" (supporting document No. 33 to staff summary report for AB 1852 proceeding [77–NL–1]), p. 3. The $0.056/kWh is the low estimate for coal or combustion turbine plants; the $0.0131/kWh is the high estimate for a combined cycle plant. The medium estimates range between $0.079 and $0.087 per kWh.

[4] Marginal cost of natural gas is the range of city-gate costs from supplemental sources shown in table IV of this report and increased by ⅛ to account for costs of delivery to final end user.

[5] IBID; a sales-weighted average was used to find statewide average price.

Gas companies also have a peaking "problem", since they must maintain backup storage capacity to meet maximum demand. There are two aspects to this problem of gas storage. Enough storage must be maintained to meet daily peak demands in the winter, so capital is tied up in storage units required only part of the year. Since gas decomposes with age, the reserve to meet peak demand must be continually turned-over, so the excess over average firm demand is sold to low-priority customers. This represents an inefficient use of a scarce resource. If the maximum demand were lowered, storage costs and sales of excess gas could be reduced.

Even overlooking these aspects, a direct expenditure for conservation measures by the individual is warranted from an economic standpoint. Table II illustrates returns to the consumer possible from expenditures in conservation. For example, based on a survey of the Sacramento area, the Commission estimates that it could (though not necessarily) cost at a maximum an additional $105 to purchase the most energy-efficient refrigerator instead of a standard model. This investment would yield annual savings of $31 per year, based on Northern California's projected prices in actual dollars, and yield on the average an annual rate of return over five years of 16.6 percent after taxes. Spending $365 to insulate an uninsulated home in Northern California would yield a 38 percent (electric savings) or a 21 percent (natural gas) average rate of return over five years due to lower heating bills. Comparable returns from conservation measures are possible in the rest of the state. And these returns generally provide more disposable income to consumers than equivalent dollar expenditures on traditional investments such as savings, stocks, or bonds. Putting $200 into a passbook savings account with a 5.25 percent annual interest rate yields an average annual rate of return of only 3.83 percent after taxes. Investing $1,000 in corporate bonds, with an annual interest rate of 8.25 percent will yield an annual rate of return over five years of only 6.02 percent after taxes. Assuming a 12.5 percent annual interest rate from an investment of $1,000 in the stock market, the consumer could have an annual rate of return over five years of only 11.96 percent after taxes. Compared to these investments, conservation really does pay.

TABLE II.—COMPARISON OF EQUIVALENT INVESTMENTS[1] BY ENERGY CONSUMERS

Type of investment	Amount invested	Annual energy savings: Kilowatt-hours	Annual energy savings: Therms	Average annual dollar savings over 5 years: Electricity	Average annual dollar savings over 5 years: Gas	Average annual rate of return after taxes over 5 years[2] (percent): Electricity	Average annual rate of return after taxes over 5 years[2] (percent): Gas
Insulate an uninsulated single-family home in northern California	$325	5,000	360	$263	$107	38.2	21.3
Insulate an uninsulated single-family home in southern California	290	3,000	215	199	68	34.6	16.9
Insulate an underinsulated single-family home in northern California	262	1,300	90	68	27	18.1	8.5
Insulate an underinsulated single-family home in southern California	200	700	50	46	16	16.6	6.9
Difference between an efficient refrigerator and a standard model	105	600		[3] 31 [4] 40		[3] 16.6 [4] 20.8	
Water heater retrofit	20	365	20	[3] 19 [4] 24	[3] 6 [4] 6	[3] 42.1 [4] 47.7	[3] 20.1 [4] 21.0
Solar water heater system with tax credit	2,000	2,100	180	[3] 110 [4] 119	[3] 53 [4] 57	[3] 10.5 [4] 10.8	[3] 8.5 [4] 8.7
Pass book account at 5.25 percent annual interest rate	200					3.83	
Savings certificate at 7.5 percent annual interest rate	2,000					5.47	
Corporate bonds at 8.25 percent annual interest rate	1,000					6.02	
Stock market at an average 12.5 percent annual interest rate	1,000					11.93	
Municipal State bonds at 5.25 percent annual interest rate	1,000					5.25	

[1] Conservation activities result in savings that accrue to consumers in the form of reduced utility bills. The increase in consumers' disposable income generated by energy savings from conservation is similar to the return from an equivalent, more traditional investment. Although a traditional investment produces a dollar return, conservation diverts money from payments for energy and allows the consumer to spend the savings on other goods and services.

[2] Compound interest calculation. Capital gains tax assumes that 5 percent of the realized long-term gain is taxed at a rate of 27 percent and 7½ percent of the gain is taxed at a rate of 13½ percent.

[3] Northern California (P.G. & E. rates).

[4] Southern California (SCE or SoCalGas rates).

With regard to the utility system, the cost of conservation measures is most appropriately compared with the marginal supply cost. The marginal supply cost is the cost of the most expensive existing or proposed new supply, and is higher than the average supply cost used as the basis for setting rates. Further, the costs that should really be compared are those at the point of end-use, where the social benefit is actually taking place.

This means that costs beyond those directly incurred to generate a given amount of electricity (i.e. the busbar cost) must be included, a factor neglected in many analyses. In addition to the busbar cost of the most expensive plant, the following must be incorporated in comparing energy supply to the costs of conservation. The first is the cost of reserve capacity, including the fixed charges for the investment. Next are the construction costs and fixed charges on the investment for transmission and distribution lines. As shown in Table III, these costs range between 20 and 60 percent of the total cost of capacity. Third are costs for transmission and distribution losses, which average 10 percent of the busbar cost of electricity. A truly accurate assessment of the costs of supplying additional power would include externalities such as environmental, health and safety costs. However, these non-dollar costs are difficult to value for any analysis.

TABLE III.—PLANNED UTILITY PLANT EXPANSION,[1] 1977 THROUGH 1985

	Installed capacity in 1976			Planned plant expansion, 1977–85		
	MW	10^6 Amount[2]	Percent T. & D.[3]	MW	10^6 Amount[4]	Percent T. & D.[3]
P.G. & E.[5]	14,048	$5,146	64	6,645	$8,175	37
SCE	12,167	4,557	62	5,431	9,458	21
S.D.G. & E.	2,062	786	62	1,231	2,602	34
SMUD	1,519	736	28	250	776	62
LADWP	5,720	2,049	58	487	2,049	51
Total	35,516	13,274		14,055	23,060	

[1] From "Summary of Electric Utility Data Submittals Under the California Energy Commission's June 1977 Order Securing Information (77–622–14)," Dec. 30, 1977, by the Energy Assessment Division, ERCDC. This is a compilation of tables 3 to 7, 21 to 25, and 28 based on utility submittals.
[2] 1976 dollars. Includes value of generation facility, transmission, and distribution lines.
[3] Percent of value or planned expenditure that is for transmission and distribution lines.
[4] Current dollars; that is, 1980 values are in 1980 dollars, etc. Includes expansion of generation facilities, transmission and distribution lines. Annual escalation rates vary by type of plant and for power line construction. The utilities optimistically choose rates which are much lower than recent historical escalations.
[5] Does not include SMUD.

The price consumers pay for natural gas is also not the appropriate comparison to the cost of gas conservation options. The current consumer gas prices are equivalent to the "city-gate" costs, plus distribution costs, plus gas taxes, plus overhead and profit. However, the "city-gate" costs are an average of the costs of old gas and more expensive new gas (either from new contracts or new fields) delivered to the utility. As with electricity, the correct comparison to conservation options is the most expensive source of supply that would be displaced. This cost would be that of the most expensive new gas delivered to the utility plus the costs for distribution, taxes, overhead and profit margin. Costs of externalities such as environmental, social, and health impacts should also be added, but again are difficult to quantify.

In addition to the preceeding costs, there are other factors that should be considered when comparing conservation to new supply on a utility system basis. Conservation has a great advantage over conventional central station electric generation or natural gas facilities in terms of flexibility. Flexibility, the ability to readily adapt to changing and unpredictable circumstances, is generally lacking in conventional, central energy distribution systems. Foreign oil or gas embargoes, drought, unexpectedly severe winters, and other unforeseen resource scarcities can adversely affect energy supply from conventional sources. Other sources of change include legislation, social policy, and foreign relations, which can change drastically within the lifetime of an electric generating plant or natural gas facility, and thus greatly alter the usefulness and economics of that facility.

Conservation is inherently more reliable than large electrical generating facilities, which are subject to unplanned outages. When the occasional failures of transmission and distribution systems are included in the comparison, as they must be, the advantage of conservation in terms of reliability is considerably greater. Because of the reliability problem of electrical generation, utility planners assume that to meet a demand growth of one hundred megawatts by constructing a large power plant requires that another fifteen or twenty megawatts of generating capacity be built as reserve margin. Saving the same one hundred megawatts of electric power through conservation demands no comparable reserve margin. Similarly, efficiency losses in the transmission and distribution system may use up another 10 percent or so of the power generated at a central station, before it reaches the end-use consumer. End-use conservation does not suffer this efficiency loss.

Another advantage is that conservation measures are much less capital-intensive than conventional supply options. Conservation measures can be undertaken fairly rapidly, with saturation times of a few years, while large generation facilities or natural gas lines and terminals can require development and construction times of ten years before supply is available. To produce the same level of energy supply, conservation programs require less capital for a shorter period of time, thus improving the utility companies' financial security.

A common objection to conservation that needs to be addressed has to do with the question of uncertainty. It is sometimes said that because of the lack of prior experience or difficulties of measurement we cannot be certain of either the cost or the effect of a conservation measure, and therefore we should hesitate before giving preference to investments in conservation. However, the uncertainties associated with conservation are dwarfed by the uncertainties surrounding conventional supply options. These factors include fuel availability and prices that are quite unpredictable (as experienced in 1973–74), major changes in our environmental knowledge (witness the persistent uncertainties surrounding Diablo Canyon), and the anticipated overruns in capital cost that have been typical of recent power plant construction. In addition, most of the conservation measures currently proposed have such a wide margin of advantage that they are almost certainly more economic despite any conceivable uncertainties. Even if the dollar cost of conservation were as high as the busbar cost of electricity generation, the weight of transmission cost; system unreliability, and social and environmental impact would render conservation cost-effective with a high degree of probability.

The utilities are planning to spend over 23 billion dollars for 14,055 MW of added generating capacity, transmission lines, and distribution lines by 1985. (See Table III). Conservation programs (shown in Table VI) could reduce peak demand by 8,000 to 10,800 MW and overall consumption by 32 to 39.4 billion kWh. Costs for electricity conservation range between \$.001 and \$.06 per kWh and \$13 and \$300 per KW. While a direct comparison must include operation, maintenance, and environmental costs, this illustrates that conservation is a less expensive alternative to traditional electrical generation. Similarly, conservation programs will save at minimum 2.4 to 2.8 billion therms of natural gas at approximately 10 cents per therm by 1985. Natural gas costs to the utility are optimistically expected to range between 16 and 20 cents per therm by 1985 (average costs in 1977 dollars, Table IV) with new gas supplies costing between 30 and 45 cents per therm. The prices to the consumer, based on average utility costs, are expected to be 32 to 40 cents per therm, in 1978 dollars. (Table V).

Because average rather than marginal cost pricing is used, gas and electric rates schedules allow a "hidden subsidy" for the continued wasteful and inefficient consumption of energy. Today, with increasing marginal cost of electric power generation and of new gas supplies, the continued use of average-cost pricing means that the average rate-payer is presently subsidizing the marginal user, such as the underinsulated house. The difference between the marginal dollar savings to the utility from conservation and the individual customer's dollar savings on his or her utility bill is the "hidden subsidy" This is the maximum amount that the utility company, using revenues from all rate-payers, could afford to pay to encourage implementation of conservation measures.

TABLE IV.—COSTS OF NEW GAS SUPPLIES[1] BY LOCATION

[1978 dollars per therm]

	1977	1980	1985	1990
Traditional sources:[2]				
El Paso		0.23	0.27	0.30
Transwestern		.28	.33	.35
Californian	[3]0.12-.24	.20	.21	.24
Supplemental sources:[4]				
Alaskan North Slope			.38	.32
Mexican		.32	.32	.32
Algerian LNG			.36	.33
Indonesian LNG			.38	.35
South Alaskan:				
Phase I only			.48	.39
Phase I and II			.39	.34
Average costs of old plus new gas:[5]				
Southern California Gas Co	.12	.14	.17	.20
PG&E Co	.17	.20	.21	.19

[1] This table shows the costs of new gas delivered to the utility, which is normally referred to as the city gate rice. This does not include the utility cost to deliver the gas to the final end user, which makes up over ⅓ of the price the pend-user pays.

[2] Vol. I of CPUC staff report for case No. 10342—"The Decline in Natural Gas Available," Sept. 30, 1977.

[3] Henry Lippitt of the CPUC, Apr. 12, 1977 report.

[4] Vol. II of CPUC staff report for case No. 10342—"The Decline in Natural Gas Available," Dec. 15, 1977.

[5] This is the average cost the utility would pay for gas, the rolled-in city gate cost, from traditional sources. This is used as the basis for the utility rates, which also cover costs of delivery to the final end-user. The source is the same as note 2.

Note: Prices for gas delivered to the utility are normally shown in dollars per MCF. However, for comparability to other tables, these were converted to dollars per therm, using 10.5 therms per MCF.

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TABLE V.—FORECAST RESIDENTIAL GAS AND ELECTRIC PRICES [1]

[Expressed in constant 1978 dollars]

Year	Electricity (cents per kilowatt-hour)					Natural gas (dollars per MCF)			Natural gas (dollars per therm)		
	P.G. & E.	SCE	S.D.G. & E.	SMUD	LADWP	P.G. & E.	S.D.G. & E.	SCE	P.G. & E.	S.D.G. & E.	SCG
1975	3.44	5.12	4.66	2.12	4.27	1.93	2.29	2.09	0.18	0.22	0.20
1980	4.67	5.86	5.52	1.84	5.30	2.90	3.02	2.77	.28	.29	.26
1985	4.85	6.34	5.76	2.20	5.43	3.39	4.17	3.82	.32	.40	.36
1990	4.71	6.45	5.84	1.71	3.96	3.70	4.59	4.20	.35	.44	.40
1995	4.62	7.24	5.31	1.98	3.96	4.10	5.19	4.75	.39	.49	.45

ELECTRICITY AND GAS PRICES COMPARED [2] (ABOVE PRICES CONVERTED TO DOLLARS PER 10^5 BTU)

[Expressed in constant 1978 dollars]

Year	Electricity (dollars per 10^5 Btu)					Natural gas (dollars per 10^5 Btu)		
	P.G. & E.	SCE	S.D.G. & E.	SMUD	LADWP	P.G. & E.	S.D.G. & E.	SCG
1975	1.01	1.50	1.36	0.62	1.25	0.18	0.22	0.20
1980	1.37	1.72	1.62	.54	1.55	.28	.29	.26
1985	1.42	1.86	1.69	.64	1.59	.32	.40	.36
1990	1.38	1.89	1.71	.50	1.16	.35	.44	.40
1995	1.35	2.12	1.56	.58	1.16	.39	.49	.45

[1] The residential sector generally pays higher prices for gas and electricity than any other sector. The prices shown are based on an average of the costs of gas and electricity from existing and new sources. Costs for supply from new sources will be significantly higher than the prices shown. In addition, these prices do not take inflation into account and are expressed in constant 1978 dollars. If these prices were expressed in current dollars (that is, 1980 amounts in 1980 dollars, etc.), they would be 80 percent higher in 1985, and 220 percent higher in 1995 if inflation was 6 percent. The prices are taken from ERCDC's "Energy Conservation Design Manual for New Residential Buildings."

[2] Conversions were made using the following relationships: 10.5 therms per MCF; 10^5 Btu per therm; 3,412 Btu per kWh; 1.05×10^6 Btu per MCF.

Employment effects of energy conservation

Historically, the number of persons employed and the size of economy, as measured by the Gross National Product (GNP) have grown as energy consumption has increased. It has often been assumed that growth in energy consumption is directly and causally related to the growth in GNP and employment, i.e. that the economy is either stimulated by increased energy supply or hampered by slower growth in energy consumption. Therefore policies promoting the historical growth rates of energy supply have been justified as leading to a sound economy and full employment.

These assumptions have arisen from a misreading of the facts, a misunderstanding of why energy use grows and how economic growth is stimulated or slowed. As well, there has been a tendency to confuse the effects of sudden supply disruptions with the quite different long range impacts of a slowdown in the growth of energy demand through cost effective conservation. Slow energy demand growth, if resulting from conservation, may be a sign of a healthy economy; while unrestricted growth in energy use, if the use is wasteful and inefficient, may be a real indicator and cause of economic disaster.

Recent economic studies question the validity and prudence of projecting future energy needs, the state of the economy, and employment trends on the basis of past performance. For example, a report done by a UCLA economist for the Energy Commission states that "energy input can be uncoupled from the national output not only by product mix shift or thermal efficiency improvements but also by increases in productivity." [10] A major study by the Ford Foundation found that although there is some relationship between growth in GNP, energy and employment, it cannot be assumed that the same ratios of growth will apply in the future.[11] Furthermore, employment and energy growth statistics for the State of California contradict previous ideas about the nature of the relation between energy consumption and employment. Governor Brown announced in his state-of-state address that almost one-half million new jobs were created in California during the past year, with only half the energy growth rate of five years ago.

The economic analyses of the Ford Foundation study found that a substantial reduction in U.S. energy input, as compared to historical energy demand patterns, can be accomplished without major economic cost in terms of reduced total real output, reduced real incomes, increased inflation or reduced employment. While it is true that a sudden and unexpected energy shortage can cause, and has caused, unemployment, a long-term slowing of energy growth signalled by clear government policy commitments to energy conservation and efficiency would not have a detrimental effect on employment levels. As the price of energy continues to rise employment may actually increase as labor is substituted for capital and material inputs.

The energy production industry itself and the economy's energy-intensive industries [12] have continuously become more capital-intensive while providing a smaller share of the nation's jobs. Nationally these industries consume approximately one-third of total U.S. energy and provide 10 percent of the total employment. In considering the impacts of the energy industry on California's economy, it is important to note that these sectors are among the least labor-intensive. When compared to 368 sectors of the national economy in terms of employment per dollar of value added, California's energy sector ranked in the lowest five percentile.[13]

Conservation activities, on the other hand, are relatively labor-intensive and offer the least expensive and most cost-effective way to expand "supply". In addition to an expansion in those industries that manufacture conservation "hardware" such as insulation, IID's and other energy saving devices, there will also be an increasing need for conservation "services", such as energy management surveys. The employment impacts are even larger as a result of the secondary effects. For example, a ceiling retrofit program would not only increase employ-

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[10] Sidney Sonenblum, "Perceptions About the Relation Between Energy and the Gross National Product," UCLA.

[11] Ford Foundation, A Time to Choose, Final Report by the Energy Policy Project (Cambridge, Mass.: Ballinger Publishing Co., 1974).

[12] An energy-intensive industry is defined here as one whose ratio of total energy consumed to total output produced significantly (at least by a factor of 4) exceeds the average energy/output ratio for the total U.S. manufacturing.

[13] Lawrence Berkeley Laboratory, "Analysis of the California Energy Industry," (LBL—7), July, 1976. The energy industry in California consists of four major sectors: oil and gas extraction, petroleum refining and related industries, electric utilities, and gas utilities.

ment in the manufacturing and installation of insulation (primary effects), but also in those industries that manufacture machines or materials used in the production of insulation (secondary effects).

Most important, however, conservation efforts stimulate the economy and employment through the savings that accrue to consumers in the form of reduced utility bills. The on-going savings in energy conservation tend to be spent on additional goods and services which create more jobs (indirect effects). Indirect employment effects are often more significant than one-time direct impacts since the former continues indefinitely with the energy savings. Furthermore, since conservation reduces the need for huge investments in additional energy supply, more capital will be available to stimulate other, more labor-intensive sectors of the economy, such as residential construction.

Employment impacts from promoting conservation are difficult to quantify, especially in the case of secondary and indirect effects. To date, the various studies assessing the statewide employment impacts of conservation programs are generally incomplete in scope and based on the limited economic data available. Moreover, as none of the studies have calculated indirect employment effects or secondary impacts, existing estimates tend to undervalue the positive employment and economic impacts of conservation. As an example, the Conservation Division calculated that appliance efficiency standards would indirectly create over 1,300 jobs starting in 1985.[14] The magnitudes for other conservation programs could be substantially larger.

CERCDC employment studies, on the other hand, have begun to evaluate possible job impacts for various programs, under more than one scenario. For example, we have estimated employment impacts for both a mandatory and a nonmandatory residential ceiling retrofit program.

A mandatory program with a goal of retrofitting within five years 90 percent of the insulatable residences (where cost-effective) would result in direct additional employment impacts of approximately 5,700 person years (PY) in manufacturing and 5,850 person-years in installation. Job impacts would be significantly lower in the absence of a mandatory retrofit program, accompanied by tax (or other) incentives. There are several reasons for this, most notably the acknowledged ineffectiveness of alternative approaches in penetrating the rental market. Rentals comprise an estimated minimum of 25 percent of all insulatable dwellings; however, tenants and owners will not benefit from the savings and the tenants do not own the property. Moreover, even with very effective promotional and incentive campaigns, the penetration into the owner-occupied sector would likely be slower without a mandatory program and tax incentives, stretching out the person-years and reducing the actual job creation. Assuming a 70 percent penetration of owner-occupied dwellings in five years from a purely voluntary program, we estimate the direct impacts at 3,280 PY in manufacturing and 2,770 PY in installation. Converting these estimates into permanent jobs over the projected five-year period results in:

	Jobs
Mandatory retrofit:	
Manufacturing	1,150
Installation	1,170
Voluntary retrofit:	
Manufacturing	656
Installation	554

Well-designed conservation programs can accomplish more than a reduction of energy waste. Conservation programs can achieve other objectives such as the freeing of capital for investments, redressing our balance of payments deficit and creating job opportunities, especially for the low skilled worker. Choosing to

[14] To calculate the indirect impacts of the appliance efficiency standards, for example, the cost of conservation must be subtracted from the savings in energy consumption in order to determine the change in consumers' disposable income. The number of jobs created by money diverted from energy expenditures to other goods and services is calculated by taking the ratio of jobs per dollar spent on average purchases, about one job per $17,000 spent (this figure was calculated by Bruce Hannon, Director of the Energy Research Group, Center for Advanced Computation, University of Illinois at Champaign-Urbana), and multiplying it by the change in consumers' disposable income due to appliance efficiency standards. The change in disposable income is calculated by subtracting the increase in the price of an appliance from the savings of reduced utility bills. After taking into account the payback for price increases of efficient appliances, the indirect job impacts of the appliance standards would occur approximately seven years after the standards become effective.

implement conservation programs may have a significant effect on the problem of structural unemployment by creating jobs for the younger, more inexperienced or less highly educated worker. Our employment impact analyses will begin to address the manpower needs associated with the implementation of conservation programs and attempt to optimize these positive employment effects by developing other strategies to complement them. In the 1979 Biennial Report to the Governor, CERCDC will be looking closely at such factors as the California industries most likely to be affected by conservation programs, subsequent changes in skill levels, job dislocations, and job permanence. By considering the broad range of economic consequences induced by conservation activities, we can formulate policies and design programs that promote the economy and welfare of Californians.

Conservation strategies

Policy tools for governmental intervention to reduce energy waste and slow the growth in energy demand range from purely voluntary information programs to mandatory standards. In between are economic incentives, such as tax credits or surcharges. Each approach has a role in the achievement of energy conservation.

Voluntary policies make use of positive actions performed through the public or private sector to benefit the public interest. Voluntary policies carry no sanctions, but operate through the provision of services or inducements which promote more informed energy-use decisions or which provide assistance to consumers to undertake energy-conserving actions.

Although voluntary methods of achieving desired goals are generally preferred, a total reliance on voluntary means does not always prove effective. For example, where the market mechanism does not operate to encourage energy efficiency, government intervention in the form of regulatory programs may be necessary to overcome market forces and achieve energy savings.

Existing CERCDC strategies are intended to overcome informational, economic and institutional barriers to energy conservation. Public outreach strategies are designed to encourage better energy conservation decision-making and help make conservation actions easier to undertake; incentive and pricing strategies operate by providing economic rewards or penalties to encourage conservation; and regulatory strategies are used in a few, limited, circumstances to ensure compliance with specific conservation objectives. These strategies should and are operating together to reinforce one another and produce a coherent approach to the implementation of energy conservation.

Outreach strategies

In an effort to increase the involvement of the public in energy conservation activities, CERCDC has developed several programs which will allow us to increase our ability to provide technical information and assistance to individuals and organizations. The Commission's approach emphasizes information programs to make the public aware of the benefits, techniques, and costs of energy conservation.

In order to influence energy use decision-making, information programs must be based on an understanding of what motivates energy use behavior. Participation of CERCDC in several survey research projects will enable us to identify and assess public attitudes and behavior patterns that may be influenced by such information programs.

Increasing the market penetration of "hardware" measures designed to reduce wasteful and inefficient energy use can't be encouraged through innovative marketing strategies. Due to their established relationship with energy consumers, utility companies have a major role to play in the dissemination of conservation information and the marketing of conservation concepts and products. CERCDC staff is currently working with both investor-owned and municipal utilities to assist them in the development of their conservation programs, as well as to initiate data collection, monitoring, and evaluation of their programs.

In addition to the utility effort, we are also working with and assisting the outreach efforts of other organizations such as local governments, schools, community groups and trade organizations. These public and private groups can tailor conservation programs to local needs, and can promote them through face-to-face contact, neighborhood and/or peer group orientation, and local credibility.

To support energy conservation efforts by public and private organizations, it is the responsibility of the Commission to make available its technical and financial resources, to guide and monitor utility conservation programs, and to help ensure that the public is protected from inaccurate information and from poor quality workmanship in energy conservation products or services.

Specific information programs include the development of an information clearing house for new developments in energy conservation, the distribution of appliance efficiency information, preparation and dissemination of "how to" articles, case studies of energy conservation projects in the commercial/industrial sector, and public presentations on energy conservation topics.

In addition, education activities through formal and informal channels will increase public awareness of the need for, benefits of, and opportunities for conservation. Educational programs include the development of energy education curricula for kindergarten through high school, a junior college textbook, and the development of program materials for the vocational training of those involved in the energy field. New funding will establish in-service training centers to meet the needs of teachers who have no instructional background in energy and energy conservation. As the conservation marketing plan develops, educational seminars will be designed for key groups such as loan officers, real estate agents, investments analysts, local government officials, etc.

A substantial marketing effort by the Commission, to complement that being conducted by utilities and others, is presently in the planning stages. Utilizing the services of professional marketing experts, marketing strategies appropriate to a public agency will be refined for targeted groups across all energy-use sectors. Activities under this program could include the advertising of special-purpose conservation programs, like commercial/industrial energy management training programs, and the promotion of energy conservation ideas through the printed and electronic media. Training films on commercial/industrial lighting and energy management, award programs keyed to bulders and designers, incentive programs, residential energy utilization surveys, a new-home buyer's guide and other innovative mechanisms could be developed to both encourage and accelerate conservation investments with emphasis placed on the local level as the focal point for action.

Facilitating conservation investments also involve a need for technical assistance, financial assistance, and consumer protection activities. Under the government energy management assistance program, public buildings are surveyed to determine opportunities for energy savings, and workshops are conducted to train building management and maintenance personnel. Technical assistance will be provided to local governments through the training of local building officials in the application and enforcement of residential and non-residential building standards, through assistance to planning officials on the energy implications of the planning process, and the training of persons responsible for reducing energy waste in local government building operations. Technical assistance will also be offered to citizen action groups in the development and implementation of energy conservation programs.

The Commission is also providing financial assistance for energy conservation projects conducted by local governments and civic organizations. Five local governments are currently operating energy conservation programs under partial state funding. This program, which will expand in 1978–79, supports such projects as preparation of an energy element of a general plan, innovative demonstration projects, and modifications to ministerial and discretionary permitting processes to permit increased energy conservation. Examples might be the development of energy conservation building codes which are able to take advantage of special local conditions and go further than the Commission-adopted statewide standards, or the preparation of zoning ordinances which improve the orientation of new homes with respect to the sun. Considerable funding is also available for outreach programs developed by citizen action groups, building on the premise that the most effective long-term impact on the energy consciousness and energy use patterns of individual consumers will occur when local governmental agencies and local citizen groups are involved in the determination and delivery of energy services.

When urging people to invest in conservation, a measure of quality control is necessary to ensure that the public receives adequate products and services. Consumer protection and safety will be enhanced through setting standards for insulation materials and establishing an inspection and testing program. The

CERCDC will also monitor and attempt to alleviate problems with the supply of insulation materials. To protect residential consumers against fraud and poor quality workmanship in energy conservation retrofit services or products, the Department of Consumer Affairs will assist the Energy Commission to publicize consumer information and investigate complaints.

Incentive strategies

Information strategies can be reinforced by incentive strategies, which operate through the marketplace by making certain actions more or less costly to carry out. They allow consumers a choice of action, even though it is the energy-efficient choice which will usually cost less to consumers in the long run.

While information strategies may convince a consumer to invest in energy conservation, the actual investment may not take place if the consumer cannot afford to raise the needed capital. Loan programs are one type of incentive that can help address this problem, allowing consumers to substitute a one-time cost (such as for ceiling insulation), for continued inefficient energy use and higher monthly bills. Cash rebates and free energy-saving hardware are incentives which have been used successfully by utilities to motivate consumers to insulate. Low interest loan programs provide a means of helping consumers finance the insulation, once they have been motivated to do so.

Tax policies are another mechanism for applying incentives to conserve or disincentives to waste. Taxes could be placed on inefficient energy consuming products or activities, to make their cost more reflective of the cost to society of producing additional energy. Or, perhaps better, tax deductions and credits can be used to help encourage socially beneficial decisions. An example is the solar tax credit enacted last year, which could be extended to cover other conservation investments. Such policies have the effect of counteracting the "hidden subsidy" discussed earlier, which now goes to support inefficiency.

Pricing

Utility rate design and the pricing of new fuel supplies represent another opportunity for encouraging energy conservation. In theory, utility rate structures are based on several elements, the primary one being "cost of service". The traditional way that cost of service has been defined has been through historical costs, which may tend to underprice current energy due to rising costs of applying additional or "incremental" amounts of energy.

Resources are most efficiently allocated when their price reflects these marginal or incremental costs, that is, the costs of providing additional energy from the construction of new power plants, the discovery of additional gas formations, or the drilling of new off-shore oil wells. As pointed out earlier, since new energy costs are usually averaged in with current supplies, the new energy is priced lower than the real costs associated with supplying new power. As a result, consumers receive inappropriate price signals which encourage them to demand more energy than if the incremental cost were reflected in the rates. "Marginal cost" pricing allows the replacement cost of energy to be reflected in energy rates, in turn encouraging consumers to make more socially optimal decisions with respect to energy use.

Similarly, other rate designs can encourage energy inefficiency. "Inverted rates," for example, price successive increments of energy consumed at successively higher prices. In other words, the more a customer uses, the higher the unit price. Peak load pricing recognizes the importance of capacity costs (the costs to the utility of supplying sufficient generating capacity to serve all customers at the same time, even though some of that capacity goes unused during off-peak times). Peak load pricing can encourage the shifting of energy consumption to off-peak times, much as a person might alter a commuting schedule to avoid rush-hour traffic. This shifting permits a more efficient use of the generating system and can also help avoid peak overloads and brown-outs.

Regulatory strategies

Since energy conservation is a public purpose that will ultimately benefit everyone, regulatory standards may be necessary to guarantee that individuals and institutions modify their actions toward that end. Mandatory energy efficiency standards can be applied where information, incentive and pricing strategies are not adequate to produce technological change in the direction of energy efficiency. Standards are typically needed when those who design energy-consuming products are not the same people who use the products and would reap the energy and dollar savings from making the products energy efficient. Thus, builders and manufacturers have little incentive to design energy-efficient buildings or appliances. Regulatory programs can overcome this market constraint by establishing minimum efficiency criteria for energy consuming products.

Another example is the case of rental housing. Barriers to the effectiveness of information, incentive, and financing programs for the rental sector are built into the structure of the market. Landlords have no incentive to undertake conservation investments since they often do not pay the utility bills and would not realize the energy and dollar savings. On the other hand, tenants are unlikely to make such an investment in a building they do not own, especially if they do not intend to live there long enough to recover the cost of the conservation investment. Mandatory requirements for ceiling and water heater insulation in existing homes would be an appropriate and effective application of regulatory strategies to help overcome the barriers to implementation in this particular sector.

The Energy Commission is authorized under AB 4195 to adopt standards by July 1, 1978 for a program of electrical load management for each utility service area. These standards, which must be cost-effective, will require the utilities to develop programs which are intended to reshape the utilities' load duration curves, thereby reducing the rate of growth of peak demand and saving fuel.

Conservation programs and expected savings

Specific programs using each of these strategies are currently underway in California. These programs, with costs and savings summarized in Table VI are briefly outlined here by end-use sector to provide a sense of the magnitude of the conservation supply potential and illustrate what must be done to achieve that potential.

Commercial industrial sector

Over half of the electricity and natural gas used in the state is used by commercial and industrial customers. Compared with the relatively homogenous residential sector, commercial/industrial end-uses and building types are varied, requiring differing approaches.

The most successful approach to this sector has been through building energy management survey programs, which aim at increasing the efficiency of lighting, heating and cooling systems, and other equipment, and at improving the operation and maintenance of buildings to minimize energy consumption. This approach consists of on-site building surveys by energy management analysts, along with educational-outreach programs to train building managers and operators in achieving optimal energy management of their buildings. Typically, the building surveys are conducted by trained utility personnel or private energy management consultants who recommend energy-conserving cost-saving actions to the building managers. The educational outreach effort is aimed at small businesses through the use of seminars, published case studies and advertising. Electrical load management standards now being proposed (under Section 25403.5 of the Public Resources Code) are expected to include a requirement that buildings with excessively high energy consumption must undergo a building operation survey to identify and reduce wasteful consumption.

TABLE VI.—CONSERVATION PROGRAM SAVINGS BY 1985[1]

Voluntary programs and mandatory standards	Electricity[3]			Natural gas[2]	
	Net annual savings (10[6] kWh)	Summer peak savings (MW)	Total cumulative program costs[4] 10[6] 1978 dollars)	Net annual savings (10[6] therms)	Total cumulative program costs[4] (10[6] 1978 dollars)
I. Commercial/industrial:					
Building operation survey[6]	15,300 to 19,800	2,700 to 4,300	52	390	Uncertain.
Motor efficiency retrofit[6]	390	58	105 to 175		
Boiler efficiency[7]				80	
II. Residential:					
Ceiling instulation retrofit[8]	200	Uncertain	230	670	904.
Cooling load reduction[9]	97 to 193	(In A/C cyclers)	167		
Night thermostat setback[10]	72 to 120		48 to 53	230 to 500	468.
Water heater (insulation and flow control)[11]	410 to 710	44 to 75	16	220 to 350	135.
New home design[12]	9	1.5	1	0.3 to 0.4	0.36 to 0.38
Furnace IID and resizing retrofit[13]				Uncertain	Uncertain.
III. Utilities and government:					
Cogeneration[14]		(800 to 1,500)			
Voltage reduction[15]	3,600 to 6,100	680 to 1,800	Uncertain.		
State water project[16]		(1,000)			
State and local government facilities[17]	252	45 to 58	ERCDC	10	ERCDC.
IV. Mandatory standards:[18]					
Nonresidential buildings[19]	7,700	Uncertain	([9])	154	([9]).
Time-of-use pricing[20]		1,120	([8])		
Interruptible rates[20]		345	([8])		
Motor efficiency[21]	416	62	4.9 to 20		
Residential buildings[22]	360	220	([6])	340	([6]).
Pool filter cycling[20]	875	400	9.4[23]		
Residential appliances[24]	2,200	760	([7])	310	([7]).
Residential water heater cycling[20]	18	147	52[25]		
Residential air-conditioner cycling[20]	46	1,440	287[25]		
V. Total estimated savings (excluding SWP and cogeneration)	32,000 to 39,400	8,000 to 10,800		2,400 to 2,800	
VI. Forecast sales in 1985	206,844	43,307		13,400	
VII. Percent of 1985 forecast saved	15 to 19 percent	18 to 25 percent		18 to 21 percent	

1 These are preliminary estimates of savings from standards with effective dates of 1977 or 1978 and from programs beginning in 1977 through 1979. The actual savings will depend on the speed of program implementation, the consumer response, the expertise of utility staff, and the actual characteristics of the targeted end-use stock.

2 Electricity savings are mainly calculated for the State by assuming program characteristics described in the ERCDC staff report in response to the AB 1852 legislation. Other savings are from staff reports on building and appliance standards, and from Federal grant applications under EPCA/ECPA for programs aimed at State and local government.

3 Natural gas savings are very preliminary due to a lack of information on sizes and efficiencies of natural gas end-use stock. Information is being collected for preparation of testimony before the CPUC on the need for an LNG terminal.

4 Program costs are the total cumulative costs by 1978, converted to 1978 dollars at a 10-percent discount rate. Program startup dates range between 1977 and 1979. For many programs, only utilities will incur costs. For other programs, utilities will pay advertising costs and incentives; costs of hardware will be borne by the consumer. Some programs will be partly funded by the State. Total costs of each program are shown where possible.

5 Changes in building operation aimed at lowering energy consumption can reduce annual usage by over 40 percent according to Federal and Rand Corp. studies. These savings assume 10 to 20 percent electrical reductions in buildings surveyed by utilities, with the electrical program costs including just utility administrative and testing costs. Gas savings are from Rand, but the commission staff is currently preparing their own estimates.

6 The motor efficiency program is aimed at medium-sized motors (½ horsepower up) to increase operating efficiencies from 50 percent to 80 percent. The program is aimed to retrofitting or replacing 90 percent of the motors in place when the standards go into effect in 1979. Retrofitting motors is expected to cost $75 per motor; replacing the motors will cost $125 per motor.

7 ERCDC staff will be working with staff of the department of industrial relations (who inspect boilers for safety) to improve boiler operating efficiencies. Negotiations are still underway on funding. Program costs are not yet certain. Savings on all boilers will be checked by 1980, with some savings lost by 1985 due to equipment deterioration.

8 Impact of ceiling insulation on air-conditioning loads is uncertain but under study. Heating savings are based on reaching 90 percent of the targeted homes. The average cost to insulate an uninsulated home is $300; for an underinsulated home it is $230.

9 Peak reductions from this program are assumed to be included in savings estimates for air-conditioner cyclers. Program costs are $60 per year for a single-family central air-conditioner; $35 per year for multifamily central air-conditioner, and $35 per year for room air-conditioners, with the program aimed at 20 percent of all air-conditioners.

10 Program costs include advertising costs and setback device purchase and installation ($100 per device). No manual operation was assumed. Savings estimates are based on installing devices in 45 percent of the homes with central systems.

11 Savings estimates range from the savings from insulating all targeted units to R–6, with a 10° setback and flow control devices, to savings from insulating to R–11, with a 10° setback and flow control devices. 90 percent of the pre-1979 stock remaining in 1985 is the goal. Insulation at R–6 costs $20 (R–11 is less, as this is a batt of ceiling insulation, whereas R–6 is a kit) and flow control devices cost $10.

[12] The new home design program is a pilot project in the southern California region to demonstrate savings possible for climatically appropriate design. It is aimed at 5 percent of the new homes built over a 3-year period.

[13] Commission staff is exploring the potential from these programs to add intermittant ignition devices and resize flue and burner openings on gas-fired furnaces to increase their efficiencies.

[14] Savings potential determined by staff and consultant studies in southern California. These savings are not included in the final total.

[15] Program costs are difficult to separate from regular utility operation and maintenance costs.

[16] The peak savings shown are the estimates of potential, assuming DWR will greatly reduce pumping on peak days and instead only operate generating facilities. These savings are not included in the final total.

[17] This program to improve operating efficiencies of State and local government buildings will be conducted by ERCDC staff, whose salaries are partly funded from the savings achieved.

[18] Under secs. 25402 and 45403.5, the commission is authorized to prescribe, by regulation, standards for energy consumption by buildings and appliances and for electrical load management.

[19] The impact of nonresidential building standards on peak demand is uncertain since much of the savings may be from reducing lighting and space conditioning use when the building is not occupied. The impact of insulation in a commercial building on air-conditioning load is also uncertain and being studied.

[20] These 6 standards for load management are not yet final, but should be completed by May or June 1978. Preliminary estimates have been made for all standards except agricultural pumping. Costs of rate changes are uncertain. Meters will cost about $500, but the cost may be split between the utility and the customer. Costs of load management measures are being investigated as the standards are being finalized and should be known by June.

[21] Motor efficiency standards are aimed at new, medium-sized motors which currently have an average 55 percent efficiency. The standards will increase this to 80 percent at an increased cost of $5 to $20 for a new motor.

[22] Savings estimates from ERCDC 1977 biennial report, vol. 3, p. 136. Costs are uncertain; however, the only major cost increase man be for higher levels of insulation. This will reduce annual heating requirements by 1,300 kWh or 90 therms in northern California and 700 kWh or 50 therms in southern California over an underinsulated house. Performance standards allow more leeway in building costs, since proper orientation is a major factor in lowering building energy requirements.

[23] Cost of this program is estimated at $10 per pool, saving 1 kW per year. In addition, each utility may have to pay an incentive. Even a $100 incentive could cost less than 1 kW per year of baseload capacity.

[24] Savings estimates from (a) ERCDC/1977 biennial report, vol. 3, pp. 133–135, (b) staff communication on IID standards, and (c) ERCDC's "Revised Staff Report on the California Appliance Efficiency Program" (relating to space heaters, storage-type water heaters, and plumbing fixtures), November 1977. Cost increases are uncertain since appliances are currently marketed that meet the standards. Additionally, model design typically changes frequently, especially for refrigerators, air-conditioners, and heaters, and standards may have a minimal impact on design costs.

[25] Utilities will pay for the entire program cost.

The savings possible are very large. A PG&E program aimed at conserving energy in their own company office showed an average 32.4 percent decrease over the base year within two years. Operational changes by several large California retail stores achieved 15 percent to 32 percent reductions over previous energy consumption. CERCDC staff estimates the potential from this program as 15.3 to 19.8 billion kWh by 1985, a decrease of 7 percent to 9.6 percent over the total forecasted electric sales. Gas savings are estimated at 390 million therms of natural gas.

A similar program for state and local government buildings, the energy management assistance program, should achieve annual savings of 252 million kWh and 10 million therms of natural gas by 1985. This program is staffed by Commission personnel, whose salaries will be partially refunded from the savings achieved. In addition, funding under the proposed National Energy Act may be available to schools and health care facilities for energy conservation measures, technical assistance and energy surveys, and to public buildings for audits and technical assistance.

The need for peak generating capacity, which is often more expensive and less efficient than baseload generating equipment, can be reduced by decreasing non-essential electric loads in commercial buildings and industries during hours of peak demand. This load management can be accomplished by several means, including mechanical control systems and devices which turn off non-essential uses during peak hours, or by altering daily schedules of electricity use. Shifting consumption periods or installing mechanical load control devices can be encouraged by changing electricity rate structures to provide incentives and disincentives to encourage shifting of electricity use to off-peak hours. Time-of-use pricing provides an economic incentive to shift by making it more expensive to consume energy during peak hours. Interruptible pricing provides a special rate for customers who install load management devices which allow non-essential loads to be turned off at peak times. Requirements for such pricing techniques will also likely be part of the Commission's load management standards when they are adopted.

The effectiveness of the commercial/industrial building energy management programs can be enhanced by pricing and regulatory strategies. The Commission is exploring the possibilities of incremental cost pricing for commercial and industrial users, which would set these customers' rates at the marginal cost of new electrical or gas supply. "Inverted rate" pricing, charging higher unit prices for greater usage, is also being considered. These pricing changes could encourage technological change toward increased equipment efficiency and serve to increase the response to other conservation programs.

Other standards established for the commercial/industrial sector will yield substantial energy savings. Effective January 1, 1978, building standards for nonresidential construction provide alternative ways of improving energy efficency in new buildings. The expected annual savings from these standards is 154 million therms and 7,700 million kWh by 1985. The Commission is providing training to local building code officials to assist them in the implementation of these standards. A computer program has been prepared to assist in designing buildings that will meet the standards, and evaluate building plans to enforce the standards.

Motor efficiency standards are currently being studied by the Commission. Such standards would reduce energy consumption by increasing the average efficiency of medium sized (half-horse-power and larger) electric motors; if implemented in 1978 and requiring a minimum motor efficiency of 80 percent, the standards could save 416 million kWh annually by 1985. Retrofitting three-fourths of the existing motors with potential for efficiency improvement would save an additional 300 million kWh by 1985, but this could not be accomplished through appliance standards.

Industrial boilers use about 800 billion Btu's annually, a predominant use of energy by the industrial sector, but are operated at low efficiency. However, the operating efficiency of industrial boilers can be improved to reduce their oil and gas consumption. The Commission, with the cooperation of the Department of Industrial Relations' Division of Industrial Safety, is initiating a boiler efficiency measurement and improvement program to improve boiler efficiencies. This program will inspect about 14,000 of the largest boilers in the state and recommend actions necessary to improve combustion efficiency. Recommendations for alternative fuels, and for implementation of co-generation programs will also be made. Savings of 32×10^{12} Btu/yr are expected by 1980. This would be roughly the equivalent of 160 million therms of gas and 276,000 barrels of oil.

Residential sector

In 1975, the residential sector required 4.7 billion kWh of electricity and 4.4 billion therms of natural gas for heating and 4 billion kWh of electricity for cooling. The residential sector end-uses of energy are comparatively well-understood and, as a consequence, programs for reducing electricity consumption are further advanced than in other sectors. The Commission has standards in effect for improved residential building construction and increased appliance efficiencies. Governmental and utility-sponsored conservation programs are in progress and are reducing energy waste in the three key end-uses within the residential sector: space heating and cooling, water heating, and appliances. Other programs, including load management standards, are well along in the planning stage and will be implemented in 1978 and 1979. By 1985, electrical consumption and peak demand could be reduced by 4.3 to 4.7 billion kWh and 3010 to 3040 MW, respectively. Natural gas consumption could be reduced by 1.77 to 2.17 billion therms by 1985.

The energy requirements for space conditioning can be reduced by a variety of methods. A building gains or loses heat as it interacts with the surrounding environment. Glass areas with no shading facing south or west will greatly increase energy requirements for space cooling in the summer. Proper orientation, shading and operation of houses can reduce summer cooling loads. Gaps around doors and windows are a major source of heat loss in the winter. By making a house a better retainer of heat, the energy requirements for heating can be lowered.

Ceiling insulation retrofit of 90 percent of existing uninsulated or underinsulated residential units by 1985 would annually save at least 200 million kWh of electricity and 670 million therms of natural gas for space heating. At current residential rates, this is equivalent to an annual savings of 143 million dollars to consumers just in terms of reduced energy bills. The total program cost in 1978 dollars would be $1.1 billion dollars. The savings of natural gas alone from this retrofit insulation program would be sufficient to heat an additional 1.3 million single-family homes built to current standards. These electrical reductions in space conditioning can be enhanced by retrofitting wall insulation and weatherstripping. Preliminary estimates indicate that wall insulation can provide as much reduction in consumption in uninsulated homes as ceiling insulation. Staff is planning a study on the interactions between these space conditioning treatments to avoid double-counting savings from a wall-insulation and a weatherstripping program.

The Commission staff is also exploring related ways to decrease wasteful consumption of natural gas for space heating. One means is to replace pilot lights on gas furnaces with electrical intermittent ignition devices which, by not burning continuously, can save a large amount of gas. Resizing burners or the addition of automatic flue dampers to reduce heat loss are other possibilities.

A cooling load reduction program to reduce summer cooling requirements through the use of window treatments, attic fans, and landscaping could save 97 to 193 million kWh's by reaching 20 percent of the air-conditioned building stock in the five major service areas. Night thermostat setback devices installed in a potential seventy-five percent of households which now do not set back their thermostats during the heating season will reduce space heating consumption by an additional 72 to 120 million kWh's by 1985.

Following space heating and cooling, gas and electric water heaters are the second largest energy users in the home. They consumed 2.9 billion kWh and 1.7 billion therms of gas in 1975. Saving energy used for water heating can be accomplished both by improving the efficiency of the water heater and by reducing unneeded consumption of hot water (with related benefits in terms of water conservation and energy savings from reduced pumping and treatment requirements). Water heater retrofit insulation involves wrapping an inexpensive fiberglass blanket around a water heater. Together with a 10° temperature setback this can reduce the "standby loss" (loss to the air) of each electric water heater by 365–520 kWh per year and by 20–30 therms per year for each gas heater. Wasteful consumption of hot water can be reduced by installing flow reducers such as low-flow showerheads or showerline flow restrictors. Water heater insulation alone or as a kit can be purchased from between $9 and $20, and flow control devices range in price from $.50 to $10. Vigorous implementation of these retrofit measures statewide could save between 220 and 350 million therms of natural gas per year and between 410 and 710 million kWh of electricity per year.

Measures to reduce requirements for space conditioning and water heating lend themselves to marketing as a "package" by utilities, retailers and contractors. Both the Energy Commission and the Public Utilities Commission are using their regulatory authority to ensure the aggressive implementation of residential outreach programs by the utilities. These programs include such features as on-site energy inspections, consumer information, direct marketing and sale of conservation hardware, and financial incentives. This effort will be complemented by requirements of the National Energy Act that utilities inform their customers of suggested conservation measures, projected savings in energy costs, and the availability of loans to help pay for installations. Under the proposed new Federal legislation, utilities must offer to inspect all residential buildings of four units or less, to arrange to have conservation measures installed and for loans made available, send to the customers lists of lenders, suppliers and contractors, and offer repayment arrangements through the monthly utility bills.

Even if this Federal legislation passes, there will still exist problems of market penetration for retrofit techniques. A marketing study sponsored by the Commission found that only 50 percent of the homeowners (not including renters) who did not have insulation and who could install it expressed an interest in doing so; reaching an additional 40 percent (the other half of the market) will be difficult. As noted earlier, rental housing represents another area where the normal operation of the market discourages insulation because landlords have no incentive to insulate since they do not pay the utility bills, and tenants are unlikely to make such an investment in a building they do not own. Similar market penetration constraints exist for water heater insulation and flow control devices. Legislation requiring ceiling and water heater insulation as well as flow control devices upon changes of ownership or as a condition of utility services would provide an effective means of penetrating the market. The program savings shown in Table IV (and above) assume that the utilities pay an incentive for retrofit ceiling insulation and the total costs for heater retrofit, but do not reflect the additional impact of a mandatory program.

The energy needed for space conditioning and water heating in new homes is being further reduced by the implementation of residential building standards (Title 25). These mandatory standards will reduce annual energy consumption by 360 million kWh of electricity and 340 milion therms of natural gas by 1985. The standards are complemented by programs which the Commission is urging the utilities and others to implement, such as the new home design program. Whereas the minimum efficiency standards will eliminate the least efficient home design and construction practices, the new home design program aims to encourage the best practices. Within each service area, the design program, aimed at both builders and buyers, is to be modelled partly on the former "Gold Medallion" and "Balanced Power" promotional campaigns, but will emphasize energy efficiency rather than promoting the sale of electricity or natural gas. This promotional program will emphasize the "passive" use of solar energy, that is, methods of utilizing the building structure itself to absorb and retain the sun's energy when it is needed for space heating, and to reject solar thermal gains in order to minimize the building's cooling load in the summer. Studies have suggested energy savings of 25–75% in space conditioning is possible for homes utilizing passive solar principles, over and above that achieved by new homes built to meet the Commission's minimum statewide efficiency standards.

Similarly, solar-assisted "active" systems have the potential to provide at least 70–75 percent of each California residence's water heating requirements, and at least 50 percent of space conditioning requirements in those units where it can be feasibly and economically installed. Active solar systems are most effective when used in conjunction with conservation measures which help reduce both the size and the cost of the systems. Measures like California's solar tax credit help overcome market constraints and institutional barriers to the penetration of solar systems. The effect of the tax credit will be to accelerate the residential application of solar equipment and encourage development of economical systems with wide application for meeting water and space heating requirements.

Improving the energy efficiencies of new appliances through the establishment of mandatory appliance efficiency standards is another means used by the Commission to reduce excessive energy requirements. Standards are in effect for refrigerators, freezers, and air conditioners. The Commission has also prohibited standing gas pilot lights on central gas furnaces, household cooking appliances, and clothes dryers. In December, mandatory efficiency standards were extended by the Commision to include space heaters, water heaters, and plumbing fittings. By 1985, these standards will reduce annual electrical consumption by 2.2 billion kWh and annual gas consumption of 310 million kWh. At current energy prices, this amounts to an annual saving of $161 million. The Commission plans to enhance the standards with appliance efficiency labeling/information/marketing programs to encourage consumers to purchase the most efficient appliances among those that meet the standards.

Some of the load management principles discussed in connection with the commercial sector apply also to the residential sector. Swimming pool filtration systems can be run during off-peak hours. For a utility like SDG&E, implementing a pool timer adjustment program could cost the utility about $800,000, save 335 milion kWh of total energy and 60 MW of peak energy, and save the utility $2.9 million each year in operating costs.[15] Statewide, this program could reduce peak demand in 1985 by 400 MW during the summer, and annually save 875 million kWh of electricity.

Other residential load management measures include cycling devices applied to air conditioners and water heaters. These mechanical cyclers turn the equipment off and on during peak hours, often with little or no effect on comfort. If sixty percent of the 2.4 million centrally air-conditioned homes in California by 1985 were equipped with cyclers, peak energy demand would be reduced by 1,440 MW or more than the capacity of a large power plant. An aggressive program of installing cyclers on new and existing water heaters could reduce their contribution to 1985 electrical summer peak demand by 150 MW. Informing consumers about the importance of load management and how they can shift some of their flexible energy-consuming activities to off-peak hours is being accomplished through Commission and utility-sponsored marketing campaigns. Additionally, rate incentives to encourage load management are being analyzed for possible applications to the residential sector.

Utility systems

The process of generating electricity provides an opportunity in and of itself for saving energy through improved efficiencies in power plant design and operation and in transmission and distribution systems.

Co-generation refers to a combination of physical systems and institutional arrangements involving industrial plants, commercial firms and utility companies to utilize energy in a more efficient manner. By matching up the industrial and commercial needs for process heat or space conditioning with the heat exhausted from a fossil fuel-fired plant, co-generation makes more efficient use of thermal energy than can be achieved by doing the two things separately. Alternately waste heat from a given industrial operation may have qualities which are suitable for generating electricity, thus making use of an otherwise unproductive resource. Estimates have placed the statewide co-generation potential in excess of 4,000 MW by 1985. Co-generation does not repreesnt a "savings" in electricity end-use demand, but a means of using fuel more efficiently.

While a few cogenerators are operating in California, and the technologies are well established, there are several problem areas that have tended to inhibit implementation of much of the cogeneration potential. Utilities are concerned that the cogeneration supply be as dependable as central station generators, and not in any way degrade the quality of existing service. Industries are concerned that they may become regulated utilities, that they may not receive a fair price for their electric output, or that they may not be able to "wheel" power (transmit it over a utility's power lines) to the highest bidder. For industry-owned cogenerators there may be a financial constraint arising from the fact that manufacturing industries normally require a greater rate of return on investment than do electric utilities. Because of the desirability of cogeneration in meeting the needs of the state for conservation of fuel resources and air quality,[16] there is a need to develop public policies to overcome these prob-

[15] This and other utility conservation program estimates are available in the Appendices of the written testimony of Jeffrey P. Harris, Sundesert/76–NOI–2, CERCDC, July 11, 1977.

[16] Phil Nesewich, "Briefing Paper: California Co-Generating Issues," CERCDC, January, 1978. Analyses of the air quality impacts of co-generation must be done on a case-by-case basis.

lems. It is the Commission's intent to work with industries, utilities, the PUC and the Air Resources Board to plan specific co-generation projects and to use its regulatory authority to assure full utility support for cogeneration where cost-effective.[17]

Voltage regulation refers to a reduction in a utility system's maximum allowed feeder voltages by a predetermined amount. Actual voltage to the customer would still be maintained at the design level, but not above it, as is presently often the case. Tests conducted by PG&E indicate that, for the commercial/industrial sector, it is reasonable to expect as much as a one percent energy savings for a one percent reduction in voltage. In cooperation with California utilities, the California Public Utilities Commission is currently conducting experiments to determine the effect of a 5 percent voltage reduction in selected substation service areas. If the tests are successful, the PUC will direct the utilities under its jurisdiction to implement voltage regulation programs throughout their service areas. Since municipal utilities are outside the authority of the PUC, legislation may be needed to require them to undertake voltage reduction programs. Statewide, voltage reductions averaging 3 to 5 percent on the relevant circuits could effect savings of 3.6 to 6.1 billion kWh and 680 to 1,800 MW, a very significant level of savings.

The State Water Project (SWP), owned and operated by the California Department of Water Resources (DWR) is both a major user and producer of electric power. As such, the SWP has the potential to help in reducing the annual peak electricity demand, and therefore the amount of generating capacity needed by utilities to satisfy demand. The reduction can be achieved through system load management by shutting down SWP pumping for a short time on the few days of the year when utility peak loads occur. Electricity normally consumed by the SWP could be fed into the utility grid for a few peak hours, thereby reducing the need for additional and expensive peak generating capacity. An equivalent amount of energy could be returned from other utilities to the SWP at off-peak times. According to one very preliminary estimate, a net savings in excess of 1,000 MW of generating capacity is possible by 1985. The SWP could even begin scheduled generation and pumping activities to complement utility supply scheduling, thus permitting utilities to maximize the use of more efficient units, resulting in lower average energy costs.

Transportation

Approximately 45 percent of total California energy use is in transportation, with automobiles consuming about two-thirds of the petroleum used in the state. California's increasing dependence on petroleum not only for transportation but for industrial and utility use, combined with the rising cost of oil and gasoline, and the growing problem of air and water quality maintenance resulting from increased oil consumption dictate the need for developing and implementing strategies for improving transportation efficiency and saving energy.

In this regard, the Commission is cooperating with the State Department of Transportation and other state, regional, and local agencies concerned with land use and transportation to develop and implement a number of strategies for saving transportation energy by increasing vehicle efficiency, raising average vehicle occupancy levels, and reducing unnecessary vehicle miles traveled.

Current estimates of two programs now underway—transportation system management (TSM) and ridesharing—indicate transportation energy savings on the order of 5 percent in urban areas for the TSM concept and 2 percent in urban areas using ridesharing. Transportation energy savings may approach 25 percent in central business districts where TSM is applied.

Specific activities in the TSM program include: traffic operations improvements to manage and control the flow of traffic; providing incentives for using transit and higher occupancy vehicles, bicycles, and foot travel; controlling parking facilities to encourage carpooling; and changing work schedules, fare structures, auto tolls or auto-restricted zones to reduce peak period travel and to encourage off-peak use of transportation facilities and transit services. In the long run, the fixed world supply of petroleum suggests the need for conservation strategies that go beyond simple efficiency improvements in existing transportation systems. The Energy Commission is meeting this need by providing land-use planning assistance and funding to localities for the purpose of actively integrating conservation into the land-use and transportation planning process.

[17] CERCDC, *op. cit.*, Vol. 3, p. 100.

ATTACHMENT B

Essential Features of California's Solar Energy Tax Credit Guidelines

ELIGIBILITY

Passage of AB 1558 (Hart, 1977) permits California taxpayers to claim as an income tax credit up to 55 percent of the cost of purchasing and installing solar energy systems, under the following conditions:

1. A solar energy system is any system that operate for the purpose of collecting, distributing, and/or storing heat, cold, or electricity which derives its primary energy from the sun. Eligible systems include solar water heaters, solar space conditioning systems, solar-assisted heat pumps, and certain energy conservation measures in conjunction with the solar installations.

2. The taxpayer must own and control the premises at the time the system is installed. In the case of new home construction, this means that the homebuilder must take the tax credit. However, the time of final "installation" could probably be delayed so that the credit could be "passed through" to the home buyer.

3. The system must be installed between January 1, 1977 and December 31, 1980. Solar energy systems must receive required building permits.

4. The tax credit must be claimed the year in which the system is installed, and the credit may be carried forward until used up. The tax credit reduces tax liability directly; it is not a deduction.

AMOUNT

Limits of the California solar energy tax credit are as follows:

1. For systems whose purchase-plus-installation costs are $6,000 or less, the amount of the available credit is 55 percent or $3,000, whichever is less.

2. For systems whose purchase-plus-installation costs exceed $6,000 and/or are installed on other than single-family dwellings, the amount of the credit is 25 percent of the total costs or $3,000, whichever is greater.

3. The Franchise Tax Board is in the process of deciding whether apartment and condominium owners whose total purchase-plus-installation costs exceed $6,000 may claim a 55 percent tax credit for each unit if each unit has its own separate solar energy system.

4. In each case where a part of the solar energy system also serves another main function, 50 percent of the costs for that component is eligible for the credit, except as otherwise defined in the Energy Commission's solar energy tax credit guidelines.

5. Any federal solar income tax credit will deduct an equivalent amount from the available California credit. That is, the combined effective federal and state credits cannot exceed that allowed by the state (through AB 1558). The federal credit would be used first.

ALLOWABLE SYSTEMS

Eligible solar energy systems include indirect thermal (active) systems and direct thermal (passive) systems, providing that each system meet existing building codes and carry the minimum warranties as defined below. Passive system features include, among others: solar glazing and shading, solariums, thermal ponds, thermal mass construction. Eligible passive features are described in detail in the Energy Commission's tax credit guidelines.

After April 1, 1978, these warranty requirements will also apply in claiming the solar tax credit:

1. *Solar Equipment Manufacturers.*—The solar collector, storage unit, and heat exchanger must be guaranteed to be free from defects in materials or workmanship for at least three years.

2. *Installers.*—The solar system, any component, or assembly must be guaranteed against defects in workmanship, materials, or installation for at least one year after date of installation completion.

CONSERVATION MEASURES

Certain energy conservation measures must be installed in conjunction with the solar energy systems in order for the systems to qualify for the tax credit:

1. Space Conditioning Systems require certain extra insulation and weatherstripping measures.

2. Domestic Water Heating requires insulation of storage tank and low-flow devices on hot-water outlets.

FURTHER INFORMATION

The Energy Commission solar tax credit guidelines also specify:

1. Other eligible conservation measures.
2. Eligible solar applications for hot tubs and swimming pools.
3. Requirements for other eligible solar applications.

More comprehensive eligibility requirements will be considered by the Energy Commission by April 1, 1978. Those requirements are expected to include solar equipment certification and required installation and system integration practices. Copies of the guidelines and criteria for the solar tax credit may be obtained by contacting the Energy Resources Conservation and Development Commission, Publications Office, 1111 Howe Avenue, Sacramento, California 95825. Form 3805L for claiming the credit may be obtained from the Franchise Tax Board, Sacramento, California 95867.

BERKELEY SOLAR GROUP
Berkeley, Calif., November 15, 1977.

The attached material is miscellaneous information about the current state of solar water heating in California. The following are included:

1. Life-Cycle Cost Analysis. A 10-year analysis showing the cash flow, tax, and discounted present value consequences of installing a solar hot water heater.
2. Price Estimates. Data from several solar manufacturers and installers on their current prices.

Please address any questions about this information to Bruce Wilcox.

LIFE-CYCLE COST ANALYSIS

The attached table shows a 10-year cash flow calculated for a typical home buyer who purchases a new home with a solar water heater. The following assumptions apply:

1. System costs $1750 installed.
2. System produces 80 percent of the energy required to heat 80 gallons of water from 65 to 120°F every day. This equals 133 x 10^6 BTU/yr of 3857 KWH of electricity or 222 therms of natural gas at 60 percent efficiency.
3. The fuel savings assume gas at $.255/therm which is the San Diego Gas and Electric rate and that price rises at 12 percent per year. Electricity is assumed to cost $.048/KWH which is Pacific Gas and Electric Company's rate for non-lifeline users. It is assumed to rise at 10 percent per year.
4. The homebuyer is assumed to have a 30 year mortgage at 9 percent with 20 percent down payment which includes the cost of the solar system.
5. Property taxes are assumed to not apply for 4 years due to legislation now proposed.
6. Maintenance cost after the first year is assumed to be 2 percent of system cost inflating at 5 percent per year.
7. The 55 percent tax credit is assumed to be 25 percent state, 30 percent federal, and to benefit the home buyer at the end of the first year.
8. The home buyer is assumed to pay 30 percent federal and 4 percent state marginal income tax rates with interest expenses deductible. The state income tax credit raises federal tax in the first year.
9. The present value (PV) of the cash flow is shown discounted at 9 percent.
10. The residual value of the system at the end of the 10 year loan period is equal to the remaining principal on the loan.

LIFE-CYCLE COST OF SOLAR WATER HEATING

	Cost					Tax benefits				Gas			Electric		
	Principal	Interest	Maintenance	Property tax	Total	State	Federal	Interest deduction	Total	Savings	Cash	PV	Savings	Cash	PV
Year:															
0	350				350						(350)	(350)		(350)	(350)
1	10	126	0	0	135	438	525	(89)	874	57	795	729	185	924	847
2	10	125	37	0	172	0	0	37	37	63	(71)	(60)	204	69	58
3	11	124	39	0	174	0	0	42	42	71	(61)	(47)	224	92	71
4	13	123	41	0	176	0	0	42	42	79	(54)	(39)	246	112	80
5	14	121	43	43	220	0	0	41	41	89	(90)	(58)	271	92	60
6	15	120	45	45	225	0	0	41	41	100	(84)	(50)	298	114	69
7	16	119	47	47	229	0	0	40	40	112	(77)	(42)	328	139	77
8	18	117	49	49	234	0	0	40	40	125	(69)	(34)	361	167	84
9	20	116	52	52	239	0	0	39	39	140	(59)	(27)	397	198	91
10	21	114	54	54	244	0	0	39	39	157	(48)	(20)	437	232	97
Total											(168)	2		1,789	1,184

Note: See accompanying material for assumptions.

Price Estimates

The following table presents information from a sample of the many manufacturers and installers of solar hot water heating equipment in California. We know of at least fifty such manufacturers and there are probably many more which we have not yet discovered. The attempt here was to get an idea of what typical hot water heating systems will be costing to builders, and how many such systems can probably be produced by the solar industry, in the coming year.

The estimates contained in the table represent the installed cost of a typical system on new construction. Estimates are given for single installations and for installations on 25 identical units, as in a single family tract development. We asked for prices on a typical system to provide 80 percent solar hot water for a family of four, in new construction on an ordinary tract-type house. Estimates of the size of such a system varied from a 52-gallon tank with 32 square feet of collectors, to a 120-gallon tank with 74 square feet of collectors. The most typical systems, however, are in the range of 80 gallons of storage with 60 square feet of collector, costing $1,1750 installed. For the same system, installed in 25 identical new homes, the cost per system drops by around 10 percent.

It is important to note that all these estimates are very rough and the installed price of a hot water heating system depends on many important variables.

The production projections in the table are intended to provide some information about the industry capacity in the coming year. We have chosen not to draw any conclusions from these projections since too many variables remain unknown.

1977

STATE OF CALIFORNIA

SOLAR ENERGY CREDIT

FRANCHISE TAX

SECTION I. GENERAL REQUIREMENTS

A. The solar energy credit may be claimed by individuals, corporations, and partnerships, but not by estates or trusts.

B. A solar energy system means equipment which uses solar energy to heat or cool or produce electricity and has a useful life of a least three years.

C. To qualify for the credit, a solar energy system must be installed on premises in California that are owned and controlled by the taxpayer at the time of installation. It must be installed between January 1, 1977, and December 31, 1980, and meet the eligibility requirements as determined by the Energy Resources Conservation and Development Commission, 1111 Howe Avenue, Sacramento, CA 95825, telephone (800) 852–7516.

D. Energy conservation measures, as defined by the Energy Resources Conservation and Development Commission, shall be eligible for the credit when applied in conjunction with a solar energy system. Conservation measures relating to a solar water heating system shall include, but not be limited to, water heater insulation and shower and faucet flow-reducing devices. Conservation measures relating to solar space heating systems shall include, but not be limited to, ceiling, wall, and floor insulation above that required at the time of original construction.

E. The credit is computed on a per system basis. For instance, a taxpayer may receive maximum credit for a system on a single-family dwelling and also another credit for a system on a swimming pool located at that dwelling.

F. Condominium owners who install system(s) on premises owned cooperatively by them shall receive the credit in proportion to the number of households served by the system.

G. The basic credit is 55 percent of the cost (including installation charges but excluding interest charges) incurred by the taxpayer up to a maximum of $3,000. This is the maximum credit for a system installed on single-family premises. If, however, a system is installed on other than single-family dwelling premises at a cost exceeding $6,000, the credit shall be the greater of $3,000 or 25 percent of the cost (including installation charges but excluding interest charges).

H. The credit can only be claimed in the taxable year in which the system is fully installed. Payments made in a prior taxable year may be included as part of the system cost eligible for the credit.

I. The credit for the cost of these systems shall be in lieu of any other deduction. The basis of any system for which a credit is allowed shall immediately be reduced by the amount of the credit or reduced to its salvage value at the end of its useful life, whichever results in the lesser basis.

J. If a federal income tax credit is enacted for costs of solar energy systems, then the maximum amount allowable for state purposes shall be reduced by the amount of the allowed federal credit.

K. To claim the credit, form FTB 3805L must be completed and attached to your California tax return for the income or taxable year of the installation. If more than one system is installed, a separate form must be prepared for each system.

SECTION II ELIGIBILITY LISTS

The Energy Resources Conservation and Development Commission is developing eligibility lists but they are not available at press time. Please contact the Commission at 1111 Howe Avenue, Sacramento, CA 95825, telephone (800) 852-7516 for technical system information or other requirements in the guidelines.

STATE OF CALIFORNIA
FRANCHISE TAX BOARD

STATEMENT TO SUPPORT SOLAR ENERGY CREDIT
FOR USE BY INDIVIDUALS AND CORPORATIONS

Attach this schedule to your Tax return

TAXABLE YEAR
19__

Year beginning ______________ 19___ ending ______________ 19___

FOR PRIVACY NOTIFICATION SEE REVERSE SIDE

NAME OF TAXPAYER

INSTALLATION DATE

Corporate No., Social Security No., Employer No. or Federal Employees Identification Number (FEIN) :

ADDRESS OF PROPERTY ON WHICH A SYSTEM WAS INSTALLED

DESCRIPTION AND FUNCTION OF SOLAR ENERGY SYSTEM AND CONSERVATION MEASURES *(attach detailed statement if necessary)*

PURCHASED FROM	INSTALLED BY

Forms should be completed for each system when more than one system is installed.
This system was installed on: ☐ Single Family Dwelling ☐ Other Than Single Family Dwelling

1. Cost of solar energy system including installation cost
2. Cost of eligible conservation measures
3. Total cost (add line 1 and 2)
4. Computation -- Complete (a) or (b)
   (a) Enter 55% of line 3 but not in excess of $3,000, or
   (b) If the system is installed in "Other Than a Single Family Dwelling" and line 3 exceeds $6,000, enter greater amount of $3,000 or 25% of line 3
5. Part-year residents and nonresidents -- Complete (a) and (b)
   (a) Enter percent from line 16(b) Form 540NR
   (b) Multiply amount on line 4(a) or (b) times percent on line 5(a) and enter amount
6. Enter federal solar energy credit allowed (part-year residents and nonresidents reduce the federal credit to the percent shown on line 16(b) Form 540NR . . . ______ X ______ %)
7. Tentative solar energy credit (line 4(a) or (b) less line 6) (Part-year residents and nonresidents line 5(b) less line 6)
8. Solar Energy System Credit - Compute in accordance with specific instruction, then:
   (a) **INDIVIDUALS** (other than condominium owner or partner) -- Transfer the amount from line 7 to Form 540 or 540NR, page 2, line 62
   (b) **CORPORATION** (other than (c) below) - Transfer the amount to Form 100, page 1, line 47(a)
   (c) **TWO OR MORE CORPORATIONS** commonly owned or controlled enter:
      (1) Ratio — Total cost (line 3) / Total cost of all systems installed in California by this group of corporations (attach schedule)
      (2) Multiply ratio times tenative solar energy credit (line 7), enter amount here and transfer amount to Form 100, page 1, line 47(a)
   (d) **CONDOMINIUM and PARTNERSHIP** -- Determine amount on line 7 applicable to each owner or partner and show the allocation below. Enter this amount on Form 540 or 540NR, page 2, line 62 or Form 100, page 1, line 47(a).

	A	B	C	D
Name				
Social Security No.				
Amount	$	$	$	$

FTB 3805L (12-77)

PRIVACY NOTIFICATION

The Information Practices Act of 1977 (effective July 1, 1978), the Governor's Executive Order B-22-76 and the Federal Privacy Act, require the department to provide the following information to individuals who are asked to supply information:

The principal purpose for requesting tax return information is to administer the Personal Income Tax Laws of the State of California. This includes the determination and collection of the correct amount of tax.

The California Revenue and Taxation Code requires every individual liable for any tax imposed by the Code to file a return or statement according to the forms and regulations prescribed by the Franchise Tax Board (Sections 18401 and 18431 and the regulations pertaining thereto). Individuals filing tax returns, statements or other documents are required to include their Social Security numbers to provide proper identification and to permit processing of the returns (Section 18431 and the regulations pertaining thereto).

Furnishing all the appropriate information requested by the return forms and related data is mandatory. The Code provides penalties for failure to file a return, failure to supply information required by law or regulations, failure to furnish specific information required on return forms or for furnishing fraudulent information. Other effects of not providing all or part of the requested information may include the disallowance of claimed exemptions, exclusions, credits, deductions, or adjustments resulting in increased tax liability, loss or delay in issuance of a refund for overpayment, interest and penalty charges on unpaid taxes and other disadvantages to the taxpayer.

Information furnished on the return form may be transferred to other governmental agencies as authorized by law: U.S. Internal Revenue Service, Board of Equalization, Office of the State Controller, Department of Benefit Payments (will become Employment Development Department and Department of Social Services 7/1/78), local tax administrators of this State and administrators of taxes measured by income of other states, Multistate Tax Commission, Attorney General, Registry of Charitable Trusts, California Parent Locator Service, Legislative Committees, Board of Control, Department of Finance, Auditor General and Legislative Analyst.

For those individuals with outstanding tax liabilities, the total amount due may be disclosed to: employers, financial institutions, County Records, vacation trust funds and process agents for the purpose of collecting the amount owed.

This will be the principal notification under the Information Practices Act and the Executive Order concerning the solicitation of information in connection with any tax return or tax liability of an individual. Additional notices will be given with respect to specific information requests during the course of tax administration activities, such as audit and investigation.

Individuals have the right to review their own records maintained by the Franchise Tax Board. The Operations Division of the Franchise Tax Board is the agency requesting the information. The official responsible for maintaining the information is Director, Taxpayer Services, Franchise Tax Board, Sacramento, California 95867, Telephone No. (916) 355-0370.

STATE OF CALIFORNIA
FRANCHISE TAX BOARD

STATEMENT TO SUPPORT SOLAR ENERGY CREDIT
FOR USE BY INDIVIDUALS AND CORPORATIONS

Attach this schedule to your Tax return

TAXABLE YEAR 19__

Year beginning ____________ 19___ ending ____________ 19___

FOR PRIVACY NOTIFICATION SEE REVERSE SIDE

NAME OF TAXPAYER

INSTALLATION DATE

Corporate No., Social Security No., Employer No. or Federal Employees Identification Number (FEIN) :

ADDRESS OF PROPERTY ON WHICH A SYSTEM WAS INSTALLED

DESCRIPTION AND FUNCTION OF SOLAR ENERGY SYSTEM AND CONSERVATION MEASURES *(attach detailed statement if necessary)*

PURCHASED FROM

INSTALLED BY

Forms should be completed for each system when more than one system is installed.
This system was installed on: ☐ Single Family Dwelling ☐ Other Than Single Family Dwelling

1. Cost of solar energy system including installation cost
2. Cost of eligible conservation measures
3. Total cost (add line 1 and 2)
4. Computation -- Complete (a) or (b)
   (a) Enter 55% of line 3 but not in excess of $3,000, or
   (b) If the system is installed in "Other Than a Single Family Dwelling" and line 3 exceeds $8,000, enter greater amount of $3,000 or 25% of line 3
5. Part-year residents and nonresidents -- Complete (a) and (b)
   (a) Enter percent from line 16(b) Form 540NR
   (b) Multiply amount on line 4(a) or (b) times percent on line 5(a) and enter amount
6. Enter federal solar energy credit allowed (part-year residents and nonresidents reduce the federal credit to the percent shown on line 16(b) Form 540NR . ________ X ________ %)
7. Tentative solar energy credit (line 4(a) or (b) less line 6) (Part-year residents and nonresidents line 5(b) less line 6)
8. Solar Energy System Credit - Compute in accordance with specific instruction, then:
   (a) **INDIVIDUALS** (other than condominium owner or partner) — Transfer the amount from line 7 to Form 540 or 540NR, page 2, line 62
   (b) **CORPORATION** (other than (c) below) -- Transfer the amount to Form 100, page 1, line 47(a)
   (c) **TWO OR MORE CORPORATIONS** commonly owned or controlled enter:
      (1) Ratio $\frac{\text{Total cost (line 3)}}{\text{Total cost of all systems installed in California by this group of corporations (attach schedule)}}$
      (2) Multiply ratio times tentative solar energy credit (line 7), enter amount here and transfer amount to Form 100, page 1, line 47(a)
   (d) **CONDOMINIUM and PARTNERSHIP** -- Determine amount on line 7 applicable to each owner or partner and show the allocation below. Enter this amount on Form 540 or 540NR, page 2, line 62 or Form 100, page 1, line 47(a).

	A	B	C	D
Name				
Social Security No.				
Amount	$	$	$	$

FTB 3805L (12-77)

PRIVACY NOTIFICATION

The Information Practices Act of 1977 (effective July 1, 1978), the Governor's Executive Order B-22-76 and the Federal Privacy Act, require the department to provide the following information to individuals who are asked to supply information:

The principal purpose for requesting tax return information is to administer the Personal Income Tax Laws of the State of California. This includes the determination and collection of the correct amount of tax.

The California Revenue and Taxation Code requires every individual liable for any tax imposed by the Code to file a return or statement according to the forms and regulations prescribed by the Franchise Tax Board (Sections 18401 and 18431 and the regulations pertaining thereto). Individuals filing tax returns, statements or other documents are required to include their Social Security numbers to provide proper identification and to permit processing of the returns (Section 18431 and the regulations pertaining thereto).

Furnishing all the appropriate information requested by the return forms and related data is mandatory. The Code provides penalties for failure to file a return, failure to supply information required by law or regulations, failure to furnish specific information required on return forms or for furnishing fraudulent information. Other effects of not providing all or part of the requested information may include the disallowance of claimed exemptions, exclusions, credits, deductions, or adjustments resulting in increased tax liability, loss or delay in issuance of a refund for overpayment, interest and penalty charges on unpaid taxes and other disadvantages to the taxpayer.

Information furnished on the return form may be transferred to other governmental agencies as authorized by law: U.S. Internal Revenue Service, Board of Equalization, Office of the State Controller, Department of Benefit Payments (will become Employment Development Department and Department of Social Services 7/1/78), local tax administrators of this State and administrators of taxes measured by income of other states, Multistate Tax Commission, Attorney General, Registry of Charitable Trusts, California Parent Locator Service, Legislative Committees, Board of Control, Department of Finance, Auditor General and Legislative Analyst.

For those individuals with outstanding tax liabilities, the total amount due may be disclosed to: employers, financial institutions, County Records, vacation trust funds and process agents for the purpose of collecting the amount owed.

This will be the principal notification under the Information Practices Act and the Executive Order concerning the solicitation of information in connection with any tax return or tax liability of an individual. Additional notices will be given with respect to specific information requests during the course of tax administration activities, such as audit and investigation.

Individuals have the right to review their own records maintained by the Franchise Tax Board. The Operations Division of the Franchise Tax Board is the agency requesting the information. The official responsible for maintaining the information is: Director, Taxpayer Services, Franchise Tax Board, Sacramento, California 95867, Telephone No. (916) 355-0370.

SECTION III. TAX CREDIT FORM INSTRUCTIONS

GENERAL INSTRUCTIONS

To qualify, the type of system installed must meet specified criteria (See Section II.) Copies of the completed FTB 3805L must be attached to all returns claiming a solar energy credit. A copy of the same form must also be attached to the returns for partnerships and condominiums that are allocating the credit to other taxpayers. Complete a separate form for each solar energy system.

SPECIFIC INSTRUCTIONS

Line 1. Enter cost of solar energy system including installation cost (do not include interest) incurred on premises in California which are owned and controlled by you at the time of installation.

Line 2. Enter cost of energy conservation measures applied in conjunction with a solar energy system to reduce the total cost of backup energy requirements. Eligible conservation measures installed with solar space heating shall include, but not be limited to, ceiling, wall, and floor insulation above that required by law at the time of original construction. Eligible conservation measures installed with solar water heating shall include, but not be limited to, water heater insulation jackets, and shower and faucet flow-reducing devices.

Line 4. Compute and enter (a) or (b):

(a) Complete this line if you installed a solar energy system in your residence, residence swimming pool or if installed in "other than a single-family dwelling" and the total cost does not exceed $6,000.

(b) Complete this line if you installed a solar energy system in "other than a single-family dwelling" such as an office, warehouse, car wash, etc., and the cost exceeded $6,000.

Line 5. Part-year residents and nonresidents must reduce the amount on line 4(a) or (b) to the same ratio that California income bears to total income. Enter the amounts as requested in 5(a) and (b).

Line 6. If a federal solar energy income tax credit is enacted, enter the amount on line 6. The federal credit (if enacted) shall reduce the State credit so that the combined credit does not exceed the dollar limitations explained at Item G Section I. Part-year residents and nonresidents must reduce the federal credit to the same ratio that California income bears to total income.

Line 8. Complete as follows:

(a) INDIVIDUALS (other than condominium owners or partners) complete line 8(a) subject to the general limitation that the maximum allowable tax credit for solar energy systems cannot exceed the tax (540 or 540NR, line 19) less the sum of the credit for personal exemption ($25 or $50), the credit for taxes paid to other states (540 or 540NR, line 63), and the credit for child and dependent care expense (540 or 540NR), line 64). Excess solar tax credit may be carried over to succeeding years.

(b) CORPORATIONS complete as instructed subject to the general limitation that the solar energy credit does not apply against the minimum franchise tax plus the tax on preference income.

(c) TWO or MORE CORPORATIONS commonly owned or controlled must prorate the amount of the credit in the ratio to which the cost of such system bears to the total cost of such systems for all commonly owned corporations.

(d) CONDOMINIUM and *PARTNERSHIP* – *Individuals are allowed credit for* the proportion their household bears to the total number of households; for example, if your household is one included *in* a total of 40 households served by the solar energy system, you should enter 1/40 of line 7.

Partners are allowed credit for their distributive share from the partnership.

Condominiums and partnerships must file a separate form FTB 3805L with their returns and disclose the distribution to each affected taxpayer. Each partner or owner must file a copy of the FTB 3805L with their tax return and their total credit is subject to the general limitations stated at lines 8 (a), (b), (c).

NOTE: (1) The credit for such cost shall be in lieu of any deduction to which the taxpayer otherwise may be entitled, if any.

(2) The basis of any system for which a credit is allowed shall either be reduced to its salvage value at the end of its useful life, or reduced by the amount of the credit, whichever results in the lesser basis.

(3) Records must be retained in accordance with appropriate statutes to substantiate the credit, credit carryover, and basis.

LOCATION OF FRANCHISE TAX BOARD OFFICES

	Address	Zip Code
Bakersfield	1300 Seventeenth Street	93301
El Monte	9660 Flair Drive	91731
Fresno	2550 Mariposa Street	93721
Long Beach	3530 Atlantic Avenue	90807
Los Angeles	3200 Wilshire Boulevard	90010
Oakland	1916 Broadway	94612
Sacramento	1912 I Street	95814
San Bernardino	330 North D Street	92401
San Diego	1350 Front Street	92101
San Francisco	345 Larkin Street	94102
San Jose	1570 The Alameda	95126
Santa Ana	28 Civic Center Plaza	92701
Santa Barbara	41 Hitchcock Way	93105
Santa Rosa	447 College Avenue	95402
Stockton	31 E. Channel Street	95202
Van Nuys	8155 Van Nuys Boulevard	91402

TELEPHONE CALLS FROM WITHIN CALIFORNIA ARE TOLL FREE
Use Only the Corresponding Number Listed Below:

Sacramento Metropolitan Area *	Information	(916) 355-0370
	Forms	(916) 322-8932
Area Codes 209, 408, 415, 707, and 916 (except Sacramento)	Information	(800) 852-7050
	Forms	(800) 852-7700
Area Codes 213, 714, and 805	Information	(800) 852-5711
	Forms	(800) 852-7700

* Also from outside California, but calls are not toll free.

OUT OF STATE OFFICES:

Chicago, IL	150 N. Wacker Drive	60606	(312) 332-4025
New York, NY	1271 Avenue of the Americas	10020	(212) 581-0100

California's New Generation of Energy Efficient State Buildings

The first three projects under the aegis of the new state architect's office break some significant new ground. By Allan Temko

Saving is the name of the political game in Sacramento, where it is no secret that Governor Jerry Brown hopes to dethrone Jimmy Carter in a campaign that may hinge on energy conservation. The austere governor (who has also been called a "phony Spartan") clearly believes that the surest approach to the White House is not by way of Middle Eastern oil fields, but by reversing the wasteful use of the U.S. environment. Hence his "small is beautiful" parsimony which, although widely publicized and apparently popular, at first consisted mainly of relaxed rural building codes and scrimping on existing social programs.

Lately, however, he has been willing to unbuckle $90 million for adventuresome office construction by the state; and if he does challenge Carter three years from now, he will be able to point proudly, on national TV, to a remarkable group of energy efficient public buildings which Sim Van de Ryn, his equally remarkable state architect (*see* June '76, p. 41), should have ready just in time for the primaries.

Van der Ryn and his staff have actually designed only one of the buildings. But he is responsible for the philosophy underlying all three, which rely heavily on passive technology, and are reckoned by Van der Ryn to need as little as 25 percent of the electricity and gas required by conventionally airconditioned structures in Sacramento's hot Central Valley climate.

Yet the new state buildings promise to be much more than technical feats—or rather antitechnocratic lessons. They also happen to be significant works of social architecture, which compare favorably with superior design in the private sector and are rare in governmental building. In strikingly different ways, for their concepts are not at all identical, the three buildings have been designed according to human needs, going far beyond mere temperature comfort, including the individual's need to be more than a bureaucratic cipher.

All of these unexpected developments, not on a "small is beautiful" scale, but in buildings ranging from 200,000 to 350,000 square feet, amount to a vindication of the unorthodox outlook of Van der Ryn, whose appointment as state architect two years ago at the age of 40 had generated mixed feelings among California architects.

Not only had he avowedly given up on architecture with a capital A, but he had ceased even to practice the modest humanistic architecture—notably housing for college students, the elderly and migrant farmworkers—which had given him and his partner Sanford Hirshen national reputations.

At the time of his appointment, Van der Ryn was a counterculture ecologist, far-out Berkeley professor, veteran of the battle for People's Park and founder of the communal Farallones Institute which sought to relate physical environment with "biological concerns." He was concentrating on recycling, frugal plumbing, bohemian "wood butcher" construction and contemplation at Zen centers such as Tassajara Hot Springs in the uppermost reaches of the Carmel Valley where he met Jerry Brown.

In the political infighting that followed his appointment, Van der Ryn showed himself more adroit than anyone expected and had the advantage of an acute shortage of office space in Sacramento, the result of a moratorium imposed on state construction by Brown's predecessor Ronald Reagan, who had adopted the financially and architecturally disastrous policy of leasing private real estate instead.

Therefore, the legislature gave almost routine approval to financing for three urgently needed buildings, together with two others that will follow soon, suggesting—at a cost of $90 million for the five—that "small is beautiful" is a relative term after all.

But the buildings were to be anything but ordinary. Rather nervily, Van der Ryn decided to do the first building himself, aided by a few top assistants brought in specially for the job. He thought he knew best what he hoped to achieve in new standards for both pleasant working conditions and economical energy consumption: objectives which he, of course, perceived as totally compatible. The block-square site near the capitol suited his intention to go lowrise, anticipating the four-story limit of his downtown plan, and allowed him to wrap a carefully shaded building around a great skylit court, which is the key to the whole concept.

Such courts, invented by the 19th century, have reappeared in many different kinds of buildings during the past 15 years, from Kevin Roche's magnificent enclosed garden for the Ford Foundation

Mr. Temko, an architectural historian, is critic for the *San Francisco Chronicle*. He is a frequent contributor to the Journal.

to John Portman's festive and theatrical hotel atriums. But all of these spaces impose heavy loads on airconditioning systems. Van der Ryn, to the contrary, hoped to achieve just the reverse by taking advantage of a special condition of the Sacramento climate: the steep and rapid fall in temperature at night, when ocean breezes blow up from San Francisco Bay through the Carquinez Straits to cause a drop of 30, 35 or even 40 degrees after torrid summer days. Although winter presents no problem in Sacramento, since heating needs are scant, from June to September the thermometer often tops 100.

Consequently Van der Ryn and his gifted young architects and ecologists adopted a *regionalist* strategy of cooling the building at night by opening vents to trap the breezes, and drawing those through the structures during the day by fans of a fairly standard high-velocity airconditioning system. At the same time, hot daytime air is expelled; and the HVAC's full refrigerating capacity, intended merely as a back-up, will go into action only under extreme conditions.

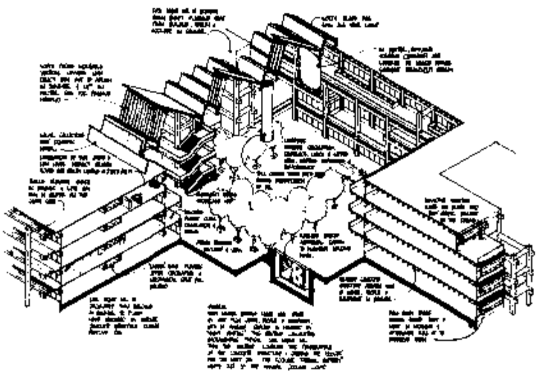
In an added touch, the cooling process will be "supercharged" by an auxiliary battery; a 660-ton rock bed sunk in the landscaped court, which is also hooked up to the HVAC, and will assume 25 percent of the cooling job.

The spacious court, 92 feet square and nearly 60 feet high at the crests of the saw-tooth skylight, surrounded by ample balconies—actually, galleries which replace corridors that are the bane of bureaucratic buildings—is planned as a social center and informational focal point. It will have cafe-like dining and seating areas, banners hung from the hefty glu-lams spanning overhead, full-sized trees and luxuriant plants: quite an order for a state office building. The court, of course, will also act as a reservoir of cool night air which the architects hope will remain pleasant on very hot days, even though some skeptical engineers doubt it. Only the finished building—as in all of these frankly experimental projects—will prove who is right.

Whatever its energy conserving role, the success or failure of the central space—surely the most generous in a California public building since the magnificent rotunda of the San Francisco city hall was built half a century ago—will depend on its play of light. It cannot hope to equal the splendor and sensitivity of Arthur Brown's masterpiece, but nevertheless may be very impressive in its own right.

This is a far cry from wood-butchery—

The variegated facade, large interior court and energy related elements of the Van der Ryn-Calthorpe design, to be cooled by trapping night air and drawing it through the building during the day, without conventional airconditioning.



maybe too far for Van der Ryn and his chief designer Peter Calthorpe, neither of whom had previously tackled so ambitious a concept. In spite of a certain heavyhandedness that seems locked in the design, if the court becomes what they wish, it will be suffused by a dappled luminous softness, filtering downward through the operable shades of the southward-slanting skylights in summer, balanced by the unshaded northern lights. In winter, it will be flooded by sunlight that should keep the building warm until after dusk. These designers are not afraid of natural light. On the contrary, they object strenuously to excessive artificial light because of its burdensome heat load, high cost and glare.

What the Californians do want is to prevent direct sunlight from penetrating their buildings in hot weather. Here common sense prevailed, forgotten in the air-conditioned age, but long known to Central Valley residents who from pioneer times have blocked out the sun with thick construction (never better than in old adobes), and also by awnings and other external sunbreaks such as old farmhouse verandahs.

Such logic has inspired a vigorously indented, broken-up exterior, which will vary on all four elevations according to solar conditions and be fitted with cheerful-looking movable canvas sunshades—probably in orange or another bright color—that can be raised and lowered at will by the building's occupants. Therefore, the facades will be constantly changing in mood, but they are crudely drawn, and complicated by a constructivist esthetic, calling for bulky, coarsely jointed concrete sunbreaks and trellises. Some are cumbersome protrusions of the structure itself, meant to express the building's thermal properties, but which clamor unnecessarily for attention, and may end up simply looking a mess.

It can be argued that such fragmentation divides into intelligible human portions what otherwise might be the forbidding mass of the building. The sun-resistant devices shade informal terraces where, because of the overall disorder, it will not matter much if individuals "do their own thing," putting out porch furniture and art as they often do on the decks of California houses.

With 76-foot-wide office spaces, whose windows face the court, no desk is farther than 38 feet from natural light. This should make for a relaxed air, which will be enhanced by task lighting.

On balance, then, this structure which began primarily as a demonstration of low energy design, promises to be a very decent building, flawed as a formal work of architecture, but profoundly humane in other ways. It will be fascinating to see what Van der Ryn's office will do in a smaller office building, occupying only half a block, which they are designing for a nearby site.

Perhaps the latter will profit from the state capital's second and more elegant example of an energy efficient project. At 350,000 square feet and a budget of $17 million, it is the first major office building designed by Robert Marquis & Associates, hitherto chiefly known for exemplary housing such as St. Francis Square in San Francisco. The new building will be the headquarters of the state department of justice, headed by Attorney General Evelle Younger, a conservative Republican who may oppose Brown when he runs for re-election next year.

Interestingly enough, Younger had intended to buy canned architecture rather than go through a distressing experience with the state architect's office, with which he had become painfully familiar under its former regimes. It even made some sense to him to order prefabbed industrial structures because a big part of the justice facility would be only a shell for its giant computers.

Van der Ryn, given to wearing kerchiefs and country clothes from L. L. Bean, might seem to be the last person to carry weight with Younger, but he persuaded him to make a serious user-oriented architectural statement and also attempt to cut gas and electricity needs by 65 to 75 percent.

The investigation of user preferences in the justice department began in Van der Ryn's office, where a gifted young consultant, the architect-programmer Bobbie Sue Hood, undertook the monumental task of interviewing almost all the employees in what, so far as I know, was an unprecedented preliminary effort in the design of a government building.

The justice department building began with an elaborate program based on employee interviews.

From this research she came up with a schematic diagram, setting forth "required relationships between major components," which was not so much a program as a physical prescription for architecture which—because of her own inexperience in actual building—was in many respects naive.

In fact, by calling for a campus-like arrangement of square "doughnut" buildings surrounding courtyards, and—for no compelling reason—specifying the height of different elements, entrance locations and circulation patterns, she was overprescribing architecture that needed much study by thoroughly professional designers.

The Marquis firm found many of her recommendations simply unworkable, such as her notions of future expansion

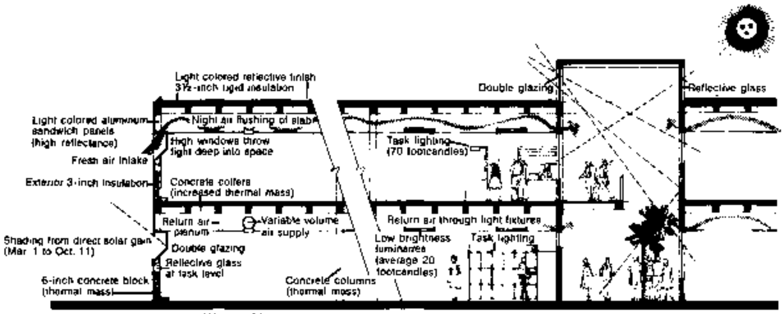
(which obviously couldn't take place on all four sides of each doughnut), as well as her inaccurate estimates of circulation square footage. All this had to be redone, and probably shouldn't have been done in such detail in the first place.

Furthermore, the concept had to be made architecture, with a capital A, something which had escaped Van der Ryn and Hood. And when Marquis and his senior designers Jim Caldwell and Jacques De Brer finally developed a plan for the large empty site on the old state fairgrounds, at the edge of town, it bore little resemblance to Hood's original scheme.

Instead, it was a richly urbane continuum of spaces that differed considerably in size and mood, deftly changing from one to two stories and organized around a variety of spaces that are attuned to both the working patterns and individual wishes of the department's several divisions. All this is connected internally by a lucidly planned grid of "streets"—really, lofty skylit corridors with cantilevered upper galleries—which pass through "neighborhoods." Their outdoor courts are the readily identifiable "turf" of the various agencies. These spaces can be used as volleyball courts, Ping-Pong areas, flower gardens, vegetable patches or simply quiet patios.

These "streets" converge at a large central court which Marquis chooses to call a "town center"; and although the nomenclature may seem pretentious, it may in the end accurately describe the social core of this immense legal and judicial operation which badly needs humanizing.

This, I'm happy to report, the Marquis firm is continuing to do in lively ways. It has continued interviewing users, and publishes some of the results in a newsletter which also reports on the design as



The state justice department building by Marquis Associates will be organized around a large skylit central space and cut through by lofty corridors (upper right). Energy elements are similar to those in the Van der Ryn design.

it develops. A cynical commentator—I, for instance—might note that some of this is little more than a sociological smoke screen, manipulating the collective client so that the architects merely are obtaining endorsements for what they intended to do in the first place; but some of the research has been undeniably helpful. The main point, perhaps, is that all the employees feel they have a stake in their environment, and are genuinely delighted that anyone noticed them at all.

This building is not yet fully designed; and I hope that it will have the dash, elegance and warmth that Marquis and his associates are striving to give it. The passive energy features are closely analogous to those in Van der Ryn's building, relying on night air for cooling. The system might be even more effective because the cold air will circulate through a plenum above a hung ceiling, thereby bringing it in closer contact with the structure; and there are many other refinements attributable to mechanical engineer Fred Dubin of New York City—one of the chief pioneers in the field.

It will also be fascinating to see if the building's fixed brise soleils in the courts are more successful, or less, than Van der Ryn's movable canvas shades, and if an almost windowless exterior (whose prefabricated metal curtain wall can be dismantled for expansion in almost every direction) will be decisively less acceptable than an outward-facing building. E. O. Tofflemire, a specialist in such enclosures, who has worked with designers as meticulous as Philip Johnson and Richard Meier, is the consultant for these facades.

One wonders how finely a humanistic Bay Area office will execute such rigorous technological ideas. For much, in the state buildings, will depend on fastidious details, good furnishings, sensitive use of color and above all a sense of architectonic command—not abstract control.

The third of the energy efficient California state office buildings could become a first genuine great ecological work of this new architectural era. It is the winner of a competition conducted by Van der Ryn—by all odds the most thoughtful

A competition yielded a pair of outstanding designs and a split over them on the jury.

ever held in the state—in which no fewer than 41 private firms entered, proving that energy efficiency is now a potentially lucrative business. Some of the contestants spent tens of thousands of dollars on their submissions.

The winning design, lo and behold, is by one of the biggest architectural and engineering conglomerates in the country, Benham-Blair & Associates, whose 550 employees are distributed in 11 regional offices, including Los Angeles and San Francisco.

The concept by Benham-Blair's chief designer, Buford Duke, calls for an immense solar collector—240 feet across and 60 feet high—as a superb symbolic touch for a building that otherwise is largely underground, somewhat reminiscent of the Oakland Museum. But it has a long way to go before it is in that class.

The intelligent process by which the competition was conceived deserves a word of explanation. The entrants were asked to meet energy performance standards, and were required to justify their designs by the same kind of thermal and light-metering model tests that Van der Ryn's staff had used in designing their prototypical first building. The six finalists in the two-stage competition were given the additional task of evaluating their results scientifically in complex computer print-outs that filled thick volumes.

These were scrutinized by a jury chaired by William Caudill, FAIA, of Houston, one of the chief begetters of the present concern with sun control problems. The jurors split three to two. Van der Ryn and Dubin cast the two negative votes, primarily because the design broke almost completely with the direction the state had been following in the other new buildings, which will use rooftop solar collectors only for heating water, and depend on night air for most of the cooling.

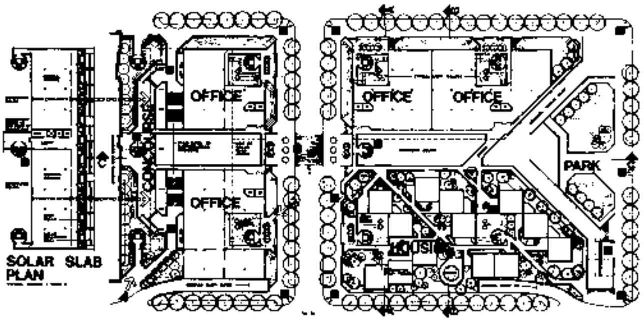
Forty of the 41 contestants, including the second prize winner, adopted a similar strategy, which seemed virtually imposed by the competition instructions. The winner is a passive earth-covered building whose surface would be an urban park, overlooked at its far end by a huge solar collector slanting upward at a 45-degree angle to be the principal external element of a six-story office building. The collector would provide the energy necessary to cool the entire complex.

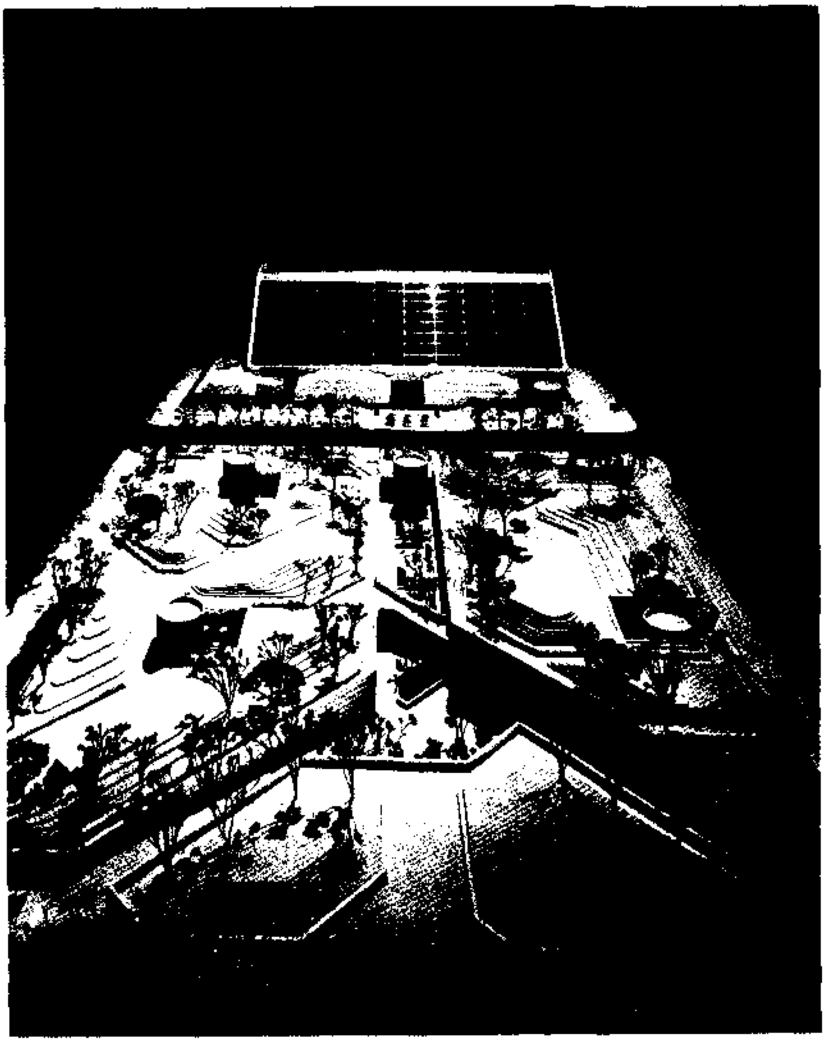
As a symbol, it should be one of the most powerful architectural proclamations of a new age. Yet at this stage there is much that is plainly wrong with the design. The collector, as proposed, seals the front of the above-grade structure which should be opened to overlook the park. The park itself, perforated by sunken courts, needs much more thought.

Nevertheless, these shortcomings may be rectified, although perhaps not at a cost the state is willing to pay. The project would give Sacramento a free inner city park which should be an oasis for thousands of state employees encased in mammoth surrounding structures, including a real brute that went up in the 1960s, which the solar collector will mercifully mask.

Unfavorable critics of the scheme, including Van der Ryn (even though he wants it built), also question its efficiency, for Benham-Blair and their consultants, Westinghouse Engineers, project savings of 50 percent, half of what Van der Ryn claims for his approach. He and his staff

Benham-Blair's competition winning design places most office space under a park, with light coming through a central mall and four courts. Above grade is a solar-walled structure and housing blocks will be added at a later stage (see plan).





—to whom the jury's decision almost amounted to religious heresy—point out, too, that the winner does not fully comply with the new capitol area plan, as stipulated in the competition. The plan indicated a design that could be built in quarter-block modules, 160 feet square, in accordance with a mixed use concept including 40 or 50 housing units on the site. Benham-Blair placed some unconvincing circular housing elements on the model, but the park looks far better without them.

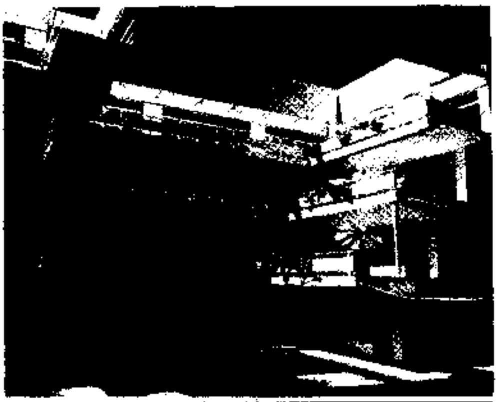
Was not the state architect's opposition based, in part at least, on fear—even hatred—of a grand design? For he and the governor, reacting against the insensate architectural "mono-culture" that big government imposed on Sacramento in the last decade, leaving it virtually unpeopled after 5 P.M., now want to transform the dismembered cityscape into a closely-knit "village in the modern sense."

But great regional capitals—Edinburgh comes to mind, and Bordeaux—do not have a village air. They are nobly urbane centers of cultivated life which possess authentic grandeur that can lift up the hearts of people of all ages and backgrounds.

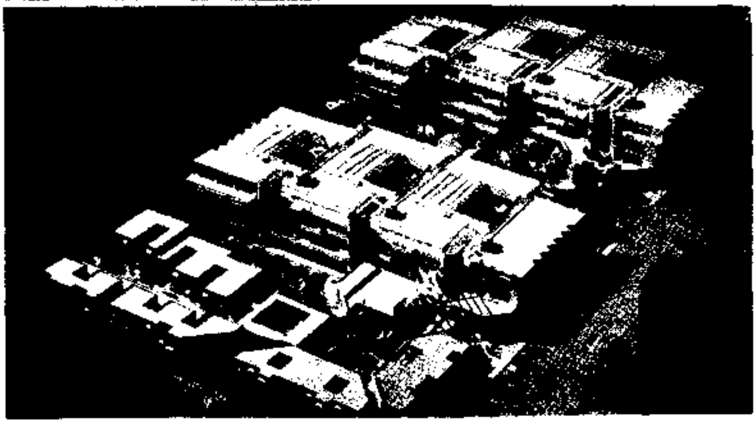
In fairness to Van der Ryn, however, the competition runner-up which he much prefers to the winner, might have accomplished something as valuable; a new kind of vernacular which could move across the city in a charming yet orderly way. For it did virtually everything he hoped for—indeed, everything he had done in his own building, only better, turning his coarser brand of design, so help me, into capital A architecture. Its exquisitely organized interior courts, meant as centers of exuberant social life as well as reservoirs of cooling air, covered with retractable skylights and splendidly surrounded by stepped-back balconies, show a direction that should also be followed.

Not surprisingly, the entry was signed by Elbasani, Logan, Severin, Freeman, an innovative firm which has won or done well in several notable competitions. But they were acting chiefly as licensed architects of record for three extraordinary talented students of Donn Logan at Berkeley: David Baker, Philip Banta and Anthony Cutri.

They are $7,500 richer today with their second prize money, but an even greater prize came to Elbasani, Logan, Severin, Freeman with the commission to design a new state office building in San Jose, giving them the chance to fully explore the possibilities of the competition entry. □



The competition runner-up by Elbasani, Logan, Severin, Freeman, organized around a series of handsome courts with retractable skylights, closely followed Van der Ryn's concepts in regard to both energy and the overall design of the capital.



Senator KENNEDY. OK. I am going to submit some written questions to you. You have made an excellent statement. It is very, very helpful to us, and a very exciting program has been developed in California.

We are going to watch it with great interest, and I think you have helped sharpen the issues here this morning with your statement, particularly in its relationship to how you view the California plan, and the job issue, which is the primary focus of our hearings, and also from the energy point of view, let alone tying this into the general issues of urban policy.

So, I want to thank you very, very much for being with us. I am going to submit some written questions to you, if I could, for you to answer. I want to thank you very much for taking your time to be with us this morning.

Mr. CLARK. Thank you.

[The following questions and answers were subsequently supplied for the record:]

RESPONSE OF WILSON CLARK TO ADDITIONAL WRITTEN QUESTIONS POSED BY SENATOR KENNEDY

STATE OF CALIFORNIA,
GOVERNOR'S OFFICE,
Sacramento, May 26, 1978.

Hon. EDWARD M. KENNEDY,
Russell Senate Office Building,
Washington, D.C.

DEAR SENATOR KENNEDY: It was a pleasure to appear before your committee and I am pleased to enclose responses to the questions posed in your letter of April 7, 1978.

Question 1. What are you doing to insure quality products and keep consumer fraud to a minimum?

Answer. The State of California has recognized the need to build consumer confidence and to insure quality in materials and installation. The state will shortly begin to certify collectors which are being sold in California. We also have established a warranty system, which operates as follows:

After June 15, 1978, every solar collector, storage unit and heat exchanger within a storage unit sold by a manufacturer, distributor or retailer to a retail buyer for use in an indirect thermal system shall, in order to qualify for the state tax credit, be covered by a manufacturer's warranty which shall contain, but is not limited to, the following terms:

That the solar collector, storage unit, or heat exchanger within a storage units, is free from defects in materials or workmanship.

That, except as provided in 2603 (e) (1) (c), in instances of defects in materials or workmanship which become evident within three years from the date of installation completion, the manufacturer shall remedy the defect in the collector, storage unit or heat exchanger within a storage unit, including if necessary, repair, or replacement at the site, without charge and within a reasonable time.

That in instances of corrosion of a collector's absorber plate or other coolant passages which becomes evident within three years of the date of installation completion, the collector manufacturer shall remedy the corrosion defect. During the first year of the warranty period, the manufacturer shall remedy the corrosion defect without charge. During the remainder of the warranty period, the corrosion warranty shall cover the cost of all parts, delivered to the site, necessary to remedy the corrosion defect, including the cost of furnishing a new collector if necessary.

The manufacture's warranty shall also provide for field inspection at no charge to the retail buyer, to verify failure, establish probable cause and determine corrective action required. However, the manufacturer's warranty may provide that the reasonable costs of the field inspection during the second and third years of the warranty period shall be at the buyer's expense, if the field inspection is requested by the buyer and there is not actual defect in the warranted product.

The manufacturer's warranty may specify reasonable installation and maintenance procedures, including specification of incompatible components, and may specify reasonable use conditions for the warranty to be effective. However, no warranty shall be violated or in any way reduced by conditions that may occur in normal operation of the system.

In addition, the Department of Consumer Affairs has established a toll free hot-line for solar complaints that will perform activities in these areas:

(a) Complaint mediation;
(b) Consumer protection service;
(c) Advertising substantiation.

Under the Contractors State Licensing Board (SCLB), a part of the Department of Consumer Affairs, a consumer protection program in solar and insulation was established. Included in the schedule is a five point program to improve consumer information, develop reliable procedures for complaint handling, workshop training for deputies in solar technology. The SCLB is also examining the impacts of a solar license for installers.

The California Energy Commission is currently developing a Testing and Inspection Program for Solar Equipment (TIPSE) to be implemented May 31, 1978. Through this program accredited private laboratories would test solar equipment to determine if it meets certain minimum criteria set by the Energy Commission. It would be up to the manufacturer whether or not they wanted their equipment tested, but it would be to their advantage to be able to tell a potential customer that their product meets state standards.

The final program aimed at increasing consumer confidence is the T-label program being developed by the California Energy Commission in conjunction with the California Solar Energy Industries Association (CAL SEIA). Through this prgoram a manufacturer whose solar equipment meets the criteria for the solar tax credit could receive labels to place on his product assuring a customer that he would be able to receive the tax credit.

Question 2. Do you plan to make solar even more attractive by eliminating tax breaks and subsidies to utilities and other large users of fossil fuels?

Answer. Governor Brown has just formed a solar advisory council (SolarCal) which consider all aspects of solar policy for California, including the possibilities of additional financial incentives. My own belief is that utilities will become more involved in promoting and financing solar installations, and this will result in the rapid growth of solar, whether or not tax breaks and fossil fuel subsidies are eliminated. I believe that such advantages should be extented to solar as well and that energy pricing mechanisms should more clearly recognize the need to conserve non-renewable fuel sources. A copy of the Executive Order establishing the Council and Office is attached.

Question 3(a). How will the proposed reforestation program work to produce energy?

Answer. Forestry management practices create large quantities of wood residues, logging slash, and precommercial thinnings. In the past, these wood wastes have posed a disposal problem to logging companies and lumber mills, as well as an air quality problem due to their subsequent in field burning. Obviously, increasing forestry production concurrently increases wood wastes. Research by the California Department of Forestry and the California Energy Commission indicate this concentrated waste material is an encellent fuel source available now. In fact, several lumber companies are currently using wood residues to supplement energy consumed in mill operations.

In addition to wood waste generated from accelerated forestry management, there are some provisions included in the program for using non-commercial species of trees, plus planting and management of fast-growing trees for direct energy conversion. Funding is a limiting factor, however, and forestry practices that produce valuable products *and* an energy source would maximize our investment. Presently $29 million is proposed for the entire forest improvement program, whereas $77 million was originally envisioned. Implementation of how much is to be earmarked for each of the three parts will be solidified through the legislative process.

Question 3(b). Do you see wood as a potential fuel source for California?

Answer. A simple answer to this question is yes. The attached table arrays the gross potential for power derived from wood sources. The total (do-able) energy potential has been estimated between 18,968–16,557 MW, a large range, but impressive numbers indeed.

Question 3(c). What is its jobs impact?

Answer. The California Energy Commission has estimated that within three years 150–200 MW of power derived from wood and agricultural wastes could be on line and would generate between 3,800–3,850 jobs. The breakdown of job categories includes: Manufacturing 1,200–1,220; construction 2,400–2,422; and operation and maintenance 200–210.

We are embarking on a new era of economic and employment stimulation, coupled with not only emerging alternative energy developments, but also with energy use patterns. Wood energy and reforestation represent some key pieces to our long-term survival puzzle, each reinforcing the other as well as enhancing other natural systems-based options. By merely extrapolating classic job equations from MW output, we aren't including the full impact and potential of the resource.

GROSS ENERGY POTENTIAL OF WOOD RESIDUES IN CALIFORNIA

Category	Acreage	Volume	Rotation	Annual potential (million dry tons)		Megawatt (a) equivalent	
				Low	High	Low	High
Mill residue		7.7 million dry tons (b)		1.0	2.0	275	550
Woods residue	167,000	6.5–8.5 million dry tons (c)		4.5	6.5	1,238	1,788
Conifer thinnings	16,700,000	15–30 tons/acre	100	2.5	5.0	688	1,375
Dead and dying trees	16,700,000	1.3 billion board ft/yr		2.5	2.5	688	688
Commercial hardwoods	2,837,000	60–120 tons/acre	90	1.9	3.8	523	1,046
Noncommercial softwoods	7,532,000	1–3 tons/acre/yr		7.5	22.5	2,063	6,187
Noncommercial hardwoods	1,319,000	40–50 tons/acre	20	2.6	4.0	715	1,100
Chaparral	7,554,000	10–20 tons/acre	20	3.8	7.6	1,045	2,090
Urban residues				4.3	4.3	1,183	1,183
Orchard prunings				2.0	2.0	550	550
Total				32.6	60.2	8,968	16,557
Btu equivalent (in 10^{16} Btu) (d)				.59	1.09		

(a) Assumes a powerplant with a thermal efficiency of 25 percent and a load factor of 55 percent.

(b) A large amount of this volume is presently being used in the pulp industry and as a fuel at lumber mills which is reflected in the annual potential columns.

(c) 2 million tons presently being used; does not include pieces less than 4 inches in diameter.

(d) 18 by 10^6 Btu/dry ton of wood.

Source: Modified version of estimates developed by Al Groncki, U.S. Forest Service (memo dated Nov. 10, 1977).

Quantification techniques are just being derived to account for the total economic and social benefits of all forms of alternative energy. This is a very exciting endeavor and I welcome the opportunity to share this with you.

Question 4(a). How is the State helping low-income groups to provide for their own energy needs and also create jobs for the unemployed in their communities?

Answer. California has made a major commitment to the development of solar technology both as a new source of energy and as a new industry which will provide thousands of jobs in the next several years. In order to meet the demand for qualified personnel, the state, local governments, private groups, labor organizations, and educational institutions have undertaken training and educational programs which range from one-day public information seminars to graduate degree programs in solar engineering.

A state-wide effort to bring unemployed and underemployed Californians into the solar industry has been initiated. The Governor's Office of Appropriate Technology and the SolarCal Office are developing for CETA a comprehensive curriculum for solar technicians which will establish a series of skill standards and learning methodologies for local programs throughout California. This program is being developed in conjunction with industry and labor groups, and can be replicated for use anywhere. The curriculum will aim primarily at the unskilled and unemployed and will feed into union apprenticeship, and junior college and university programs. We expect that a second phase of this project—that of training trainers in the field of solar technology and in use of the curriculum—will be initiated by Sonoma College in September, 1978.

As part of California's urban strategy, the state will retrofit up to 500 low-income residential units in Oakland with solar domestic hot water systems, and train 20 unemployed Oakland residents in solar technology. This program is unique in that it is the first application of the state-wide CETA-sponsored curriculum, and the first fully cooperative solar project involving organized labor, solar equipment manufacturers, small solar businesses, and state and local government in a job development and retrofit program. It will result in increased local self-reliance and new job and business opportunities in the inner city.

Another major effort in solar training is being put together by the Sheetmetal Workers International Association. They are developing a training program, complimentary to the state program, to train their apprentices and journeymen in solar technology.

Community colleges, colleges, an universities throughout the state are offering over 150 different solar-related courses; and weekend seminars are being held for do-it-yourselfers, dealing with solar hot water heaters and solar greenhouse construction. The following listing represents solar-related training programs in California:

Office of Planning and Research: Dr. Ron Lipton, Sacramento, CA. Contract period: March 1, 1978 to February 28, 1979, funding: $77,182.

Provides development of a master training curriculum for solar technicians for use by training agencies. Provides consulting services for local groups in establishing and administering solar technician training programs. Sets up state clearinghouse for information regarding solar technician training.

Proteus Adult Training, Incorporated: William M. Maguy, Visalia, CA. Contract period: February 21, 1978 to February 29, 1979, funding: $159,925.

Project will undertake Solar Retrofitting at Porterville State Hospital and in low income farmworker homes. There will be ten participants.

San Bernardino Westside CDC: Valerie Pope, San Bernardino, Ca. Contract period: December 1, 1977 to November 30, 1978, funding: $331,795.

Project consists of 20 percent classroom training and 80 percent work experience. Participants will receive training and work experience in the manufacturing and installation of solar energy panels and other related energy conservation equipment. Training will also include sheet metal and machine shop work.

San Bernardino Westside CDC: Valerie Pope, San Bernardino, CA. Contract period: October 1, 1976 to November 30, 1977, funding: $258,104—Total funds obligated.

This project was designed to provide work experience to the disadvantaged in the technological field of solar energy, specifically, winterization, rehabilitation, and retrofitting. A central solar collector was designed and constructed, and ten homes were rehabilitated, insultated, and retrofitted with solar heating apparatus.

California State College, Sonoma: Rita Garant, Rohnert Park, CA. Contract period: August 1, 1976 to July 31, 1977, funding: $92,558.

The goal of this project was to provide skills development for CETA eligible persons in solar energy technology at public facilities. Trainees were educated in all relevant aspects of solar energy technology including climatology, etc.

Center for Employment Training, Solar Energy Project, Robert Johnson, San Jose, CA. Contract period: January 1, 1977 to June 6, 1977, funding: $45,894.

This subgrant provided add-on resources to make it possible for migrant and seasonal farmworkers being trained to be building maintenance workers to learn to fabricate and install solar water heating systems. Our subgrant included $21,000 California Energy Commission funds for materials. Participants were enrolled under a grant to CET from Proteus, Incorporated, who received their basic funds from the State CETA Office/La Cooperativa.

Question 4(b). Do you support Assembly Bill 2841 which calls for training low-income persons in energy-related areas?

Answer. This bill is in the process of major revision. In concept we strongly support the idea of a publicly-funded training program. The details remain to be worked out and we are cooperating with the legislature to insure that an efficient mechanism for operating high-quality solar training programs are developed.

Questions 5 (a) and (b). Do you see a necessity to mandate the use of solar devices on new homes? Do you think Minnesota's law requiring existing homes to have a certain amount of insulation before being sold is applicable to California?

Answer. Both the California State Public Utilities Commission (PUC) and the California State Energy Resources Conservation and Development Commission (ERCDC) are looking into the problems associated with mandating energy efficiency in homes.

Recently the PUC made a recommendation that after 1981 public utilities be allowed only to hook up to new homes which are properly insulated. The ERCDC has published a report, "Solar Energy in California: Residential Thermal Applications" in which they recomend that the legislature enact legislation clarifying the Commission's ability to direct energy efficient design for new housing. However, no direct action is being taken at this time in California.

I hope this information is useful to you. We are most concerned that the nation begin a major effort to develop alternate energy sources and new jobs. California has already begun, and we would be happy to cooperate with you in any way possible.

Sincerely,

WILSON CLARK,
Assistant to the Governor for Issues and Planning.

Enclosure.

OFFICE OF THE GOVERNOR,
Sacramento, Calif., May 3, 1978.

Gov. Edmund G. Brown Jr. has signed an Executive Order creating a SolarCal Office in the Business and Transportation Agency. The executive order also creates a SolarCal Council to advise the governor and the SolarCal Office.

In the executive order Gov. Brown said the SolarCal Office will provide "a focal point within the state government to assist in the maximum feasible commercialization of solar energy."

He said the Council will advise the Governor and the SolarCal Office on the means to achieve rapid development of solar energy in the state.

The Council also is charged with developing administration policies and plans for maximum feasible solar commercialization, making information available to the public about the use and benefits of solar energy and promoting cooperation in solar energy development in California with the federal government as well as public and private interests.

The governor appointed Sim Van der Ryn, California's state architect as chairman of the council; Wilson Clark, the governor's assistant for issues and planning, as executive secretary of the council; and Jerry Yudelson, as director of the SolarCal Office.

Council members serve at the pleasure of the governor and receive no compensation.

Attached is the executive order and a list of the appointed members.

EXECUTIVE DEPARTMENT, STATE OF CALIFORNIA

EXECUTIVE ORDER B-43-78

Whereas, Rapid solar energy development and commercialization creates jobs, stimulates economic growth, conserves scarce fossil fuels, provides a safe, clean and renewable energy resource, and reduces utility costs to commercial, industrial and private consumers; and

Whereas, The State, already the national leader in solar energy, can further develop solar commercialization and business development projects by coordinating solar energy activities and policies of State agencies; and

Whereas, The solar industry as well as consumers, labor and business groups look to the State for assistance in economic and business development, public information, and coordinated public participation in State solar policy development; and

Whereas, the Secretary of the Business and Transportation Agency is the Governor's principal liaison with the business community.

Now, therefore, I, Edmund G. Brown Jr., Governor of the State of California, by virtue of the power and authority vested in me by the Constitution and Statutes of the State of California, do hereby issue this order, to become effective immediately:

1. There is established in the Business and Tranportation Agency the SolarCal Office, to provide a focal point within State government to assist in the maximum feasible commercialization of solar energy. The Secretary of Business and Transportation Agency is directed to establish the position of Director of the SolarCal Office, who shall be appointed by and serve at the pleasure of the Governor.

2. There is established a SolarCal Council to work with the SolarCal Office. The Chairman of the Council shall be the State Architect, and the Executive Secretary of the Council shall be the Governor's Assistant for Issues and Planning. The SolarCal Council shall consist of members who shall be appointed by and serve at the pleasure of the Governor. Additional members will be appointed from State government to serve ex-officio.

3. The SolarCal Council shall have the following responsibilities:

Advise the Governor and the SolarCal Office on the means to achieve rapid development of solar energy in the State;

Develop Administration policies and plans for maximum feasible solar commercialization;

Make information available to the public about the use and benefits of solar energy; and

Promote cooperation in solar energy development in California with the federal government as well as public and private interests.

4. The Director of the SolarCal Office shall have the following responsibilities.

Assist the SolarCal Council in meeting its responsibilities;

Implement the State's solar energy policies and plans;

Advise the Governor and the Secretary of the Business and Transportation Agency on the concerns of the solar business community, particularly those of small businesses;

Develop and implement projects in solar commercialization;

Coordinate the solar energy activities of state agencies.

5. All State agencies, departments and commissions are hereby directed to assist and cooperate with the SolarCal Office and the SolarCal Council in carrying out their responsibilities.

In witness thereof, I have hereunto set my hand and caused the Great Seal of the State of California to be affixed this 3rd day of May, nineteen hundred and seventy eight.

EDMUND G. BROWN, JR.,
Governor of California.

Senator KENNEDY. Our next witness is the Secretary of Labor, Ray Marshall.

Secretary Marshall, we are delighted to have you here as we focus in this particular hearing on the issues of jobs in this country. We take note that your background and experiences for years prior to coming with the administration has been focused upon jobs in rural areas, and also, on minorities, and it has been a career that has been committed toward development of employment and job opportunities.

We appreciate your coming this morning, and after you have introduced your colleagues here, perhaps you should take 2 minutes, if you would, and just tell us—we know you have been working night and day on the coal strike and we won't let you get by without just making about a 2-minute comment—about what you think the possibilities are in terms of ratification of the new agreement.

STATEMENT OF HON. F. RAY MARSHALL, SECRETARY OF LABOR, ACCOMPANIED BY ARNOLD H. PACKER, ASSISTANT SECRETARY FOR POLICY, EVALUATION, AND RESEARCH; RON KUTSCHER, ASSISTANT COMMISSIONER, BUREAU OF LABOR STATISTICS; AND WILLIS NORDLUND, SPECIAL ASSISTANT TO THE UNDER SECRETARY OF LABOR

Secretary MARSHALL. Thank you, Mr. Chairman.

I have with me today, on my immediate left, Arnold Packer, who is the Assistant Secretary for Policy, Evaluation, and Research. Next to him is Ron Kutscher, Assistant Commissioner of the Bureau of Labor Statistics. On my right, Willis Nordlund, Special Assistant to the Under Secretary of Labor.

After three contracts, Mr. Chairman, you would think we would have more experience, and therefore, build a record to be able to predict the outcomes of these negotiations. [Laughter.]

But this is a situation in which each event seems to not necessarily have much relationship to the preceding one.

I am, however, hopeful as most observers of this most difficult process are, that we will get a settlement.

We think this outcome is the only way to resolve the conflict. That is one of the reasons we worked so hard for a negotiated settlement.

As you know, all other outcomes are only partial, incomplete solutions at best. The parties in the coal dispute must resolve their problems themselves. Our objective has been to relieve as much pressure on the public as possible while the parties negotiate their settlement.

I think we have achieved that outcome.

Now, the principal parties who are concerned with the dispute have considerable motivation to negotiate and resolve it themselves. They see, as we do, that all other outcomes are less desirable for them and for the country. Therefore, we are watching hopefully that the dispute will be resolved.

I think, however, that the total strike does emphasize the importance of labor matters, and labor-related matters, to our energy policy. Long before the strike actually took place, we had started preparing for a tripartite approach to the resolution of some of the basic underlying problems in the coal industry, particularly the eastern bituminous coal industry, because it is clear that this immediate conflict is dealing mainly with symptoms and not with the basic underlying causes.

That is the reason that the President has proposed to create a commission on the coal strike to try to deal with some of those long-range problems that simply manifest themselves as symptoms in this particular conflict.

We think that that is extremely important as a part of the policy that we are evolving, and that we had started long before the strike took place, because it was clear to all who knew the situation in that industry that we were going to have problems, and that there are the long-standing underlying forces that we would have to deal with, and that they cannot really be dealt with during the heat of negotiations.

That has been one of the basic problems that we face.

Senator KENNEDY. I won't let the opportunity go by without making a comment about the importance of the health issue in terms of the considerations of the contracts.

The polls used by some show that it is not a current issue or a matter of great importance to people. Others polls show that it is.

But it certainly seems to me as someone who tries to follow that issue that that is a matter of considerable importance and consequence in consideration of the negotiations.

Secretary MARSHALL. We think that it is obviously extremely important to coal miners. Safety and health also have been a major issue there. They are justifiably concerned about the safety and health of their work because it is a dangerous occupation. It is one of those areas where the tripartite approach seems to be a good one.

The Government has partial responsibility for mine safety and health. The Department of Labor assumed responsibility for mine safety and health on March 9.

We believe that there is a lot that the parties working together could do to improve mine safety and health. We do not believe that it is possible to have an adequate solution to that problem without cooperation among labor, management, and Government.

We also believe that some of the other problems that the industry has are directly related to the safety and health issue. This is an important problem and an important cause of the so-called wildcat strike, for example. If we can do something about the safety and health problem, then I think we would do something to reduce the incidence of wildcat strikes.

So that they are all very closely interrelated, and it is also clear we are not likely to be able to make at least eastern coal a very important part of our energy policy unless we deal with some of these long-term problems.

Senator KENNEDY. OK, Mr. Secretary.

We look forward to your testimony.

You understand, Mr. Secretary, we are interested in the type of analysis that goes into fashioning a National energy policy, as related to the issues of jobs and employment.

I think all of us are very mindful that this was a policy that was developed in a relatively short period of times—over 90 days time. There were a variety of agencies that had an input into it. It is one of the important factors as we as a country deal with the problems of continuing unemployment and look to the future in terms of employment possibilities.

What kind of analysis went into the fashioning of the energy program from the point of view of employment? It seems to me that we in the Congress have probably not given it the kind of attention we should have.

I am not sure that the administration gave it the kind of attention that it should have. We are very much interested in what is happening now; what did happen in the past; what kind of priority this will have in the future as you move along; and what ought to be done by the Congress in dealing with this issue?

We are very much interested in your comments. As the person who has the primary responsibility within the administration, we are interested in your views on this issue.

Secretary MARSHALL. Thank you, Mr. Chairman.

I agree that it is extremely important that we analyze the employment impact. I think it is also important to recognize that there are some areas of employment impact that are very difficult to analyze. We have thought a lot about them, but we need more information, particularly at the subnational employment levels. We have done more work on national impacts of energy policy than we have trying to determine the subnational—regional and sectoral—impacts. We believe in the Department of Labor that a sectoral approach is extremely important, and we are developing it.

We did, during the development of the energy policy, have expressed concerns, and provided what analysis we were able to provide at that time of the employment impact.

The prepared statement that I have provided for the record outlines a number of the basic energy employment relationships. It tries to show where we stand with respect to our understanding of the critical relationship between energy and employment and what remaining problems and issues we think should be addressed.

Specifically, we first discuss the near-term impact on employment of sharply higher energy prices, particularly as they place unexpected burdens on certain industries and regions.

Second, we examine the relationship between energy conservation and employment as a critical element in our national energy policy.

Finally, my prepared statement examines the long-term adjustment problem and the Department of Labor's role in this adjustment.

The most dramatic impact of energy on employment has come from the sharp increase in all energy prices as a result of the initial quadrupling of OPEC oil prices. The immediate effect of this action was substantially increased inflation which, in turn, was a major contributor to the massive recession of 1973–75.

This country and indeed the economies of other industrial and developing countries are still recovering from this impact which resulted in the highest rates of unemployment experienced by this country in the postwar period. While we have been fortunate to make substantial progress toward recovery, many countries are still experiencing substantial unemployment due to the failure of OPEC to recycle funds received for oil exports into employment generating productive activities.

In essence, the OPEC "tax" on energy has led to higher world savings rates which, combined with the fear of inflation, has led many countries to follow restrictive macroeconomic policies resulting in high and ever rising unemployment. Until these oil bill funds are effectively recycled, the world unemployment problem will plague us with such attendant problems as increased pressure on trade practices and monetary stability.

We emphasize this, Mr. Chairman, because it is clear that the United States will have great difficulty dealing with either the energy or the employment problem unless we consider it in the international context.

Domestically, this high employment impact has been addressed relatively effectively through the correct application of macroeconomic policies. Specifically, this administration has implemented its fiscal stimulus package and has proposed further tax cuts to compensate for the loss in spending power. The administration's longer term commitment to achieving full employment is evident in its strong support of the Humphrey-Hawkins legislation now before the Congress.

The macroeconomic effects of higher energy prices on employment are clearly the most significant in terms of magnitude. However, the sharp increase in energy prices has also brought disruptions within particular industries and regions. For example, we have seen severe dislocations that adversely impact specific areas of our country as we rapidly expand the production of coal, gas, oil, uranium, or virtually any other large energy resource. The "boomtown" syndrome in Western coal development is indicative of this problem. The problems, of course, transcend just labor market dislocations and include the availability of housing, roads, schools, parks, hospitals, et cetera, public attitudes toward new residents, the ability of local communities to improve tax systems, adequate information for rational decision-making, and many others.

THE RELATIONSHIP BETWEEN ENERGY CONSERVATION AND EMPLOYMENT

One key near-term method of adjusting to higher energy prices is conservation of our scarce energy resources. Since conservation is such a key element, and since its impact on employment is not well understood, I would like to turn to this critical relationship.

Historically, there has been a close relationship between this country's production, energy consumption, and employment. Some believe that these variables are inextricably intertwined and that a reduction in energy must inevitably lead either to cutbacks in production and employment or substituting "cheap" labor to make up for this loss in energy. For example, it is frequently believed that reducing energy usage by a factory would force the managers to send part of their work force home or perform jobs that were done by machines and energy by hand. These relationships have grown out of the belief that conservation is synonymous with curtailment.

I want to emphatically distinguish between these two actions and their opposition impact on employment. Energy curtailment such as experienced during the OPEC oil embargo clearly resulted in employment cutbacks as producers were unable to adjust their production process to such unplanned, immediate reductions in energy supply. However, conservation is the planned, more efficient use of our scarce energy resources. Thus, while conservation results in reduced energy use, its impact will be job creating.

Conservation programs are likely to result in net job creation for two reasons. First, to the extent that conservation entails insulating, weatherizing, maintaining, upgrading, or in some other manner improving the efficiency of a building or machine, jobs will be created in these activities. Second—and even more important—is the indirect impact resulting from the fact that energy production and distribution—except for coal—are very capital intensive, as can be seen from the table in my prepared statement.

To the extent that consumers spend less income on energy resources and more income on more labor-intensive alternative goods and services, employment will increase. We are just beginning to gather data on this relationship, but I am convinced that it will in the long run have a substantial impact on employment.

In the coming years, aided by the knowledge that energy conservation measures enhance job opportunities, we expect individuals and corporations to continue to seek more efficient ways of utilizing energy. We already see numerous examples of new energy conserving technologies in such areas as better insulated buildings, more efficient electrical machinery, and energy-saving refrigerators.

I want to assure this subcommittee that I fully support the conservation component of the proposed national energy policy. I believe that properly implemented it can assist in achieving our employment goals. It makes good sense in terms of improving our efficient use of energy, of extending the supply of nonrenewable energy resources, of environmental impact, and of employment.

THE DEPARTMENT'S ROLE IN CONSERVATION

During the past 2 years the Department of Labor has stepped up its efforts to create conservation-related employment. Comprehensive Employment and Training Act (CETA) prime sponsors participate with agencies in the Government in weatherization activities particularly for the homes of low income and elderly persons. These projects include installing insulation, storm windows, plastic wall coverings, weather-stripping, wrapping pipes, caulking, minor roof repairs, and repairing holes and cracks in walls.

Other CETA participants are employed in "energy audits" in which houses are checked to determine the extent of avoidable heat loss. Still others are involved in education/demonstration efforts to inform others about substantial fuel savings available through proper weatherization and how to go about securing these services. We estimate that CETA sponsors have joined forces with the Community Services Administration (CSA), and the Department of Energy (DOE) to weatherize over 100,000 homes in the last 3 years. In terms of jobs, we estimate that about 16,000 weatherization jobs have been created. We plan to continue this program as evidenced in a memorandum of understanding between the Department of Labor, the Department of Energy, and the CSA which commits our agencies to continuing joint efforts in the weatherization area.

The emphasis on conservation is extremely important, but there are limits to such actions in terms of known technology. Energy demand continued to rise. Conservation can accommodate part of this increase, but barring some dramatic technological breakthrough we must work to expand energy production as well.

This task involves both increasing domestic production in established energy sources and developing alternative sources of energy. While I am not in a position to endorse any mix of potential energy options, I am sure of two things: First, alternatives to nonrenewable fossil fuels must be developed; second, the employment consequences of different energy mixes will be substantial and we must plan for these impacts on our work force.

The Department of Labor through its employment and training programs is engaged in a variety of activities to assist industries and individuals in adjusting to changing employment patterns in the industry. Literally, thousands of workers have received skill training through local and national CETA programs and were placed in energy-related industries. I would like to emphasize that this has been one of the main objectives we have had with the CETA program, to try to achieve as many national objectives simultaneously as possible. The weatherization program, for example, indicates that we do something to help with our energy problem, do something to help the low-income people, and at the same time provide jobs. Therefore, this multiple objective we believe, wherever we can achieve multiple objectives in these programs, we should strive to do it. Therefore, we concentrated attention on the energy area for that reason and have, therefore, trained a large number of people for our energy-related jobs.

Senator KENNEDY. The real complaint, Mr. Secretary, is that you are planning 100,000 homes in 3 years. We have 14 million homes that need weatherizing. Canada is planning to do all of their homes in 8

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years. CETA is a worthwhile program; it has been successful. It is successful up our way, but you know it is a pretty cautious step, I would think.

Secretary MARSHALL. I think the reason it would appear less cautious than it might is that all the weatherization done in the country will not be done through our program. We have been trying to concentrate on the homes of low-income people. The CETA system, you know, is a decentralized system and therefore what gets done in the local areas depends largely on what the local prime sponsors elect to do. What we have done at the national level is simply assist them.

Senator KENNEDY. The fact is the tax incentives provided are focused in terms of middle- and upper-income people. The winds of weatherization programs you are talking about are going to include low-income groups.

Secretary MARSHALL. That is right.

Senator KENNEDY. And I think it is a very cautious step. We are for it and I am strongly supportive of it. But, the spinoff in terms of employment would be extremely modest.

Secretary MARSHALL. What we expect to happen is that as the overall level of unemployment goes down and you get more and more of the unemployed back to work in the private sector, the importance of these kinds of programs in the total CETA effort are likely to rise. But again, the nature of the CETA system makes it very difficult for us to force activity into a particular area. We could, however, do that with our national program. We are trying to develop some programs that are energy-related that might be national rather than going entirely through the CETA system. One is to try to do some things to improve railroad beds. This has significant energy implications because I am told by the experts that one rail line has the transportation equivalent of nine superhighways. That kind of activity, done at the national level, could do a lot to improve energy utilization.

The Department is undertaking two employment initiatives that I feel hold considerable promise for improved safety and productivity in the mining industry. I feel these are particularly important in light of the Department's new responsibilities for mine health and safety. One initiative is the development of a miner's apprenticeship program. As you know, most miners acquire their skills through various on-the-job training activities. The quality of these programs is widely variable. Therefore, we have developed a systematic, modular training program for miners that will provide a standardized curriculum. We are convinced that this approach will insure an adequate supply of well-trained miners for expansion in the mining industries.

A related initiative involves the training of migrant and seasonal farmworkers for coal-mining jobs. A consortium consisting of Wabash College in southern Illinois, the United Mine Workers of America, and the coal operators is sponsoring this Department of Labor-funded project. They have joined together to insure that there are guaranteed jobs for the trainees—including about 40 percent female enrollees—at a starting salary of $15,000 per year. About 400 trainees are expected to be involved in this project.

The Department of Labor is also becoming involved in the emerging energy industries. For example, a growing number of CETA sponsors have begun programs in the solar industry and other alternative energy technologies. In California we are training solar water heating technicians with the help of Sonoma State College's School of Environmental Studies. In San Jose, former migrant farm workers are being trained as solar technicians as part of a broader maintenance course. In Nevada, CETA and private industry have combined to train directional drilling technicians.

As a result of the administration's solar technology, we have proposed to the Department of Energy and the Community Services Administration that they join with us in a pilot project in solar utilization and employment. The program would operate through the CETA system on guidelines more or less similar to the weatherization program. The project would seek to develop low cost home applications for solar energy, train CETA enrollees for solar-related jobs, and overcome structural barriers to efficient use of solar energy.

To the extent the project shows solar energy to be practical, we could explore solar retrofitting programs for low income and elderly homeowners. Such programs could be a positive impetus to the solar energy industry by enlarging the total demand for solar devices and by contributing to the supply of skilled labor.

In terms of employment impact in the long run, the most crucial factor is that the country move as rapidly as possible from our dependence on foreign oil to the use of the lowest cost, reliable domestic energy sources consistent with safety in production and concern for those individuals facing employment adjustments. Long-run energy supply policy, however, should not be based primarily on the number of people alternative energy industries would employ. However, our policies should reflect great concern for those required to make adjustments. Indeed, the policy of "gradualism" in price decontrol explicitly recognizes the potentially disruptive effects of instant decontrol on employment.

As we develop the long-run strategy, the direction of adjustments and the new patterns of energy demand and production should become more apparent. At this point, the Department of Labor can play a major supportive role by assisting the labor market adjustment process. We can examine in more detail areas in which there may be skill shortages in particular occupations. We can determine which sectors will enjoy increased demand for their output—and hence increased employment—as a result of anticipated conservation actions. We can intensively examine which industries will experience employment declines and what actions can be taken to assist displaced workers through retraining, upgrading, and relocation. We will attempt to determine whether these changes will engender regional shifts in employment and production.

Anticipating these questions, the Department initiated a research program in the area of energy and employment.

Our basic research element was a broad base review of energy models to see which ones were best adapted to answering specific energy-employment questions. We anticipate further work in this area to sharpen our insight an enable us to better plan our programs to assist in the adjustment effort. Research has also been done on the geographic employment effects of changing energy prices. Armed with such research into the energy-employment relationship, the Department can better harness its existing programs such as the labor market information system, the occupational analysis program and the Employment Service Job Matching Service to facilitate the process.

Such research will also help us develop new initiatives to assist in improving the smooth functioning of labor markets. One initiative is already at an advanced stage of development. The Department has cooperated with the Department of Energy and the Tennessee Valley Authority on the design and implementation of the construction manpower demand system (CMDS). This system is producing data on occupational and geographical specific employment needs in the powerplant construction industry over the next 5 years.

In addition to our internal analytical efforts, interdepartmental coordination will be pursued and strengthened. I will encourage joint programs with other agencies such as the Departments of Energy; Commerce; Housing and Urban Development; Health, Education, and Welfare; and Transportation in the areas of energy-related employment programs.

It is my firm belief that our energy policy must be consistent with our employment policy. As the country adjusts to dramatically higher energy prices, we must examine our own energy sources and put them to the most efficient use.

To assist in the adjustment process, both in the near-term and long-term, the Department of Labor can smooth the transition in specific labor markets facing technological or structural shifts. Given the proper balance of monetary and fiscal policy and structural programs, we can enjoy the benefits of safe, reliable, and lowest cost energy that is available in a full-employment economy. In working toward these goals, broad coordination and cooperation will be required.

Mr. Chairman, I would be happy to try to answer your questions.

[The prepared statement of Secretary Marshall follows:]

Prepared Statement of Hon. F. Ray Marshall

Mr. Chairman and members of the subcommittee, it is a pleasure to be here today to give you my view on the effects of energy policy on employment and to discuss what measures can be taken to provide more jobs as we create and conserve energy.

During the last several weeks the coal situation has dramatically brought to light the importance of labor resources in the National Energy Plan (NEP) outlined by the President in April of last year. I believe that the dialogue on national energy issues, for the most part, has omitted serious consideration of the potential employment impact of the proposed NEP. In determining the best strategy we must have a clear understanding of the energy-employment relationships.

The impacts on potential employment are significant since, particularly in the long run, different energy strategies may yield significantly different employment consequences. For this reason, it is important to consider the employment consequences of a particular energy strategy before committing ourselves to that strategy.

Today, I plan to outline a number of basic energy-employment relationships, where we stand with respect to fully understanding this critical relationship, and what remaining problems and issues should be addressed. Specifically, I would like first to discuss the near-term impact on employment of sharply higher energy prices, particularly as they placed unexpected burdens on certain industries and regions. Second, I will examine the relationship between energy conservation and employment as a critical element of our NEP in adjusting to higher energy prices in the near-term. Finally, I will examine the longer term adjustment problem and the Department's role in this adjustment.

THE NEAR-TERM IMPACT OF HIGHER PRICES ON ENERGY-EMPLOYMENT

The most dramatic impact of energy on employment has come from the sharp increase in all energy prices as a result of the initial quadrupling of OPEC oil prices. The immediate effect of this action was substantially increased inflation which, in turn, was a major contributor to the massive recession of 1973–75. This country and indeed the economies of other industrial and developing countries are still recovering from this impact which resulted in the highest rates of unemployment experienced by this country in the postwar period. While we have been fortunate to make substantial progress towards recovery, many countries are still experiencing substantial unemployment due to the failure of OPEC to recycle funds received for oil exports into employment generating productive activities. In essence, the OPEC "tax" on energy has led to higher world savings rates which, combined with the fear of inflation, has led many countries to follow restrictive macroeconomic policies resulting in high and ever rising unemployment. Until these oil bill funds are effectively recycled, this world unemployment problem will plague us with such attendant problems as increased pressure on trade practices and monetary stability.

Domestically, this employment impact has been addressed relatively effectively through the correct application of macroeconomic policies. Specifically, this Administration has implemented its fiscal stimulus package and has proposed further tax cuts to compensate for the loss in spending power. The administration's longer term commitment to achieving full employment is evident in its strong support of the Humphrey-Hawkins legislation now before the Congress.

The macroeconomic effects of higher energy prices on empolyment are clearly the most significant in terms of magnitude. However, the sharp increase in energy prices has also brought disruptions within particular industries and regions. For example, we have seen severe dislocations that adversely impact specific areas of our country as we rapidly expand the production of coal, gas, oil, uranium, or virtually any other large energy resource. The "boomtown" syndrome in western coal development is indicative of this problem. The problems, of course, transcend just labor market disclocations and include the availability of housing, roads, schools, parks, hospitals, etc., public attitudes toward new residents, the ability of local communities to improve tax systems, adequate information for rational decisionmaking, an many others.

THE RELATIONSHIP BETWEEN ENERGY CONSERVATION AND EMPLOYMENT

One key near-term method of adjusting to higher energy prices is conservation of our scarce energy resources. Since conservation is such a key element, and since its impact on employment is not well understood, I would like to turn to this critical relationship.

Historically, there has been a close relationship between this country's production, energy consumption, and employment. Some believe that these variables are inextricably intertwined and that a reduction in energy must inevitably lead either to cutbacks in production and employment or substituting "cheap" labor to make up for this loss in energy. For example, it is frequently believed that reducing energy usage by a factory would force the managers to send part of their workforce home or perform jobs that were done by machines and energy by hand. These relationships have grown out of the belief that conservation is synonymous with curtailment.

I want to emphatically distinguish between these two actions and their opposite impact on employment. Energy curtailment such as experienced during the OPEC oil embargo clearly resulted in employment cutbacks as producers were unable to adjust their production process to such unplanned, immediate reductions in energy supply. However, conservation is the planned, more efficient use of our scarce energy resources. Thus, while conservation results in reduced energy use, its impact will be job creating.

Conservation programs are likely to result in net job creation for two reasons. First, to the extent that conservation entails insulating, weatherizing, maintaining, upgrading, or in some other manner improving the efficiency of a building or machine, jobs will be created in these activities. Second—and even more important—is the indirect impact resulting from the fact that energy production and distribution (except for coal) are very capital intensive (as can be seen in the following table).

Industry:	Output per worker hour (1972) dollars
Petroleum refining	76.0
Gas utilities	56.7
Pipeline transmission	49.3
Electric utilities	32.0
Crude petroleum, natural gas	26.3
Oil, gas-drilling, exploration	17.5
Median value for all industries	17.3
Coal mining	13.9

Source: BLS, industry manpower factors.

To the extent that consumers spend less income on energy resources and more income on more labor intensive alternative goods and services, employment will increase. We are just beginning to gather data on this relationship, but I am convinced that it will in the long run have a substantial impact on employment.

In the coming years, aided by the knowledge that energy conservation measures enhance job opportunities, we expect individuals and corporations to continue to seek more efficient ways of utilizing energy. We already see numerous examples of new energy conserving technologies in such areas as better insulated buildings, more efficient electrical machinery, and energy saving refrigerators.

I want to assure this subcommittee that I fully support the conservation component of the proposed NEP. I believe that properly implemented it can assist in achieving our employment goals. It makes good sense in terms of improving our efficient use of energy, of extending the supply of nonrenewable energy resources, of environment impact, and of employment.

THE DEPARTMENT'S ROLE IN CONSERVATION

During the past two years the Department of Labor has stepped up its efforts to create conservation related employment. Comprehensive Employment and Training Act (CETA) prime sponsors participate with agencies in weatherization activities particularly for the homes of low income and elderly persons. These projects include installing insulation, storm windows, plastic wall coverings, weather stripping, wrapping pipes, caulking, minor roof repairs, and repairing holes and cracks in walls.

Other CETA participants are employed in "energy audits" in which houses are checked to determine the extent of avoidable heat loss. Still others are involved in education/demonstration efforts to inform others about substantial fuel savings available through proper weatherization and how to go about securing these services. We estimate that CETA sponsors have joined forces with the Community Services Administration (CSA), and the Department of Energy (DOE) to weatherize over 100,000 homes in the last three years. In terms of jobs, we estimate that about 16,000 weatherization jobs have been created. We plan to continue this program as evidenced in a memorandum of understanding between DOL, DOE and CSA which commits our agencies to continuing joint efforts in the weatherization area.

ASSISTING IN EMPLOYMENT ADJUSTMENTS IN THE ENERGY SECTOR

The emphasis on conservation is extremely important, but there are limits to such actions in terms of known technology. Energy demand continued to rise. Conservation can accommodate part of this increase, but barring some dramatic technological breakthrough we must work to expand energy production as well.

This task involves both increasing domestic production in established energy sources and developing alternative sources of energy. While I am not in a position to endorse any mix of potential energy options, I am sure of two things: first, alternatives to nonrenewable fossil fuels must be developed; second, the employment consequences of different energy mixes will be substantial and we must plan for these impacts on our workforce.

The Department of Labor through its employment and training programs is engaged in a variety of activities to assist industries and individuals in adjusting to changing employment patterns in the industry. Literally, thousands of workers have received skill training through local and national CETA programs and were placed in energy-related industries. For example, welders were trained for the Alaska pipeline, offshore drill rig construction and maintenance workers for the oil industry, mine maintenance mechanics for the coal industry, operating engineers for oil and gas companies, and craftworkers for shipyards building oil and liquified natural gas tankers, coal barges and other energy related transportation equipment.

The Department is undertaking two employment initiatives that I feel hold considerable promise for improved safety and productivity in the mining industry. I feel these are particularly important in light of the Department's new responsibilities in mine health and safety. One initiative is the development of a miner's apprenticeship program. As you know, most miners acquire their skills through various on-the-job training activities. The quality of these programs is widely variable. Therefore, we have developed a systematic, modular training program for miners that will provide a standardized curriculum. We are convinced that this approach will insure an adequate supply of well-trained miners for expansion in the mining industries. A related initiative involves the training of migrant and seasonal farmworkers for coal mining jobs. A consortium consisting of Wabash College in southern Illinois, the United Mine Workers Association, and the coal operators in sponsoring this Department of Labor funded project. They have joined together to ensure that there are guaranteed jobs for the trainees (including about 40 percent female enrollees) at a starting salary of $15,000 per year. About 400 trainees are expected to be involved in this project.

The Department of Labor is also becoming involved in the emerging energy industries. For example, a growing number of CETA sponsors have begun programs in the solar industry and other alternative energy technologies. In California we are training solar water heating technicians with the help of Sonoma State College's School of Environmental Studies. In San Jose, former migrant farm workers are being trained as solar technicians as part of a broader maintenance course. In Nevada, CETA and private industry have combined to train directional drilling technicians.

As a result of the administration's solar technology, we have proposed to the Department of Energy and the Community Services Administration that they join with us in a pilot project in solar utilization and employment. The program would operate through the CETA system on guidelines more or less similar to the weatherization program. The project would seek to develop low cost home applications for solar energy, train CETA enrollers for solar related jobs, and overcome structural barriers to efficient use of solar energy.

To the extent the project shows solar energy to be practical, we could explore solar retrofitting programs for low income and elderly home owners. Such programs could be a positive impetus to the solar energy industry by enlarging the total demand for solar devices and by contributing to the supply of skilled labor.

LONG-TERM ADJUSTMENTS

In terms of employment impact in the long run, the most crucial factor is that the country move as rapidly as possible from our dependence on foregin oil to the use of the lowest cost, reliable domestic energy sources consistent with safety in production and concern for those individuals facing employment adjustments. Long-run energy supply policy, however, should not be based primarily on the number of people alternative energy industries would employ. However, our policies should reflect great concern for those required to make adjustments. Indeed the policy of "gradualism" in price decontrol explicitly recognizes the potentially disruptive effects of instant decontrol on employment.

As we develop the long run strategy, the direction of adjustments and the new patterns of energy demand and production should become more apparent. At this point, the Department of Labor can play a major supportive role by assisting the labor market adjustment process. We can examine in more detail areas in which there may be skill shortages in particular occupations. We can determine which sectors will enjoy increased demand for their output (and hence included employment) as a result of anticipated conservation actions. We can intensively examine which industries will experience employment declines and what actions can be taken to assist displaced workers through retraining, upgrading, and relocation. We will attempt to determine whether these changes will engender regional shifts in employment and production.

Anticipating these questions, the Department initiated a research program in the area of energy and employment. Our basic research element was a broad base review of energy models to see which ones were best adapted to answering specific energy-employment questions. We anticipate further work in this area to sharpen our insight and enable us to better plan our programs to assist in this adjustment effort. Research has also been done on the geographic employment effects of changing energy prices. Armed with such research into the energy-employment relationship, the Department can better harness its existing programs such as the Labor Market Information System, the Occupational Analysis Program and the Employment Service Job matching service to facilitate the process.

Such research will also help us develop new initiatives to assist in improving the smooth functioning of labor markets. One initiative is already at an advanced stage of development. The Department has cooperated with the Department of Energy and Tennessee Valley Authority on the design and implementation of the Construction Manpower Demand System (CMDS). This system is producing data on occupational and geographical specific employment needs in the power plant construction industry over the next five years.

In addition to our internal analytical efforts, interdepartmental coordination will be pursued and strengthened. I will encourage joint programs with other agencies such as the Departments of Energy, Commerce, Housing and Urban Development, Health, Education and Welfare, and Transportation in the areas of energy related employment programs.

CONCLUSION

It is my firm belief that our energy policy must be consistent with our employment policy. As the country adjusts to darmatically higher energy prices, we must examine our own energy sources and put them to the most efficient use.

To assist in the adjustment process, both in the near-term and long-term, the Department of Labor can smooth the transition in specific labor markets facing technological or structural shifts. Given the proper balance of monetary and fiscal policy and structural programs, we can enjoy the beenfits of safe, reliable, and lowest cost energy that is available in a full employment economy. In working towards these goals, broad coordinaton and cooperation will be required.

Senator KENNEDY. Thank you very much.

I think these concluding statements give us some additional hope when implemented in terms of our energy program and its relationship with employment. We are going to hear from some of those who will follow you, Mr. Secretary; some of the leaders of some of our unions who have been the most concerned about employment, who would think that we ought to develop an employment impact statement in terms of energy and energy alternative systems.

We have environmental impact statements which are required in terms of various governmental activities that will impact the environment. We are at a point where over the period of the next few years we are going to make major watershed decisions at the national policy level, in the Congress and in the executive branch in moving this country to try to meet the challenge of our energy crisis.

First of all, do you support that concept and do we have the kind of data which is necessary and essential to do it? If we do, are you going to do it? If you don't what are we going to do about it?

Secretary MARSHALL. I support the concept. I think the answer to the second part is that we do not, but we should develop it. We have particularly inadequate information on the subnational level. We can do things that predict what will happen in the whole country but because of the possibilities of substitution and relocation it is very difficult to pinpoint where that activity is likely to take place. If you are going to plan for particular labor markets, it becomes very important to do that.

Now, as I mentioned in my prepared statement, we have underway several efforts to try to get better data and to make a better determination. I don't think that we need necessarily to achieve perfection in this area. My view has always been that, first, you will never get perfection in any kind of economic analysis because you never get completely adequate data. Therefore, you have to make the very best use of the data that you already have. I think we should start with that immediately, looking at it, and analyzing it, and getting the best fix that we can on the employment implications of different kinds of energy development.

Senator KENNEDY. We had some very interesting testimony yesterday, from Mr. Benson, for example, that compared the employment impact of the move toward nuclear power on Long Island, versus solar power, pointing out that there was close to three times as many jobs created by the use of solar energy in this area. We have also heard impressive testimony this morning about the practical impact on employment in the State of California by moving more dramatically in the area of solar energy. It just seems to me that if you say: "We have problems in doing the kind of careful evaluation with the greatest degree of precision," then I think we ought to be able to, in reviewing that testimony and the practical experience that is taking place in some area, be able to form some initial impressions on this that ought to have an impact on decisions by the administration in the development of alternative energy systems.

Secretary MARSHALL. Well, I think we should be able to examine those and determine the employment impacts.

Senator KENNEDY. How are we going to do that? All of us, I think, are mindful that in the announcement of the energy program last year that there was very, very, little reference in terms of the specific employment impacts. There were general comments with respect to macroeconomic implications, but very little in this type of analysis of what we can expect now and in the future?

Secretary MARSHALL. In the Department of Labor we are very much concerned about the employment impact, of course, and have these efforts underway that I mentioned in my study. In addition, we also collect studies that other people have done, analyze those and try to draw whatever inferences we can from the employment impacts they have discovered.

I think that it makes sense in the long run to develop solar energy. It is a much less labor-intensive source of energy, but it would have positive employment effects.

Senator KENNEDY. Well, do you have or does your Department now have the ability to project labor demand for each energy system presently in operation or future renewable energy technologies or various conservation strategies?

Secretary MARSHALL. We don't have the ability to do it with precision. Therefore, I would say that it would be very difficult for us to rely on what we are able to do at this point expect in one area where we have made the greatest advances and that is in the construction industry. Construction of powerplant facilities and the demand for labor in that industry has been developed significantly by this interdepartmental cooperative effort.

Senator KENNEDY. Can we expect in any energy proposal that would be sent to the Congress an employment impact comment or statement in the future?

Secretary MARSHALL. Well, I think that you can expect that we will do the best that we can with that and indicate the limitations of whatever statement we do make.

Senator KENNEDY. Obviously we have existing directions that we will be facing over the period of these next few weeks and months. Initiatives by the administration, for example, expansion of the investment credit program, can or may, in terms of its tax implications, further imbalance the fashioning and shaping and development of alternative energy systems, but has very marginal impact in terms of employment. As one who has had serious reservations in any event about that particular program, we see where about 95 percent of the investment credit has gone to the major 500 corporations, and the increase over the period of the last 9 years has been about 72,000 jobs, a 0.15-percent increase in employment.

Again, the significant increase in the expansion has been outside of the top 1,000 corporations.

The thing we are concerned about, both with the recommendations that the administration is making in terms of tax policy and in terms of energy policy, is that we are just not having the kind of hard, realistic analysis about the specific employment impact. I think it is fair enough to say that we have heard before this committee many hours of testimony from the Council of Economic Advisers about the macroeconomics but not the precise analysis of the impact of various alternative energy systems and conservation programs; and what it will be over any reasonable period of time of expectation. It seems to me that we are entitled to that type of analysis. I believe you believe the same thing. Maybe some of these ought to be directed toward Mr. Schlesinger rather than you. But, I want to make sure that we have a strong record in terms of this part of our hearing.

Secretary MARSHALL. I do agree that we ought to do that.

Senator KENNEDY. Have you been asked by the Department of Energy for this type of analysis?

Secretary MARSHALL. During the time that we were putting the energy program together we gave our suggestions about the employment impacts and this was one of the things Mr. Packer and Mr. Nordlund tried to concentrate heavily on.

Senator KENNEDY. The perfect energy system or the macroeconomics?

Secretary MARSHALL. Well, we would try and look at both. Maybe Mr. Packer would enlarge on what he has been doing and what the Department of Labor has been doing, specifically with respect to that.

Senator KENNEDY. OK.

Mr. PACKER. OK, the problem is, of course, extremely complicated. Frequently, more highly labor-intensive energy sources will be more expensive.

We have a concern over inflation and the balance of payments——

Senator KENNEDY. But shouldn't we, in the Congress, be able to make some choice about that? When you send up your proposal shouldn't we be able to make some kind of judgment about whether it is going to be jobs or inflation? We are entitled to that.

Secretary MARSHALL. The price-of-employment factor.

Mr. PACKER. That is right. The CBO did make an estimate of the price-employment impact and so did we. We worked with the Department of Energy to see what that balance would be.

Senator KENNEDY. But not perfect alternative energy systems, was it?

Mr. PACKER. We did take a look at, for example, the program that was proposed but there was no attempt that I am aware of to see what would happen, for example, if you really drove the price of oil up and tried to subsidize other sources of energy. But that was because there was a general feeling—and I think analysis would bear that out—that any of those alternative approaches which were higher cost would ultimately lead to less employment than one that was balanced.

Senator KENNEDY. Have you give us that kind of information? Is that your own personal view or is that based upon data that has been developed and submitted to the Congress?

Mr. PACKER. Well——

Senator KENNEDY. I mean, for example, in terms of the high cost of energy, did you analyze the present cost in terms of tax expenditures in the area of the petroleum industry or in terms of the utilities, and compare that to what it would be for solar? I don't ever remember any kind of such analysis as that being asked for; and perhaps the job implications are going to be in this as well.

Mr. PACKER. That is correct.

Senator KENNEDY. Well, the important thing, I think, is to try and see if you can't get some agreement about where we are going to go now and in the future. I don't think the Congress really demanded such an analysis of you people. We have not really demanded it, for example, in the competitive impact of the national energy program. Nothing was done effectively on that. I don't think it was really done for the precise job aspects of it, and I think what we are trying to do is to see how we are going to deal with it now based upon what our energy policy was or is at the present time and what we will do in the future.

Mr. PACKER. I think we have looked at broad alternatives in that direction. For example, high conservation programs that emphasize conservation; ones that emphasized more intensive capital utilization. In the broad shifts, one does not find very dramatic changes in employment.

Senator KENNEDY. You are reaching conclusions now? I would like to have you submit that kind of data that would show that. It is obvious from your own response you don't believe in it because you are reaching your own kinds of conclusions and we have heard very detailed analyses of various energy systems related to particular areas with their exact job implications. We are trying to find out whether there is a similar kind of an analysis that can be done in a broad stroke with respect to national alternative energy policies whether it is in the alternative energy or in the field of conservation.

I think your response would indicate that you don't believe that there is great swings on it. We have heard very important testimony that there is a very important swing on it. Now, I mean that might not be right and we are not analyzing it in that respect, but it was impressive testimony. And we are asking whether we can expect to get analysis on the alternative energy systems from an employment point of view. I think we are entitled to that.

Mr. PACKER. I really was referring back to the studies that were made since 1974, in the previous administration, for example, they had done some work on alternative broad policies. Every one of those that I have found indicated that the pace of change, the overall macro effects, swamped the differences. I think I have seen some of the sources of studies you referred to, Mr. Chairman, and they never get complete. For example, surely it would be more employment-generating to put big solar apparatus on homes, but one has to wonder, unless the Government is going to subsidize those, what that will mean to the selling of homes themselves if homes are more expensive. And as you trace through those things, the different kinds of studies I have seen over a period of 4 years since 1974, always show that the assumptions are such that you don't get the kinds of changes that you might think.

The most important thing is that the price of energy has been the most important characteristic of the employment effects of alternative policies. The price of energy has been the major determinant of the employment effects in the studies that I have been familiar with. We can certainly provide to the staff the substantial studies.

Senator KENNEDY. Have you done analysis of what the conservation would be in terms of jobs versus new production for the same amount of barrels of oil?

Mr. PACKER. Yes; we know that up to a point and I think we are close to it, conservation is more employment-intensive.

Senator KENNEDY. Well, have you got that type of analysis? Have you done that type of analysis?

Mr. PACKER. We can find that for you. I don't have it at my fingertips. Some of it may be a couple of years old.

Senator KENNEDY. Is it important for both the administration and the Congress who are examining national energy policy, is it important to have that type of analysis?

Mr. PACKER. Yes; it is.

Senator KENNEDY. It has to come from the Department of Energy, I suppose, but it has to be shaped in terms of the Department of Labor. Now, what I would like to know is whether you think it is important to do.

Mr. PACKER. Yes; it is important. I think much of it has been done. It certainly could be improved extensively, but I think you will get the broad outlines of answers to the questions you are asking. We will get back to the Department of Energy and provide your staff with the analyses that have been done and perhaps talk to them about further analysis you think is appropriate.

Senator KENNEDY. Well, it isn't just what we think is appropriate. It is, hopefully, what you think is important, too, in the Department of Labor from an employment point of view.

Mr. PACKER. Yes.

Senator KENNEDY. If you don't think it is terribly important you are just responding to us. I think that is somewhat indicative, which is a disappointing attitude, very frankly. It seems to me that we would expect that from the Department in terms of fashioning and shaping the policy. Just like we expect from the Justice Department what the competitive impact from an antitrust point of view will be on an energy program. And you are the ones that have got both the information and I think the responsibility to have that. Now, whether Schlesinger is going to ask you to ignore it, is one thing; but if you don't believe that it is important and you are going to give us warmed-over analysis of old studies, then save yourself the time and don't bother.

Mr. PACKER. My own personal and thought-through position after working on this problem for 4 to 5 years, is that we have worked closely. I have worked personally, on the energy-employment situation and I am fairly well convinced that we are close to the appropriate policy in employment terms. We have done studies over a period of time and we have looked at the old studies. The new programs are not so substantially different from what has been analyzed before to make me change my mind. But you are right about our responsibility. We would be very active and very forthright if we thought that the energy policies were being done without full consideration of the employment aspects of it.

Senator KENNEDY. What is your analysis, for example, in the expanded investment credit concerning the major energy producing companies? What will that mean in terms of employment?

Mr. PACKER. You are talking about the overall investment tax credit?

Senator KENNEDY. Yes; the one that will be sent up by the administration, the expansion of it.

Mr. PACKER. As you know, there are——

Senator KENNEDY. No; what is your analysis?

Mr. PACKER. I have never found the investment tax credit in my analyses to be as potent as some other people have. But there is a wide difference. The evidence is certainly mixed enough that I would think anybody who was 100-percent certain about the employment impact would be mistaken. Again, I don't think we have oversold those employment impacts compared to the other alternatives. We generally know that a tax reduction is going to work out to about 3 to 1, personal to corporate. If you are going to give a corporate tax cut, investment tax credits are, in my judgment, the most employment-generating tax cuts you can have in the corporate field. They are the most effective. And given the usual practice of a 3 to 1 ratio with personal to corporate income tax cuts, I think the investment tax cut is appropriate from an employment point of view.

Senator KENNEDY. Mr. Secretary, my time is up on this. I don't know whether I have been able to make myself clear.

Secretary MARSHALL. Oh, I think it is clear.

Senator KENNEDY. I hope you can understand what we are driving at in terms of how we would like to work with the Department.

Secretary MARSHALL. Let me say, Senator, I think that what you are trying to say is clear; it is to me. And I think that we share your concern and that is one of the reasons we have initiated these studies to find as much as we can about the employment impact. But what we do in going about trying to get answers to questions is first see what other people have done; determine where the gaps are; and, then determines what kinds of things we need to do to be able to fill those gaps. That is the reason we have an ongoing research program, to attempt to do that.

The second point is that we agree very completely that we should interact with the Department of Energy and we have been doing so. We have cooperated very closely with them both on our research programs and in particular areas. We have, for example, an interdepartmental committee on the coal industry to look at those problems. In addition we are focusing on energy and employment problems generally.

So, we have looked at all those. As I said at the outset, however, we are not satisfied with the answers that we get.

Now with respect to the investment tax credit, we clearly don't believe that we can rely very heavily on that for our overall employment policy and that is the reason that we give major emphasis to the direct or selective employment programs. We think that if you refine the analysis further you will find that if you are looking at tax cuts, then the investment tax credit becomes effective relative to other things that you could do. If you look at the various ways you could reduce unemployment it becomes a much more expensive way to reduce unemployment than the direct programs we rely most heavily upon.

Senator KENNEDY. The chart you see is the analysis done for Long Island of nuclear plant employment compared to conservation and solar energy use from the jobs point of view. The final conclusion is there is a 270-percent difference for the same kind of capital investment. That was done in a narrow area but on two major kinds of energy systems.

As I say, it is very detailed and there is a lot of information provided in there. But it is the kind of analysis that in a more general kind of way I would hope as we are fashioning an energy policy that we would be able to get for alternative sources of energy, so that we know. As the Congress makes decisions on various alternative systems, as well as in the areas of conservation, what the employment impacts are going to be.

I think, Senator McGovern, you are next.

Secretary MARSHALL. I think this job analysis is a good beginning but there are a lot of other things we would like to know, like what kinds of jobs are being created and how transferable they are.

Senator KENNEDY. That is right and that is important. It's important whether the jobs are created in the community and whether those are unskilled jobs—whether they are skilled jobs. That is the kind of thing that we ought to have so that we know. Maybe we can make some judgments that we are prepared to go for somewhat more costly systems if in the longer run it is going to be cheaper in direct moneys in terms of other kinds of employment problems, maybe not.

Secretary MARSHALL. We agree with that.

Senator KENNEDY. But that is the kind of analysis we need so we are able to legislate in an informed way.

Senator McGovern.

Senator McGOVERN. Thank you, Mr. Chairman; and thank you for your statement, Mr. Secretary.

Mr. Marshall, in the opening pages of your prepared statement you lay the foundation for your own view that much of the unemployment problem in the country today stems from the very sharp rise in energy prices after 1973, the inflation that caused, and the failure of the OPEC countries to recycle the profits from those sharp increases in oil prices. You state specifically that the administration has attempted to counter that with its fiscal stimulus package, along with the $25 billion tax cut. I wonder if you, as Secretary of Labor and as a professional economist, have come to the view that we will have greater impact on reducing unemployment through a tax cut method than we would if we pursued some of the other possibilities you have mentioned this morning. You have referred, for example, to the upgrading of the rail system in the Nation. Making reference to the efficiency of rail transport you noted the fact that you get more performance out of a mile of track, than you do 9 miles of superhighways. What, in your judgment, would be the relative impact on the employment situation of investing that proposed $25 billion tax cut in an alternative way? For example, in public investment, say in rebuilding the rails, and providing support for the construction of solar collectors across the country, and the retrofitting of public buildings, stepping up what you are now doing in the way of insulating homes as well as other buildings? Wouldn't we really get more jobs and more economic stimulus out of carefully selected public investment of that kind than we would out of the tax cut?

Secretary MARSHALL. Yes; you do get more impact out of direct expenditures, if you are concerned mainly about employment, than you do out of tax cuts.

Senator McGOVERN. Right.

Secretary MARSHALL. Our basic view is that you need a mix. How much it costs to create a job through direct expenditures depends, of course, on what kind of expenditure you undertake. If it is a highly capital-intensive activity, it yields few jobs relative to the amount of money committed.

Senator McGOVERN. The kinds of things we are talking about here are not capital-intensive, however.

Secretary MARSHALL. That is right. That is the reason we advocate to continue to build up a substantial public service employment program. As you know, in the last year we have more than doubled that program and our proposal for the future relies heavily on doing those kinds of things. We believe that we ought to do those within the limit of our ability to mount effective programs and to be sure that the work done is meaningful work and that the programs are adequately administered. We believe that is the way. Our general analysis is that through macro policies, if we didn't do anything else, we could get unemployment down to about 4.8 percent without any inflationary impact from what you do as a result of that program.

But using these direct expenditures which create jobs for much lower cost and are much more targeted, we can close that gap and move to 4-percent unemployment contemplated by the Humphrey-Hawkins bill and still that would not be inflationary because of anything you do in the program. Now, you might get inflation, and that doesn't mean inflation might not be a problem; but our analysis doesn't suggest that is anything that we do as a part of that effort.

So that we believe that you need the general policies to stimulate the private sector and to get jobs there, but that we also need to give heavy reliance on public programs and our recommendations are that they continue to be improved.

Now we also believe that the link needs to be perfected. That is, we need to perfect the relationship between public jobs, public service programs, and the regular economy, so that you don't just get one category of people who build up in the public service employment and training and work experience program but try to provide ways to move them out. Now, the general stimulus of the economy should make business sufficiently good that people in the public programs can move into the regular economy.

Senator McGOVERN. Let's just look again for a moment at the matter of the rail system in the country. I think any good energy policy not only has to produce more energy but it also has to address the problems of unemployment and inflation in the country. It strikes me that one area that is very fruitful, very hopeful to do all of these things in a kind of a package, would be to commit ourselves more vigorously than we have to upgrading the rail system. I heard President Meany say the other day that there were 7,000 derailments in the United States last year. The track beds in my State are so bad that we have had to slow the trains down to about 7 or 8 miles an hour. We have even had two trains that fell off the track in South Dakota while they were standing still. [Laughter.]

We talk about the United States being No. 1, and maybe we are in some categories, but we must be about No. 19 in our rail system. Yet, here you have a transportation system in this country as a whole which is burning about 9.5 million barrels of oil every day; we know that the rail system is the best way to move heavy goods efficiently, maybe even to move large numbers of passengers if we had a decent system—I am just wondering if we ought not to take a very critical look at the size of that tax reduction and consider diverting part of it into upgrading our rails, or other things of a similar nature. That's just not public service employment. This could be worked out in concert with private industry. You would get a more efficient use of energy, No. 1; second, you would produce literally millions of jobs, I think, both skilled and unskilled; third, we are told this is a more environmentally safe means of transportation and if it is cheaper it also combats inflation; and it just strikes me that it is a lot more—that it is a more solid way to approach the economic and energy problems of the country than handing out a small tax cut to everybody. I would like a tax cut, too, but you know we could fritter that away in a hurry and in the end have very little to show for it, whereas carefully directed investment of this kind I think would help everybody.

Secretary MARSHALL. Yes; we agree. We have been trying to do a number of things to accomplish that. It has one other advantage. Most of the jobs in the railbed rebuilding program, particularly in the Northeast, would be located where you need them; that is they would be located in areas of very high unemployment. We have been exploring a program with ConRail, for example, because ConRail is in the area of special need. But, the need that you indicate is all over the country. We have been trying to locate needs where jobs can be created near where people live. That has been one of the reasons that we have pockets of high unemployment. A railbed reconstruction program would have that effect. We have also been exploring and working with the Department of Transportation in developing a policy to deal with that generally. Immediately, our concern was to use as much of the CETA resources as we could because they are designed to put unemployed people to work immediately and we are trying to concentrate those heavily on the disadvantaged. One serious problem with the disadvantaged in the large cities, particularly of the Northeast, has been that the jobs are growing outside areas where people live. So that program would have that added advantage.

Senator McGOVERN. Mr. Secretary, notwithstanding the chart Senator Kennedy referred to, indicating that you get more of a job impact out of solar development than you do out of nuclear construction, do you have the feeling, as I do, that we are drifting toward a nuclear future much more than we are toward solar development, unless there is some reversal in the present energy policies the administration is pursuing. I don't really see much indication in that administration energy package that there is a serious commitment to the development of solar power in this country.

Secretary MARSHALL. Well, I thought that we did have a serious commitment to develop solar energy. It seems to me that some of that requires research and technology so that we know more about it, but also proceeding to use effectively what we already have.

Senator McGOVERN. Well, there was a lengthy piece that appeared in the Outlook section of the Washington Post a couple of weeks ago by Mr. Dennis Hays. Let me read a couple of observations here and I would like your comments on this. He says that, "Solar, wind and biological energy sources combined will receive less than one-fifth as much as is directly spent on nuclear fission." This is talking about the President's current budget.

"Renewable energy sources will receive $200 million less than breeder reactors alone."

Then he makes this conclusion: "In fact, after adjusting for inflation the Federal solar budget is $40 million lower this year than it was last year."

Now, granted that you can argue that there is something in there for solar development, if those analyses are anywhere near right it is really a pretty feeble commitment, isn't it?

Secretary MARSHALL. Well, what I would want to know before I concur would be what other people are doing. It doesn't seem to me you can measure the impact of a Federal program entirely in terms of how much we spend on it. We need to know what our expenditures are relative to others. For example, in our own area, one of our most effective training programs is apprenticeship training. However, the Federal Government spends very little on it because most of the work is done by others. I think in the solar area that the States are doing some things and there is a lot of private activity. Before you could conclude that this shows inadequate attention to it, if the Federal action is designed to serve as a catalyst to other activities, you immediately develop the things you know more about. It seems to me that what we really need is to develop diversity but to move ultimately to as rapid development of solar energy as we can reasonably promote.

But I am not familiar or conversant with the total expenditures that are going on in these different areas so I don't know whether that amount is the right amount to stimulate adequate solar development.

Senator McGOVERN. Just one more question, Mr. Secretary. I was impressed with the line of questions that Senator Kennedy directed at you and your associates as to whether you have the capability to give us some estimates on the various labor impacts of the different energy strategies. There is a document that just came to my attention. I think it was just released, "Jobs and Energy," put out by a group calling itself "Environmentalists for Full Employment."

They quote a number of things and I will give you one sentence typical of the kind of things they are trying to pull together. They say the Senate Commerce Committee staff has estimated that 1.6 billion in interest subsidies and loan guarantees for conservation retrofits would generate 400,000 jobs.

I would just like to pin down, if I can, what your answer was to the general line of questioning that Senator Kennedy was developing. What detailed analyses can you provide on the labor impact of various energy strategies in the near future and in the mid-term future. In other words, do you have that capability? If so, can that information be made available to us?

Secretary MARSHALL. We do have capability to provide answers. I indicated that we are doing some analysis there. We are not entirely satisfied with the level of that analysis and we are trying to perfect it. Let me ask Mr. Kutscher from BLS who has worked hard on this tell you what he is involved in at the Bureau of Labor Statistics.

Mr. KUTSCHER. I think that, as the Secretary mentioned in his testimony, our capability is mainly at the national level and not to do State or area analyses. But we do have a 160-sector model——

Senator KENNEDY. If you would yield. I think the Senator's question deals with the systems, though. We are not asking what it is going to be in Framingham or Pocatello, but in terms of the energy systems; that is what the question is.

Senator MCGOVERN. Just to illustrate that, supposing you were to consider an energy future that was based rather substantially on the development of renewable sources of energy, solar power, wind power, geothermal, conversion of waste materials to energy—what, for example, would be the job-creating impact on an energy design of that kind as over against one that relied primarily on the more conventional sources of energy and possibly heading eventually toward greater reliance on nuclear power?

What would be the implications nationally of a nuclear future as over against a solar future in terms of jobs? Which one produces the most jobs, which one is the least inflationary, which one is the most environmentally safe? Aren't those the kinds of studies that the Department ought to be undertaking in conjunction with the Energy Administration?

Mr. KUTSCHER. I think they are important. I think we are much more capable of answering the job impact on conventional energy sources than we are on the new energy sources such as solar and wind where very little data are available at the present time.

Secretary MARSHALL. In other words, there is not even an SIC code for many of these areas, and those need to be developed and we need to get experience in the relationship between the development of the energy source and the employment effect.

Senator McGovern. Mr. Secretary, couldn't the Department give more emphasis and attention on at least trying—recognizing the data that is available—trying to come up with some answers?

Secretary Marshall. Yes.

Senator McGovern. I think the energy question is extremely important, but I think the unemployment thing is so critical and so painful that if we can relate these two issues together in a way that developing the best possible energy policy would also create the maximum number of good jobs, this is really what we are about.

Secretary Marshall. That is right. I agree completely, Senator.

Senator McGovern. Thank you, Mr. Chairman.

Senator Kennedy. Senator Javits.

Senator Javits. Thank you very much. I am grateful to my colleagues for having scheduled these hearings, because I wanted to get a sense of proportion. It is one thing to get jobs out of energy, that's fine, but it is another thing to relate energy supplies with this great, drastic, unbelievable loss of jobs, which the Secretary says is heavily attributable to the increase in price and energy curtailment. Therefore, instead of turning the pyramid on its point, I would like to have your appraisal of what the relationship is between greater supplies of energy as compared with the prospects of employment, in view of the fact that you pointed out that highly expensive energy costs us drastically in terms of employment. Now, I am cognizant of the conservation aspects. I am as devoted to conservation as any of my colleagues, and insofar as that produces jobs—great; but what I am talking about and asking you is that, as the Secretary of Labor, where must our focus be? Should it be on producing energy which will produce the most jobs in the energy production, or on producing energy so that in all the fields supplied by energy production we get more energy available for greater expansion that will produce infinitely more jobs than what we now produce, whether out of nuclear or out of solar—leaving aside the problem of conservation?

Secretary Marshall. I think you have to concentrate on producing energy.

Senator Javits. It should be our highest national priority?

Secretary Marshall. With our energy policy; through other means we can concentrate on reducing unemployment.

Senator Javits. Do you believe that the reduction in the cost of energy has an even greater relationship to unemployment than the number of people used to produce energy?

Secretary Marshall. I think our analysis shows that, too; yes.

Senator Javits. Now, you say that you think your analysis shows this relationship. I think we have to have it on record.

Secretary Marshall. Yes.

Senator Javits. To present a balanced picture.

Secretary Marshall. Yes, my statement shows that.

Senator Javits. You are satisfied that your statement is adequate in terms of evidence?

Secretary Marshall. Well——

Senator Javits. I think that your statement mainly draws conclusions.

Secretary MARSHALL. Well, yes, I think that conclusion can be fully supported by the evidence.

Senator JAVITS. Would you be kind enough, then, to submit whatever will buttress that conclusion in terms of such findings as you have made?

Secretary MARSHALL. Yes.

Senator JAVITS. Would you do that?

Secretary MARSHALL. Yes.

Senator JAVITS. Mr. Chairman, I ask unanimous consent that it will be included.

Senator KENNEDY. It will be included.

[The following information was subsequently supplied for the record:]

SUPPORTING INFORMATION ON THE RELATIONSHIP BETWEEN THE COST OF ENERGY AND ITS IMPACT ON EMPLOYMENT

The importance of the impact of a rise in the cost of energy on unemployment is illustrated by the following analysis. In 1977 the bill for imported oil amounted to approximately $45 billion. More than 80 percent of this amount represents increases in the price of the oil stemming from OPEC's initial quadrupling and subsequent increases in crude oil prices. Analytically the impact can be seen as a "tax" of roughly $35 billion by OPEC on the American public.

The usual deflationary impact of a $35 billion tax increase, assuming no offsetting action, would translate into roughly half a percentage point of higher unemployment or roughly a half million workers.

Alternately, we can examine the impact in terms of the cost of "wringing out" the additional inflation stemming from the energy price increase through a deflationary macroeconomic policy. Thirty-five billion dollars represents roughly 1¾ percent of GNP or a similar amount in terms of an increase in overall prices. Assuming a price multiplier of two, the ultimate impact of the $35 billion "price increase" would result in an increase of an additional 3½ points of inflation. To "wring out" 1 point of inflation through deflationary policies requires a decrease in GNP of roughly $80 to $100 billion. Hence, the cost of wringing the 3½ points of inflation would mean contracting the economy by roughly $300 billion. Such an action would result in a dramatic increase in the level of unemployment.

Yet another way of examining the impact of the increase in OPEC oil prices on U.S. employment is in terms of its deflationary effect on the world economy. Over the period 1953–1973, U.S. real export demand grew at an annual rate of 6.7 percent. This growth in real exports reflected a substantial increase in the volume of world trade and resulted in the increasing importance of this sector in the U.S. economy. Specifically, real exports as a percent of real GNP grew from 3.8 percent in 1953 to 7.1 percent in 1973. This increased growth in exports by 1973 accounted for additional in U.S. employment of roughly 2½ million workers.

The year 1973 marked the cyclical peak of the economic expansion both in the U.S. and the OECD countries. Following an increase of 5.9 percent in the 1973, real growth in all OECD countries fell to 0.2 percent in 1974 and declined by 0.9 percent in 1975. In the U.S., after increasing by 5.5 percent in 1973, real growth declined by 1.4 percent in 1974 and by 1.3 percent in 1975. The world recession and the continuing weakness in the export demand for U.S. products in major industries countries has means that U.S. real exports grew at an annual rate of only 2.8 percent since 1973.

Had real export demand increased at the 6.7 percent pace experienced in the 1953–73 period, U.S. exports would have advanced to $113.3 billion or 15.8 percent above actual levels reached. An additional 15.8 percent billion in exports would have resulted in 1977 real GNP being 1.2 percent higher than actually experienced. In terms of the unemployment rate, the direct effect this added growth translates into a 0.6 percentage point reduction in the unemployment rate. Thus, rather than the 7.0 percent unemployment rate experienced in 1977, continued growth in real export demand would lead to an unemployment rate of 6.4 percent or roughly an additional half million workers employed.

Senator JAVITS. The other thing is the relationship between the Labor Department and the Department of Energy. I gather you have one ongoing study—in your prepared statement—on this particular subject. You speak about the construction manpower demand system.

This system is producing data on occupational and geographical specific employment needs in the powerplant construction industry over the next few years. Isn't it a fact you have to have a very close interconnection with the Department of Energy in order to estimate what labor will be needed in a particular skill, et cetera, and to plan for that?

Secretary MARSHALL. Yes, and we do have a very close relationship.

Senator JAVITS. You do.

Secretary MARSHALL. Yes.

Senator JAVITS. Therefore, you are satisfied that the two departments coordinate in terms of future outlook for the labor pool of the United States?

Secretary MARSHALL. Yes, we are working very closely with them.

Senator JAVITS. You have already?

Secretary MARSHALL. Yes.

Senator JAVITS. Is there any data you can give us on that score?

Secretary MARSHALL. On the——

Senator JAVITS. On, for example, if the Labor Department follows the recommendations of the Department of Energy can the Labor Department tell whether or not the labor supply of the United States will be adequate or inadequate?

Secretary MARSHALL. Yes, we can provide information on that.

Senator JAVITS. I think that this is a very important point, and would you explain—and again I ask unanimous consent, Mr. Chairman, that it appears in the record.

Senator KENNEDY. Without objection, so ordered.

[The following information was subsequently supplied for the record:]

The Departments of Labor and Energy are working to develop a closer relationship in assessing the impacts of energy policy on employment and training. Although substantial areas of improvement do exist, the present relationship must be viewed in context of the relative newness of the Department of Energy and the reorganization efforts underway at the Department. Over the coming months and years, however, we are expecting to develop an ever closer relationship between the two Departments.

The Construction Manpower Demand System (CMDS) provides a good example of the benefits of a cooperative working relationship. Developed and implemented under a joint arrangement between DOL and DOE, the CMDS is a computer based management information system designed to provide users with reliable forecasts of the future volume, composition, geographic distribution, and associated capital and labor requirements of construction activity. Initial implementation of this system has focused on the needs of energy related construction, and a report has already been prepared showing the employment requirements, by location and occupation, of anticipated power plant construction between 1977 and 1981. The Department anticipates that DOE will be provided with online access to the entire CMDS energy project file which will contain continuously updated information on every major energy/construction project underway or announced.

Capability for more general analysis of energy/unemployment relationships is provided by the Office of Economic Growth within the Bureau of Labor Statistics. This office has been developing a close working relationship with the Energy

Information Agency, the statistical collection and analysis arm of the Department of Energy.

The BLS economic growth projections model can evaluate the energy requirements implicit in alternative patterns of economic growth and alternative energy policy scenarios. The model is also capable of estimating the change in the future employment requirements of major industries which result from changes in energy availability. Analysis from the output of this model has been used for examining interagency evaluations of the impact of the coal strike.

The Office of Economic Growth, in consultation with the Department of Energy, has also developed in model form the energy requirements of 160 different industries, providing a basis for ranking the industries according to their dependence on a particular type of major energy source for maintenance of output and employment. This procedure allows identification of those industries most likely to be affected by curtailments of various energy sources, taking into account not only the direct use of energy but also the indirect energy needed to produce the goods and services used in the course of producing that sector's output.

There is also growing DOL–DOE cooperation in the planning and implementation of training programs. In the area of weatherization, one program has provided for the insulation of some 100,000 homes of the elderly and low income families. Labor for the program is provided by workers being trained under the Department of Labor's CETA program, while materials are contributed by the Department of Energy and the Community Service Administration. Another CETA project being run jointly with the Department of Energy involves the training of former farmworkers for jobs in the nuclear energy field. The Department of Labor's Job Corps is currently engaged in discussions with the Department of Energy about the possibility for additional energy related training projects for disadvantaged youth.

Finally, consultations are underway between the Departments of Labor and Energy concerning an interagency memorandum of understanding which would provide for a high level steering committee to insure coordination in areas of mutual interest to the Departments.

Senator JAVITS. Finally, Mr. Secretary, I must say I feel a lot less like a voice in the wilderness when I see your conclusions about what the quadrupling of the OPEC price did to us and also the admitted—I will admit it, but you argue and I have argued for months—failure of OPEC to effectively recycle its funds into employment-generating and productive activities. I think it is one of the great failures of our policy, it is one of the great failures of harmonizing our policy with that of the other industrial countries of the world, and it will bring on—and I have said this 20 times and I say it again—a serious recession or depression in 1979–1980 unless we move to correct it. I won't ask you to agree with me about the last part of that, but I do greatly appreciate your giving your findings as to what is really eating at this economy in terms of employment and in terms of its productivity.

Would you care to make any estimate of what would happen in terms of U.S. employment if there was a basic policy change in the OPEC countries, which are producing such huge surpluses, toward a recycling of their funds into employment-generating productive activities, to use your words; and would you specify some of those? Did you actually have particular productive activities in mind when you wrote that portion?

Secretary MARSHALL. I think there are a number of outcomes you would see. Of course, it depends on where the OPEC savings, the income they have derived from the higher price of oil, were invested and in what kinds of activities you increased in different countries. But clearly, if it was reinvested, say, in the industrial countries, then what would happen would be that unemployment would decline in those countries. One of the problems you have in Western Europe is rising unemployment as a result of the higher prices of oil which drains resources out of those economies and into the OPEC economy. If they had declining unemployment and more expansion in Western Europe it would help our balance of payments considerably. But one of our balance-of-payments problems derives directly from the lagging economies in Western Europe, Japan, and other industrialized countries of the world.

If the investments were recycled into the less developed countries and into the kinds of activities that were less competitive directly with the manufacturing employment in the United States, for example, and more designed to promote the balance in those developing countries between rural and urban areas, then that effect would be to greatly reduce the international competitive position in many manufacturing activities particularly low wage textiles, garments, shoes, in those areas.

It would also greatly reduce the tendency for people in those developing countries to leave those countries and come into the United States illegally. That would help, I think, significantly reduce the pressure either from low cost goods or people who are unable to get jobs in those countries, going to those countries. So that the net effect of that, in other words, would be instead of those less developed countries having to try to produce low cost manufactured products in order to get the resources to pay the higher oil prices, they would be able to get the resources from investment activity rather than export activity and that that would greatly improve their activities. I do believe unless that happens some way, that we are not likely to be able to have a healthy international economic environment.

Senator JAVITS. You encourage me greatly to continue the position which I have taken. In sum, Mr. Secretary, you would place high priority upon the United States using its position everywhere—economically speaking, diplomatically, politically, socially, and in terms of security—to influence our industrialized trading partners to join us in the effort to bring about these results, that is, to bring about intelligent and orderly investment of these vast surpluses either in the developed or in the developing world or in both.

Secretary MARSHALL. Yes.

Senator JAVITS. And, of course, at the very least to maintain the stability of the price of oil with a sense of responsibility toward the world——

Secretary MARSHALL. Yes.

Senator JAVITS [continuing]. In view of its admittedly uneconomic nature.

Secretary MARSHALL. Yes.

Senator JAVITS. Thank you very much, Mr. Secretary.

Senator KENNEDY. Thank you very much, Mr. Secretary.

Secretary MARSHALL. Thank you, Mr. Chairman.

Senator KENNEDY. Next we have Mr. William Winpisinger, president, International Association of Machinists and Aerospace Workers; Mr. Anthony Mazzochi, vice president, Oil, Chemical and Atomic Workers International Union; and Mr. Edward Carlough, president, Sheet Metal Workers International Association, Washington, D.C.

Would you gentlemen be good enough to come up as a panel.

Mr. Ruttenberg, we are glad to have you as well.

Mr. RUTTENBERG. I am substituting for Mr. Carlough, Senator Kennedy.

Senator KENNEDY. Fine. We will start off, if we could, with you, Mr. Winpisinger.

STATEMENT OF WILLIAM W. WINPISINGER, PRESIDENT, INTERNATIONAL ASSOCIATION OF MACHINISTS AND AEROSPACE WORKERS

Mr. WINPISINGER. Thank you very much, I am William Winpisinger and I am president of the International Association of Machinists and Aerospace Workers. I very much appreciate the opportunity extended to me this morning as part of this panel to express some views on the subject of these hearings.

It seems to me, it is a timely opportunity because in my judgment there seems to be at work in our land today a virtually perverse law which suggests that public enlightenment and understanding of the energy problem is inversely proportionate to the amount of verbiage and rhetoric spouted by all the corporate international spokespeople. The more we are told, it seems, the less we know, the more heat, the less light; the greater supply, the higher the price; the more we talk about energy independence, the more we depend on foreign crude; the more we are told to rely on the hallowed free marketplace, the greater degree of concentration and monopolization; the more energy companies advertise, the more their credibility is destroyed; the more energy the consumers use, the lower their utilities rates. We are urged to conserve, but penalized with higher prices if we do; it just seems in the whole world of energy up is down, front is back, peaks are valleys, and the rich are getting richer and the poor, poorer.

I think that as the Congress, through the work of this committee, goes about addressing solutions, with that kind of a backdrop, that it is a commendable exercise indeed, and I think it is the very first time that anyone in Government has sought to focus on how those decisions are going to impact upon jobs and future employment opportunities.

I will make my oral remarks as brief as possible. I will cover a detailed and lengthy prepared statement which I now offer for inclusion in the record.

Senator KENNEDY. It will be printed in its entirety.

Mr. WINPISINGER. Thank you. I think it is no secret that the membership of the group I am privileged to represent is employed in virtually every sector of the industrial complex of our country and in almost every instance they are industries which are highly sensitive to energy sources, supplies and prices.

The national energy policies or in many cases, the lack of them, directly impact on the jobs, incomes and security of the IAM members working in them.

Regrettably, it is not possible to report in any definitive way or to quantify even by sector of industrial occupation category, just what the extent of energy impact is on the IAM membership, except in a very, very negative way. We learned, for example, that some 15 to 18 thousand IAM members in Ohio were idled from work for approximately two weeks during the natural gas shutoff in the winter of 1976/77. In 1974, during the oil embargo, we learned that 2,000 air transport workers were idled when the airlines used the scare as an excuse to curtail marginally profitable or totally unprofitable flights and schedules. We also learned during the embargo scare that some 8,000 civilian aircraft manufacturing employees suffered reduced worktime, layoffs and loss of income, due to an emergency low priority for fuel for civilian light aircraft aviation purposes.

Not only do we not know the impact of energy inputs and alternative energy sources on employment within industries where we have members, we are appalled to learn that there is no definitive analysis or study for our Nation on a macro basis. The Department of Energy has made no such study. It was revealed moments ago that the Labor Department has none. The Office of Management and Budget has made none. The Commerce Department has no study. The Bureau of Labor Statistics has no study. And the Congressional Research Service has no energy/employment analysis or studies available.

In effect, Mr. Chairman, what we have is the evolvement of a national energy policy, albeit, I think far from coherent, that concerns itself with control, allocation, prices and profits, but utterly fails to take into consideration its impact on the human factor of production.

We can develop the most profuse energy production and utilization program conceivable, but if it results in widespread displacement of human labor, what good will it do?

Indeed, productivity is linked directly to industrial energy consumption. Energy displaces labor. And, herein lies the dilemma of IAM members and working people in general. As the productivity index goes up, jobs and job opportunities appear to decline.

I think there is plenty of evidence before this committee to indicate that. Further, I think it is no longer safe to say as we often used to do, that displaced production workers will find employment in service industries. Will they find employment as supermarket clerks? Boxed beef and packaging machinery are replacing meatcutters and stockroom clearks. As bank tellers? Again, I doubt it, since electronic fund transfers and automatic driveup windows are taking over. Centrex has already replaced all of our telephone operators. So has taped and prerecorded messages. And computerized switching and billing systems are displacing thousands of other types of services employees.

In my organization, direct job loss is coming about in the highly skilled stamping, machine tool and tool and die industries through numerical control—computerized—tools and automated control panels. The energy required to operate that whole range of machines is electricity, and the electric consumption is on the increase. But the number of jobs decreases. At least in recent years.

I think the point is, that increased energy consumption may not create jobs in the economy. There may not be a correlation between energy growth and employment growth. Certainly it is true in certain microeconomic instances, as you have heard.

At this stage of the game, on a macro basis, no one knows for certain, as you demonstrated with the Secretary. I think we should know. It is time, perhaps, to begin focusing on energy efficiency, rather than labor efficiency. A good share of the energy problem may be found in wasteful, expensive and mismatched uses of energy. Such a focus may save jobs as well as energy.

Lack of any reliable energy—employment impact data not only inhibits the deliberations and proceedings of this distinguished committee, but, I think, it also impedes development of a comprehensive national manpower policy and achievement of a full employment economy. It would seem the latter, that I, among many, assumes would be the most important thing, what really matters in our country today.

It would seem reasonable to suggest that the Bureau of Labor Statistics in the Department of Labor and the Department of Energy form statistical analysis and support groups to provide the Executive, the Congress, and the public with reliable energy impact data.

Similarly, it would seem reasonable to expect that national energy programs emanating from the White House would include employment impact analyses, and that future energy development, conservation and conversion proposals and programs would contain job impact analyses. Beyond prices and rates, which are largely noncompetitive today, there is no way for working people and trade unions to compare the relative merits of one energy source with another.

But working people are not only concerned with their jobs, they are also concerned with the prices they pay for home energy uses. There was a time when nonprofit consumer-owned and publicly owned power and utility agencies and systems provided a cost yardstick, against which costs and rates of private investor-owned utilities could be measured. In that way consumers and regulatory agencies had some objective means to determine when excessive consumer rates and cost increases were occurring.

That yardstick principle has been seriously eroded over the past couple of decades. If measurement of energy efficiency is to be realized, if working people are asked to sacrifice their jobs to greater energy inputs and if consumers are to be asked to pay for energy development, conservation, and conversion projects, then it is only fair that they be given information which comes from a source other than the energy companies and utilities themselves. We would recommend, therefore, that Department of Energy, or perhaps SEC or FTC, makes this data available on a regular and timely basis.

Working people are also dependent on energy for transportation to and from work. Gasoline and oil prices are a large part of their so-called costs of doing business, if you will. Energy orthodoxy requires them to continue relying on gasoline for the bulk of their transportation needs, at least until the year 2000. Any new technologies with respect to auto fuels is not seriously considered, although conservation measures such as speed limits and fuel consumption (MPG) standards are.

Meantime, the petroleum glut has not noticeably reduced gasoline pump prices, which soared 77.4 percent from the beginning of the OPEC embargo through the first half of 1977. Profits of leading oil companies during the same period increased an average of 103.4 percent, while average weekly earnings for workers increased 38.5 percent over that nearly 6-year period.

It is amazing to us how the economics of scarcity and the law of supply and demand inevitably rebound to the profit ledgers of the energy companies and to the glory of free enterprise.

Growth demand for energy is based on orthodox assumptions related to population and GNP growth. The assumption is that energy demand increases exponentially over time, and must, if the production of goods and services is to keep pace with increases in the number of people and their needs and demands.

In the near future, that is up until the year 2000, it is assumed by orthodox analysts that energy supply will lag behind demand. How they can be certain is questionable. Available figures describing supply and reserves of fossil fuels and uranium appear to be under the control of and dominated by the energy companies. It is to their advantage to understate reserves and current production. It is further assumed that up until the year 2000, the major portion of our energy supply must come from known and developed technologies. This assumption is based on an historical precedent that 20 to 30 years are required from development of a new technology to its commercial application.

Hence, according to the orthodoxy, in the near future, our energy supply must continue to come from fossil fuels, nuclear reactors, and to a very limited extent, already developed hydroelectric power.

Orthodox thinking gives little credence to geothermal, wind or solar power in our energy future. Also neglected are synthetic products produced from coal, biomass energy, cogeneration, energy produced from solid waste disposal plants and the potential of space solar power.

It is obvious that the current so-called energy crisis gives us an unparalleled opportunity to develop a rational, fair, democratically controlled, national energy policy. Given the assumptions of orthodox economists and energy experts, we have no choice but to proceed with development of all energy sources. We can continue to develop large scale centralized systems, such as most fossil and all nuclear systems are, and we can develop decentralized and local systems with small scale technology inherent in solar, biomass, cogeneration and solid waste disposal.

We can continue to develop all sources with private investment, but we can also developed energy sources with direct public investment. The latter holds out the prospect of, not only increasing supplies, but providing consumers once again as well as Government regulators with the cost and financial data, against which the performance and prices of the private sector can be measured. In effect, we can restore the yardstick principle to the energy industry and gain the benefit of competitive influences.

We also have a tremendous opportunity to dovetail the development of the new energy sources, such as solar, cogeneration, biomass, small hydro and wind, with a national manpower policy and full employment program. Development of the new sources, launched on a full-scale basis, would create several million jobs in direct employment, with the ripple effect adding a great many more employment opportunities.

Full-scale development of alternative energy sources would provide job opportunities for the hardcore, low-skilled and semi-skilled unemployed. It would also open up employment for skilled building tradespeople, mechanics, technicians, engineers, architects and scientists.

Probably no other program could be designed to better serve the national interest and the people's interest, than achieving full employment through development of alternative energy sources.

We must be wary, however. The giant energy companies, already vertically and horizontally integrated, are casting covetous eyes upon the alternatives, particularly solar, and I guess staking out a claim on buying the sun. I don't think we can permit that to happen. Of all sources, solar power must be the people's power.

As a general statement, when the survey of growth demand, development status and prospects for future energy from all sources is completed, one can only conclude that all sources must continue to be developed, with as much public benefit emphasis as possible. Until employment impact analyses are made, until supply, demand, reserve and private cost and financial data are reliably reported, then working people have no choice but to accept the assumptions of orthodox economists and energy experts.

For if the lights do go out, or the power is shut off, or the oil does stop flowing, working people will be the first to find it out.

Thank you very much.

[The prepared statement of Mr. Winpisinger follows:]

Prepared Statement of William W. Winpisinger

Mr. Chairman, members of the committee, my name is William W. Winpisinger. Since July 1977, I have been priviliged to serve as International President of the International Association of Machinists and Aerospace Workers.

IAM membership is found in nearly every sector of the U.S. industrial complex—aerospace, air transport, automotive, construction, electronics, light manufacturing, metals fabrication, machine and machine tool, tool and die, maritime, shipbuilding, nonferrous metals and mining, and railroads.

All these industries are highly sensitive to energy supplies, sources and prices. The nation's energy policies, or lack of them, directly impact the jobs, income and security of IAM members employed in them.

Regrettably, it is not possible to report in any definitive way, or to quantify by sector of Industrial Occupation category, just what the extent of energy impact is on the IAM membership; except in a negative way. We learned, for example, that some 15 to 18 thousand IAM members in Ohio were idled from work for approximately two weeks during the natural gas shut-off in the winter of 1976/77. In 1974 during the oil embargo, we learned that 2000 air transport workers were idled when the airlines used the scare as an excuse to curtail marginally profitable and unprofitable flights and schedules. We also learned during the embargo scare that some 8000 civilian aircraft manufacturing employees suffered reduced worktime, lay-offs and loss of income, due to an emergency low priority for fuel for civilian light aircraft aviation purposes.

Not only do we not know the impact of energy inputs and alternative energy sources on employment within industries where we have members, we are appalled to learn that there is no definitive analysis or study for the nation on a macro basis. The Department of Energy has made no such study. The Office of Management and Budget has made no study. The Commerce Department has no study. The Bureau of Labor Statistics has no study. And the Congressional Research Service has no energy/employment analysis or study.

In effect, Mr. Chairman, what we have is the evolvement of a national energy policy, albeit it is far from coherent, that concerns itself with control, allocation, prices and profits, but utterly fails to take into consideration its impact on the human factor of production.

We can develop the most profuse energy production and utilization program conceivable, but if it results in widespread displacement of huamn labor, what good will it do?

As Richard Grossman and Gail Daneker have pointed out in their study, Guide to Jobs and Energy, industry has historically substituted energy for labor. After substitution for labor in each process of the production chain, the total number of workers needed for production decreases.

This fact alone seems to contradict the current industrial management argument, and of government spokespeople, too, that "more energy leads to more jobs."

According to Grossman and Daneker, greatly increased energy consumption in primary metals; stone, clay and glass; food; chemicals; and paper products has resulted in static or declining employment over the past 20 years. They note the same for steel, aluminum, and agriculture. They also note that between 1961 and 1973, electric utilities increased their kilowatt output by about 130 percent, their revenues by 260 percent, their construction costs by 340 percent. But employment in electric utilities increased only 21 percent.

Indeed, productivity is linked directly to industrial energy consumption. And, herein lies the dilemma of IAM members and working people in general. As the productivity index goes up, jobs and job opportunities appear to decline.

Further, it is not longer safe to say, as we often do, that displaced production workers will find employment in service industries. Will they find employment as supermarket clerks? Boxed beef and packaging machinery are replacing meat-cutters and stock room clerks. As bank tellers? Electronic fund transfers and automatic drive-up windows are taking over. Centrex has already replaced telephone operators. So has taped and prerecorded messages. And computerized switching and billing systems are displacing thousands.

In the IAM, direct job loss is coming about in the highly skilled stamping, machine tool and tool and die industries through the Numerical Control (computerized) tools and automated control panels. The energy required to operate these machines is electricity, and electric consumption is on the increase. But the number of jobs decreases.

The point is, increased energy consumption may not create jobs in the economy. There may not be a correlation between energy growth and employment growth. Certainly it is true in certain microeconomic instances.

At this stage of the game, on a macrobasis no one knows for certain. But we should know. It is time, perhaps, to begin focusing on energy efficiency, rather than labor efficiency. A good share of the energy supply problem may be found in wasteful, expensive and mismatched uses of energy. Such a focus may have jobs as well as energy.

Lack of reliable energy—employment impact data not only inhibits the deliberations and proceedings of this distinguished committee, it also impedes development of a comprehensive national manpower policy and achievement of a full employment economy. The latter, one assumes, is what really matters.

It would seem reasonable to suggest that the Bureau of Labor Statistics in the Department of Labor and the Department of Energy from statistical analysis and support groups to provide the Executive, the Congress and the public with reliable energy impact data.

Similarly, it would seem reasonable to expect that national energy programs emanating from the White House would include employment impact analyses, and that future energy development, conservation and conversion proposals and programs would contain job impact analyses. There is no other way for working people and trade unions to compare the relative merits of one energy source with another.

But working people are not only concerned with their jobs, they are also concerned with the prices they pay for home energy uses. There was a time when non-profit-consumer-owned and publicly-owned power and utility agencies and systems provided a cost yardstick, against which costs and rates of private investor-owned utilities could be measured. In that way consumers and regulatory agencies had some objective means to determine when excessive consumer rates and rate increases were occurring.

That yardstick principle has been seriously eroded over the past two decades, an erosion due in no small part to a lack of access to valid investor-owned cost and financial data. If measurement of energy efficiency is to be realized, if working people are asked to sacrifice their jobs to greater energy inputs and if consumers are to be asked to pay for energy development and conversion projects, then it is only fair that they be given information which comes from a source other than the energy companies and utilities themselves. So we would recommend that Department of Energy or perhaps SEC make this data available on a regular and timely basis.

Working people are also dependent on energy for transportation to and from work. Gasoline and oil prices are a large part of their "costs of doing business." Energy orthodoxy requires them to continue relying on gasoline for the bulk of their transportation needs, at least until the year 2000. Any new technologies with respect to auto fuels is not seriously considered, although conservation measures such as speed limits and fuel consumption (mpg) standards are. Meantime, the petroleum glut has not noticeably reduced gasoline pump prices, which soared 77.4 percent from the beginning of the OPEC embargo through first half of 1977. Profits of leading oil companies during the same period increased an average of 103.4 percent, while average weekly earnings for workers increased 38.5 percent over that nearly six-year period.

It is amazing how the economics of scarcity and the law of supply and demand inevitably redound to the profit ledgers of the energy companies and the glory of free enterprise.

ENERGY OVERVIEW AND COMMENTARY

Growth demand for energy is based on orthodox assumptions related to population and GNP growth. The assumption is that energy demand increases exponentially over time, and must, if the production of goods and services is to keep pace with increases in the number of people and their needs and demands.

In the near future, that is up until the year 2000, it is assumed by orthodox analysts that energy supply will lag behind demand. How they can be certain is questionable. Available figures describing supply and reserves of fossil fuels and uranium appear to be under the control of and dominated by the energy companies. It is to their advantage to understate reserves and current production. It is further assumed that up until the year 2000, the major portion of our energy supply must come from known and developed technologies. This assumption is based on a historical precedent that 20 to 30 years is required from development of a new technology to its commercial application.

Hence, according to the orthodoxy, in the near future, our energy supply must continue to come from fossil fuels, nuclear reactors, and hydro electric power.

The fallacies of these assumptions appear to be be several. First, there is currently an oil glut, due to stepped up domestic discovery, Alaska pipeline and North Sea oil production, and the federal strategic petroleum stockpile program. (Energy Preparedness).

Second, the production of coal and conversion from natural gas to coal-fired industrial and electric generating plants has increased. Western strip mining of low-sulfur coal has increased and, until the recent strike by coal miners, eastern deep mining operations were on a sharp upswing.

Third, natural gas reserves, according to industry sources, appear to be declining, but, natural gas producers argue, if prices are deregulated, then they can greatly increase their supply. Apparently, the answer to this riddle will become known when Congress makes its decision on deregulation. If natural gas prices are deregulated, then one is left to surmise that the producers will release a new set of supply figures, which will relieve the natural gas shortage. How much natural gas may actually be in the ground, will probably remain a mystery for decades, or until someone other than the producers make the surveys, gather and report the statistics. In any case, following the producer's logic, we should expect increased natural gas production in the near future, if the price they are exacting is met. The issue clearly is one of price in the near term, rather than supply, and the shortage is in the figures, not in the ground.

In the case of nuclear energy, fission currently provides about nine percent (some sources say one percent—it depends upon whose figures one uses) of national needs. Industry and government proponents of nuclear power project that it will provide 20 percent of total electrical energy by 1985 and about 50 percent by 2000. These projections are based on the assumption that there are sufficient domestic uranium reserve to feed some 232 planned nuclear plants, an assumption which may be open to doubt, if Canadian sources of uranium cannot be tapped. Again, the energy companies supply their own figures, so there is no objective way of knowing the extent of uranium reserves. Some existing fast breeder reactors are already judged to be technologically outdated, but industry and orthodox experts are touting fission on the basis that, by the time uranium reserves are depleted, a breeder reactor which converts unusable uranium into plutonium, will be on the line in force. In the meantime, the federal government will have to have overcome critical safety and waste disposal problems. This is a little bail-out program destined to cost taxpayers several billion dollars by 1985, the earliest possible date for permanently disposing of nuclear wastes, according to OMB.

But again we have a basic contradiction between the orthodox economic assumption of scarcity on the one hand, and industry assurances of a plentiful supply of nuclear energy on the other.

It is the kind of double-think and contradiction that permeates the economics of the entire energy industry.

As for nuclear fusion, there is no known way to control the one-million degree heat and energy release that would make it useful. For this source, the experts are right. There won't be a significant increase in supply of energy.

Orthodox thinking gives little credence to geothermal, wind, and solar power, in our energy future. Noxious gasses, excessive salinity and land surface collapsing are said to prevent substantial geothermal development. Wind once generated electricity and pumped water on millions of American farms, but it is now argued that to generate one megawatt of power requires a windmill of 180 feet in diameter on a 200 foot tower, with an average wind velocity of 30 miles per hour. Thus, thousands of towers would be needed to replace one coal generating plant. Perhaps, but think of the jobs that could be created in manufacturing if farmers went back to using their own individual windmills.

Solar energy gets more attention then geothermal or wind, but even so, it is predicted that by 2000, only one-third of new construction and one-third of old construction will be fitted with solar heating systems. It is conceded by the orthodoxy that solar heating will play an increasingly larger part in meeting future energy needs, but we are cautioned not to be overly optimistic about solar heating systems, since the energy supplied for this purpose would be only about five percent of the national energy need.

There is a curious observation to be made in this survey of the orthodox assumptions underlying our present energy policy. Apparently there is no prospect of supply ever catching up with demand. Of the fossil fuels, it is said the petroleum supply will be exhausted, possibly within 30 to 40 years; natural gas supplies will be exhausted, possibly in 10 to 20 years; coal will be exhausted, possibly within 300 to 500 years. Hence, we can see why the President's National Energy Plan puts so much emphasis on coal.

About nuclear power, it is said that conventional fission reactors will exhaust their low-cost fuel supply (uranium) possibly within 30 to 40 years. Fast breeder reactors are thought to be able to greatly extend the potential fuel supply (plutonium) of fission reactors, but none say it will be low cost and safety and waste disposal problems, as well as the President's non-proliferation desires, must be solved. Fuel supply for fusion reactors is virtually unlimited, at what cost is unknown, but fusion's feasibility is still to be proven.

It is said that the number of sites for future hydroelectric power is extremely limited, but overlooked is the fact that only 800 of 50,000 dams in the U.S. are licensed to produce power. Thus, there would appear to be a great deal of potential if existing dams were to be fitted with trubine generators. That would create a considerable number of jobs in electrical machinery and electrical equipment manufacturing, construction and maintenance. Power generated at small dams could be used for individual industrial units or possibly even individual farm needs. Or it could be used as peaking power for larger systems.

Neglected in the orthodox survey of power sources are synthetic petroleum produced from coal, although a number of energy companies are currently engaged in government-funded synthetic research and development projects. It is conceivable that synthetics will supply a significant portion of not only energy needs, but petrochemical needs in the near future. Coal gasification demonstration projects are already in existence. Synthetic motor oil is on the market in limited supply and petroline, a synthetic gasoline, may be marketed next. DOE Secretary Schlesinger has unofficially put priority on creation of a liquid fuel replacement for the transportation sector.

All liquefied natural gas (LNG) does not have to be imported. There are remote areas of the U.S. where it might be economically feasible to process it, too.

Overlooked also is biomass energy, which could be a significant source of energy on farms and ranches and in small rural communities, assuming they are given the means and initial funding to construct and operate biomass plants. Loans and grants are now available for rural and small community water and sewer systems. Electric generation from Biomass and solid waste disposal plants could similarly be funded, thus creating jobs and job opportunities in thousands of depressed rural communities. And the research and development, design and engineering, construction and manufacture of these small generating plants would create thousands of jobs upstream.

But one should focus more closely on the development and utilization of solar energy. There are two basic systems for solar energy production. One is at hand and familiar. That is terrestrial solar power. The second is in the research and development stages and futuristic. That is Solar Power Space Satellites.

First, all the technology necessary is in hand for terrestrial solar power development for hot water heat and building heat. Many firms are already marketing solar home heating and hot water heating systems. The American Solar Energy Association has outlined a comprehensive federally assisted program to have 11 million homes in America fitted with solar hot water systems by 1985. This contrasts with President Carter's goal of 2.5 million homes by 1985 and DOE Secretary Schlesinger's goal of 1.3 million solar homes by 1985.

The State of California, by the way, is well on the road to solar home heating and will have more solarized homes in 1985 than the entire nation.

In Japan, 2 million homes have solar hot water heating. Israel has 200,000 solar homes. And Australia requires that solar heating units be installed on all new buildings constructed in the energy-short northern provinces.

There is absolutely no reason why technology should be used as an excuse to delay or prevent the installation of solar hot water and building heating systems. It must be promising, for an energy giant such as Exxon to already be in the business. And a giant aerospace firm, Grumman Corp., is on the market with solar passive and active building heat systems. (A passive system stores energy where sunlight strikes building walls or floor or roof and is capable of providing 80 to 100 percent of a structure's space conditioning requirements, but cannot easily be added to existing structures. An active solar system can be bolted onto roofs or walls of existing buildings and can supplement conventional furnaces, by moving, with fans and pumps, solar heated air or liquid to storage areas, from which the heat can be withdrawn as needed).

Solar is also being applied industrially, at a soup canning plant and in laundries and car washes in California; at a fabric drying plant in Alabama; at a concrete block factory in Pennsylvania; and for pasteurization at a brewery in St. Louis.

According to the American Solar Energy Association, the potential for solar application is 45 million homes, 10 million apartment houses and 15 million commercial and farm buildings, which could be retrofitted, and 2 million new structures built each year.

The beauty of solar is that it is renewable, nonpolluting and its installation is labor intensive.

In fact, the Solar Energy Association, in testimony before the House Committee on Small Business, has very forcefully demonstrated that conversion to solar energy can be looked upon as major employment program for the hard core, low and semiskilled unemployed. But a major solar conversion effort would also provide thousands of jobs for skilled carpenters, sheetmetal workers, plumbers and other building tradesmen who are suffering from chronically high unemployment. Upstream from installation, thousands of fabricating and manufacturing jobs would also be created.

The Solar Heating and Cooling Demonstration Act of 1974 has been in operation for three years now. The technology and reliability of solar heating and cooling have been proven. The major barrier to an all-out solar conversion program is front-end money for mass production and marketing and initial installation costs for consumers. In terms of employment, taking the strain off the advertised "shortage" of fossil fuels, and nuclear power, it is sound economic and common sense for the federal government to boost solar power on a massive scale.

There are two precautions that should be taken however. One is that the giant energy companies are already casting a covetous eye upon solar. This is in line with their "total" energy concept. The established energy companies should not be permited entry into the solar industry. If they are permitted entry, it will be just a matter of time before history repeats itself and the cost of solar power will be pegged to the monopolistic price of petroleum, natural gas, coal and uranium. Solar power must be the people's power. Solar power must restore the low-cost competitive yardstick that has been missing from the energy scene for over two decades.

The second precaution is that, in its infancy, the solar power industry will be highly susceptible to confidence games, quick buck artists, and sham manufacturers and installers. The industry and consumers must be protected against these opportunists and predators, through an enforceable licensing system at the state and local levels. Warranties for work, parts, service system performance and safety must be strict and adhere to standards promulgated and for review by the Consumer Product Safety Commission, Bureau of Standards, and Housing and Urban Development Department.

The far term future for solar power may be further augmented by the Solar Power Satellite. Futuristic in concept and design, the Solar Power Satellite is at least as feasible at this stage, as is nuclear fusion. Simply put, the idea is to put a large satellite in geosynchronous orbit some 22,000 miles above the earth. In that orbit, the sattellite is constantly illuminated by the sun. The solar rays are converted to electricity by an array of solar cells or photovoltaic cells, which generate electricity directly when sunlight falls on them. The electricity is then transmitted to an Earth receiving site, from where the power distribution system will fan-out to communities and homes. It can be tied-in with existing transmission and distribution systems. Huge an heretofore unknown amounts of electric power can be generated by this method—several satellites could produce more electricity than all other alternative sources combined now produce.

Barriers to Solar Power Satellites becoming reality are large. The first is a safety and environmental problem stemming from the microwave beam which would transmit the energy from space to the earth collector. Microwaves can be extremely hazardous if not kept within minimal strength tolerances. Microwave environmental-effects experiments have yet to be completed and the danger eliminated. A second barrier is the cost of the program. Such an undertaking is similar in scope and cost to the Apollo program, or from $60 to $80 billion. At this early stage, electric power from the Solar Space Satellite is not cost-competitive with other sources.

Since the technology to develop the system is at hand, and since its development would provide socially useful employment for a large corps of highly trained scientists and engineers and highly skilled technicians and craftspeople, research and development funding by the federal government ought to be encouraged, and expanded. Currently some 12 or 15 aerospace firms have been or are involved with Solar Power Satelites. However, if solar power is to be the people's power, one would expect such a vast publicly funded program to be federally-owned and operated, rather than the property of a few private corporate giants.

As a general statement, when the survey of growth demand, development status and prospects for future energy from all sources is completed, one can only conclude that all sources must continue to be deveoped, with as much public benefit emphasis as possible. Until employment impact analyses are made, until supply, demand, reserve and private cost and financial data are reliably reported, then working people have no choice but to accept the assumptions of orthodox economists and energy experts.

For if the lights do go out, or the power is shut off, or the oil does stop flowing, working people will be the last to know and the first to find it out.

CONSERVATION

Meantime, there are certain conservation measures which can be undertaken to prolong the life of nonrenewable resources, and hopefuly will delay further increases in energy prices.

A functional definition of conservation is taken from Dr. Duane Chapman, in Energy Conservation, Employment and Income, published last year.

"Conservation in a philosophical sense has taken two partly contradictory meanings, one emphasizing the preservation of natural environments and the other giving its concern to the public interest in the proper management and development of natural resources."

Energy conservation, therefore, is not simply a matter of "returning the earth" principles. It is not a no growth economic principle. It is not a return to the horse and buggy days or some idyllic and pastoral early 18th Century never-never land.

Energy conservation is not abandonment of the nation's technology base, nor the impediment to future technological development. It is not lower living standards or a downgrading of skills and wage and income levels.

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It may be development and mass marketing of the electric automobile. It may mean the upgrading of skills and income levels of mechanics, tradespeople and workers in general.

Energy conservation is more than turning-off lights, abiding by speed limits, setting the thermostat at 65° and wearing warm wollen sweaters indoors. It is corporate responsibility to refrain from non-competitive and price gouging practices. It is corporate responsibility to serve the consuming public first, at the expense, perhaps, of profit maximization. It is government responsibility to regulate the regulated in the interest of the public and social accounting system.

Energy conservation is a greater sharing of privately held, whether usurped or purchased, resources, with members of the public at large.

CONTROL OF ENERGY COMPANIES

If we are to get a handle on the mind boggling dimensions of the energy issue, then we must somehow rise above the laws of economics that are distorting the discussion.

We must, instead, raise the issue on ethical grounds. We must infuse and elevate the discussion, to the plane of justice and equity. These human values must become the common denominator in solving the energy crisis.

With that understood, we can then reduce the problem to five manageable components. These five components of the energy problem are:

Control, allocation, prices, profits, sacrifice.

Control is the key to the other four elements.

The energy companies seized control of the oil industry at the turn of the century. That is well known. What may be less well known is that they became multinational oil companies after World War I, when they, with considerable and indispensable help from the U.S. State Department, gained valuable concessions in the Mideast. They were in Mexico before that. One of the historical amazements of that turbulent period in Mexican history is that the American oil interests were able to prevail upon both sides of the Mexican civil war to preserve their oil fields and pipelines. Apparently that is what General Pershing was doing down there. In reality, the Punitive Expedition was an oil preservation operation.

Another measure of the control and power of the oil interests occurred during World War II. Allied Forces were alarmed by fuel shortages. The Roosevelt Administration proposed public acquisition of the holdings in Saudi Arabia. That made eminent sense in terms of national security and the war effort. But it didn't make sense to the American oil interests. Operating from within the war councils, they torpedoed that proposal, and another, which called for construction of a government-owned refinery and pipeline in the Middle East. They termed public ownership as "fascist" and argued it would shackle "free enterprise." Standard Oil of California, Texaco, Jersey Standard and Mobil blocked the effort. Their concern was not the war effort, rather it was control over the supply of crude and the mischief it might cause to their pricing policy if the government delivered and sold to independents outside the fraternity.

Now Franklin D. Roosevelt was a powerful President. World War II was a powerful cause. But the oil companies were more powerful than all.

These are but two of many historical examples which demonstrate what we mean by control, with control meaning power. The oil companies have it and the government and people do not.

Currently, the multinational energy companies maintain and perpetuate their power through the manipulation of at least five levers of power.

First, Exxon, Mobil, Gulf, Standard of California and Texaco are, for all practical purposes, part and parcel of the OPEC Cartel. Along with British Petroleum and Royal Dutch Shell, they comprise the "seven sisters," who've dictated production, distribution, sales and prices since the 1920s, for Iraq, Iran, Saudi Arabia, and Kuwait.

All are vertically integrated, i.e., they not only drill and pump crude, but they refine, transport and sell petroleum products through their own retail outlets. "From the wellhead to the gas pump" is the common expression.

In spite of the Arab embargo, in spite of the takeover of the oil land themselves, by the Saudis, the Iranians and others, in spite of the OPEC countries arbitrarily increasing the price of crude fourfold, in spite of all this, Exxon, Mobil, Standard of California, Gulf and Texaco remain in the Middle East doing business as usual and enjoying the new artifically high world prices for oil.

And to remain there, they have had to influence, if not dictate, U.S. foreign policy, while assuaging the chauvinistic temperaments of kings, shahs and shieks.

The companies are in Venezuela and Canada, too, and in Algeria and Indonesia and Alaska and the North Sea and the Antarctic. But they have used the OPEC Cartel as a scapegoat to absolve themselves from any responsibility for the energy crisis and all the while they are part of it and reaping its benefits.

A second lever of power used by the energy companies is the joint venture. There are domestic joint ventures and foreign joint ventures. There are horizontal joint ventures and vertical joint ventures. There are temporary and permanent joint ventures.

All are used for one primary purpose: to reduce the rigor and risks of competition.

The joint venture is not a subsidiary; it is a step child; it is a separate corporate enterprise in which the bulk of the stock is owned by two or more parent companies.

Their are joint venture pipelines; joint venture refineries; joint venture exploration companies and joint venture bidding combinations for offshore and oil shale leases. The Alaska Pipeline is a joint venture.

This joint activity would seem to be prima facie evidence of anti-competitive abuses. Yet Congress and the Department of Justice are amazingly tolerant. No one know how many joint ventures there are among oil companies. Experts agree there are hundreds.

Experts also agree that joint ventures avoid competition; provide a common meeting ground for supposedly competitive firms; result in the exchange of information and production and marketing planning; concentrate economic power; and foreclose economic participation on the part of alternative businesses and potential competitors. And, needless to say, joint ventures have not led to lower prices for petroleum products.

Such behavior amounts to merger, which could be prosecuted under the antitrust laws. In fact, it has become clear, in view of the current energy debate, that we are dealing with one giant petroleum octopus with only its tentacles labeled Exxon, Gulf, Texaco, etc.

The third lever of control and power exercised by the energy industry is the interlocking directorate.

The Clayton Act states, "no person at the same time, shall be a director in any two or more corporations . ." which are engaged by virtue of their business and location of operations, as competitors.

Tell that to the energy cmpanies.

Primary interlocks occur between oil companies and other energy companies. General Dynamics, you may be surprised to learn, is a major coal producer, and has a director sitting on the board of Diamond Shamrock Oil Company, Republic Steel is also a big coal producer, and shares a director with Standard of Ohio. Republic Steel and Marathon Oil are also interlocked through one director.

In utilities, we find interlocks between Mobil and Consolidated Edison, Standard of Indiana and Commonwealth Edison, Standard of Ohio and Detroit Edison, and Getty Oil and Southern California Edison.

Imagine an environmentalist walking into a Con Ed board meeting and suggesting it switch to solar power, with the Mobil Oil director sitting there!

There's more. The oil companies are locked into uranium mining and milling companies, liquefaction and even solar energy research and development firms. And, to a lesser extent, natural gas.

The glue that binds this welter of corporate relationships together is—money. And money is the fourth lever the energy companies use to consolidate and expand their power.

At last count, fourteen banks were tied to 18 of the largest oil companies, through interlocking directorates. All the big names are involved: Exxon and Morgan Guaranty; Exxon and Chase Manhattan; Exxon and Bank of America; Gulf and Mellon National; Mobil and Chemical Bank; Mobil and First National; Texaco and Continental Illinois; Texaco and Chemical; Atlantic Richfield and Chase; Atlantic Richfield and First Chicago. There are dozens more. A diagram showing the lines running from oil companies to banks and back, looks like a piece of string art.

Banks aren't the only financial tie with the energy companies. Insurance companies, investment companies and foundations are very much a part of the complex, too.

For example, Continental Oil Company (Conoco) has primary interlocks with Bankers Trust Company, Morgan Guaranty and Continental Illinois Bank & Trust. These banks, in turn, have interlocks with insurance, investment, and other energy companies.

In case of the Conoco and Morgan Guaranty tie, secondary interlocks occur with four of the nation's largest insurance companies—John Hancock, Aetna, Metropolitan and Penn Mutual: two coal companies, three other major oil companies, two large utilities, and a gas pipeline.

That's all under the Morgan roof. Conoco has two other banks tied-in, in similar fashion.

Multiply this network by all the major oil companies, and some idea can be had of the enormous concentration of weatlh and power centered in the industry.

Interlocking directorates make it all possible.

It is difficult to perceive the lines of distinction and ownership between banks and energy companies. Ordinarily, one might expect it is the banks who ultimately call the shots. But when it is realized that literally millions of dollars in employee benefit funds are deposited by the energy companies, in the major banks, then the lines of authority and distinction become even more blurred. In effect, what we have is a siameze octopus, with the economy wrapped in its clutches.

There is one more lever of power employed by the companies and banks, virtually invisible, but essential to the economic and political hegemony. It is the accounting firm.

A mere seven firms audit the books of the largest oil companies. The services these firms render go beyond accounting and auditing, to include tax assistance. They perform well in the latter function. The multinational energy companies haven't paid taxes on their foreign profits for years and, in reality do not pay taxes here at home, since they are, in essence, tax collectors, who pass the cost of taxes onto consumers, in the form of prices. They also receive all investment tax credits enjoyed by other members of the corporate world.

The "Big Seven" accounting firms also design data processing and information systems, do consulting, executive recruiting and pension and investment planning for the companies.

The advantages of this concentration are fairly obvious. A uniformity of practices and procedures is established, which tends to reduce the industry to conformity.

Data for revenues, operating costs and other financial figures are closely guarded as inside and proprietary information, not to be divulged for public consumption or government regulatory purposes. There are ample cases where the energy companies and their banking trusts have refused to open their books to the Securities and Exchange Commission and even the Congress.

Finally, there remains the possibility that accounting firms are used as conduits for the flow and exchange of information and policy among and between the members of the energy-financial sodality.

These then are the levers of power used by the energy interests to control and monopolize the industry, victimize the economy and command the government.

To summarize, there are five:

The OPEC Cartel Arrangement
The Joint Venture
The Interlocking Directorate
Banking and Financial Institution Interties
The Accounting Firm Fraternity

Political contributions and the interchange of corporate with federal energy agency personnel are two highly visible abuses of power, but presumably are commonly known. Why belabor the obvious?

We can deduce from this didactic discussion, several generalizations.

The first is that structural challenges to and changes in the private control of energy investment are probably preconditions to the political possibility of solving the energy crisis in an equitable and just manner.

This is why we need continued regulation of natural gas and home heating fuels.

This is why we must insist on full financial disclosure from energy companies.

It is why we must look to the rejuvenation of federal anti-trust prosecutions in the energy industry.

It is why we must insist on horizontal and vertical divestiture of the energy giants.

It is why we must look toward public, as opposed to private development of alternative energy sources.

What has been described in this analysis of corporate control and power is a kind of reactionary socialism, which makes the future of American contingent upon investment decisions by and in behalf of a few corporate entities and extremely wealthy people.

When this or next winter's excessively high fuel bills come rolling in; when the gas pump prices increase and the electric rates soar through the fuel adjustment clause, it won't be the perpetrators of this energy scandal who will sacrifice and suffer.

Since the crisis of 1973/74, average weekly earnings of working people have increased roughly 6 percent per year. Energy company profit increases have outstripped wage increases nearly threefold—averaging 17 percent per year. The inequity for working people is bad enough.

For the seven million or more unemployed it is tragic. And unconscionable.

There is a fundamental and human right to the basic necessities of life. The energy cisis is denying this right to millions of Americans.

It remains for public spirited and progressive citizens to remind the nation's policy makers and the public, that the sun and solar energy belong to the people, not the energy companies; that the waters of the ocean and rivers belong to the people, not the monopolies that the children of the ghettos have as much claim to ownership of publc lands, oil shale and offshore oil deposits, as do a few private investors.

Senator KENNEDY. That was an excellent statement and testimony. Just before hearing from you, Mr. Mazzocchi, this point was perhaps well illustrated in the advertisement in the Washington Post last week. I don't know whether you say this.

Mr. WINPISINGER. Is that the same atrocity that I have here?

Senator KENNEDY. Maybe that is where I got it from. But the petroleum industry has never been shut down, not even for a day and it makes the point, to extract energy from the Earth the primary requirement is manpower. It must somehow save the needs for this manpower even if it shuts down for 100 days. In other words, the petroleum industry is capital intensive, it does not need a lot of manpower to extract the energy from the Earth, and it continues on.

Mr. WINPISINGER. I could toss in that it does need large chunks of money to search for and find oil and gas.

Senator KENNEDY. That is right.

Mr. WINPISINGER. That ought to be tossed out on the basis of false and misleading advertising.

Senator KENNEDY. Truth in advertising, yes. But it points up, as your statement has, the dimension of this whole employment issue.

Mr. Mazzocchi, I would like to ask you to proceed next.

STATEMENT OF ANTHONY MAZZOCCHI, VICE PRESIDENT, OIL, CHEMICAL & ATOMIC WORKERS INTERNATIONAL UNION, ACCOMPANIED BY FRANK COLLINS, CONSULTANT ON ENERGY MATTERS

Mr. MAZZOCCHI. I would like to express my appreciation and that of my organization for this committee focusing on what we consider a pivotal question, the relationship between jobs and the exercising of energy options. I will try to make my remarks as brief as possible and submit our prepared statement for the record.

In a lengthy congressional debate on energy policy, there has been very little attention paid to the connection between energy policy and levels of employment. Similarly the national energy plan presented by the administration had little to say about the impact of the plan on the working people of the country. There has been a great deal of discussion about the impact of these incentives—meaning large increases in energy prices—on the consuming public. However, this subcommittee's hearing is the first organized congressional consideration of the impact of the proposed new energy policies on employment opportunities for American workers, millions of whom are unemployed at the present time.

If we are to create jobs through energy policy, the Government must begin by requiring every energy proposal be accompanied by a formal jobs impact statement. This procedure would give the Congress and the administration an essential guideline for making choices between alternative energy technologies.

Even more importantly, employment impact statements must be required for energy policy proposals which effect going industries. An enormous energy industry already exists. It has more than 1 million workers and capital plant worth hundreds of billions of dollars. In addition, large industries such as the automobile and petrochemical industries are interlocked with the primary energy industry. Comparatively modest changes in energy policy could carry price tags of tens of thousands of jobs. Until energy policy stops being made in an information vacuum concerning employment impact, we are not going to create jobs through energy policy.

The so-called energy crisis of the past several years has turned out to be political and economic rather than one of actual shortages. The Arab oil embargo gave us a short-lived scare, now almost forgotten. The natural gas shortages of last year were mainly due to factors such as poor planning and diversions of interstate gas into intrastate use at higher prices.

The immediate crisis is political and economic and it centers around imported oil. Without the sudden quadrupling of the prices of OPEC oil, we would not be meeting here today. Without the OPEC price increases, there would be no general perception of an energy crisis except for a few ecologists crying aloud in the wilderness about shortages in the long-term future.

As the immediate energy crisis is political and economic, it is necessary to look at the history of the past few years before making grand decisions. Following the OPEC price rises in 1973–74, most of the countries of the world, including the United States, sank into the deepest recession since the Great Depression. Unemployment rose to the highest levels since the 1930's. Clearly, high energy prices were not good for workers. Since its peak in 1975, unemployment by official count has dropped less than 30 percent. High priced energy is the real meaning of the energy crisis.

Under these circumstances, it is strange that the No. 1 prescription for U.S. energy policy would be the further raising of energy prices. The arguments in support of higher energy prices are not for one minute concerned about possible recessionary effects of the continuing high levels of unemployment. Instead the propaganda for higher prices says (1) that producers need more money before they will go out and produce more energy and (2) that the way to conservation is through higher energy prices.

The argument that higher oil prices are required to encourage the companies to explore for oil is clearly self-serving. The price for newly developed domestic oil is now almost four times its preembargo price. How much more do the companies need to go to work?

The argument that higher energy prices are needed to conserve energy leaves us cold. Energy prices to the consumer have already doubled and tripled. The result was a recession. All that this kind of energy conservation means is that lower paid workers are expected to cut back because they cannot afford to pay ever higher prices while the affluent remain untouched.

The way to energy conservation is not high prices but well conceived programs to cut down on energy waste. A few of these programs have already been partially legislated. These include the regulations requiring annual improvement of the energy-efficiency of automobiles, the home insulation program and aid for public transportation. Much more needs to be done.

Energy conservation cannot do the whole job. In the long-term future, United States and world resources of the fossil fuels (oil, gas, and coal) will be eventually depleted. If alternative sources of energy are not deveoped, depletion means that the world will sink deeper and deeper into economic recession as the prices of remaining low-grade resources rise in response to higher costs of extraction.

But what is the time scale? Must we have a crash program for the development of alternative energy technologies or do we have more time?

The answer to whether we must have a crash program or proceed in a more deliberate way requires that we know exactly where we stand on the time scale of the eventual depletion of fossil fuel resources. Especially oil and gas. Where we stand depends, not on the dubious arithmetic of the amounts of oil and gas in place, but by how much it actually costs to get them out. These costs are not public information. The companies refuse to reveal the details of their bookkeeping on the costs of exploration, development and production. The data are withheld on the grounds that they are proprietary information. Unless and until these data are forthcoming, Congress is really not in a position to know the degree of urgency of the energy crisis.

Policy for the funding of research and the commercial development of the various energy alternatives is a critical matter. It involves choices, choices of the most desirable kinds of energy to promote and choices of their priorities. Congress is in a difficult position in making these choices. Large sums of research and development money are involved and the merits of the various options can be lost in the scramble of large corporate interests for contracts. It is therefore important that Congress construct durable criteria for judging the merits of competing energy options.

In assessing energy policy, it must be kept in mind that energy is only an intermediate. It is one of the means to the satisfaction of human needs. Therefore, energy policy is not an end in itself and the choice of energy options must be regarded as an avenue to broader national goals. The promise of ample energy supplies will do little to advance our society if increasing numbers of Americans are unemployed, the poor are poorer and the quality of life is degraded.

We propose three criteria for judging the desirability of an energy technology.

The first requirement is that it be safe, safe for the health of workers and the public and that it impose minimal disruption on the natural environment, beginning with its extraction from the earth. Full employment is of little use to a worker sick in the hospital or dead in the graveyard. We will not accept the proposition that workers' health and the natural environment must be further degraded in order to provide more energy. Health, safety and environmental concerns must be engineered into any new energy source. If an energy source is found to be inherently unsafe or highly destructive of the natural environment, then that energy source must be abandoned.

The second requirement is that the new energy source be reasonably priced. One of the bases of America's historic prosperity has been its abundance of natural resources including low-priced energy. An energy policy based on the alleged virtues of high-priced energy can only produce economic erosion and destroy existing jobs. It is essential that each energy policy be carefully examined with respect to the cost of a unit of energy to be ultimately delivered. This is particularly true in the case of new energy sources that are heavily subsidized in the course of commercial development. Some of these can turn out to be high-priced and uncompetitive, once the subsidies are removed.

The third requirement is that an environmentally acceptable and reasonably priced source of energy be also a fruitful source of jobs. Otherwise, we would not be creating but are destroying jobs through energy policy. We need to look at the wages and salaries content of a unit of energy delivered to the consumer. Where the energy source is capital intensive, we will find that the energy cost is largely made up of interest on borrowed money, profits on invested capital, and royalties. Interest, profits and royalties do not produce jobs. Returns on capital must first be subtracted from the consumers energy dollar before calculating the percentage that goes into pay for workers or, in other words, into jobs creation.

Finally, the largest jobs drain is our dependence on massive amounts of imported oil. OCAW calculations indicate that these imports are equivalent to the export of as many as 150,000 American jobs. In part, the high level of imports is due to existing Government policy. Amazing as it may seem, the foreign operations of U.S. based multinationals are in effect subsidized by the U.S. Treasury. These subsidies are in the form of foreign income tax credits, tax deferrals and other benefits not available to domestic operations. State taxes receive no equivalent consideration.

Early in January this year, IRS finally admitted that the per barrel "income tax" of many of the OPEC countries was legally invalid as a basis for a dollar-for-dollar income tax credit and that henceforth it would not be acceptable. Even if the tax credit is not restored by rewriting the tax laws of the various OPEC countries, other U.S. tax credits remain. If I were a multinational oil company, I would want to produce oil abroad where the U.S. Government policies help make it more profitable instead of here in the United States.

In concluding, I will say again that the current energy crisis is more a matter of energy prices and profits than of actual energy shortages. Where we stand with respect to the eventual depletion of fossil fuels, particularly oil and gas, is unclear because the energy companies do not let the public in on their bookkeeping. For the funding of alternative energy technologies, proper criteria must be established. The energy source must be reasonably priced, be benign with respect to impact on workers and the environment and create jobs rather than destroying them.

Thank you.

[The prepared statement of Mr. Mazzocchi follows:]

Prepared Statement of Anthony Mazzocchi

The convening of these hearings is a significant occasion as it is the first concrete step that Congress has taken to explore the effect of energy policy on employment. The final form of the energy legislation that Congress passes is highly important to labor, particularly to the Oil, Chemical and Atomic Workers International Union. This legislation will have major effects on employment in the primary energy industry and in all industries that are dependent on reasonably priced energy.

It is disheartening that, in the lengthy Congressional debate on energy policy, there has been very little attention paid to the connection between energy policy and employment. Similarly, the National Energy Plan presented by the Administration had little to say about the impact of NEP on the working people of the country. On the other hand, there has been much consideration of the financial incentives to the energy industry supposedly needed to elicit the production of more energy supplies. There has been a great deal of discussion about the impact of these incentives (meaning large increases in energy prices) on the consuming public. This Subcommittee's hearing is the first organized Congressional consideration of the impact of the proposed new energy policies on employment opportunities for American workers, millions of whom are unemployed at the present time.

If we are to create jobs through energy policy, we must begin by requiring that every energy proposal be accompanied by a formal jobs impact statement. The direct and indirect effects on jobs of a new piece of legislation are usually not obvious and must be carefully traced through all their possible ramifications.

An enormous energy industry already exists. It has more than one million workers and capital plant worth hundreds of billions of dollars. In addition, large industries such as the automobile and petrochemical industries are interlocked with the primary energy industry. A new energy policy can set up a chain of events affecting employment all down the line. As examples, a large increase in the price of natural gas or an industrial gas users tax could price a given petrochemical out of the world market. High priced natural gas would lead to high priced nitrogen fertilizer affecting the viability of many agricultural operations at a time when farmers are in economic distress.

The ripple effects of a given item of energy policy on employment in industries once or twice removed require to be mapped out. Calculations of jobs gained or lost as against energy or oil imports saved should be an essential ingredient of energy decision-making. A jobs impact statement attached to each energy policy proposal could prevent costly mistakes in legislation from being made.

When we turn to the alternative energy technologies proposed for the longer term future, a thorough analysis of the jobs impact is even more essential. Here, we propose to spend hundreds of billions of dollars over the years and set this nation on courses that are not easily abandoned or reversed. For this, we should be asking ourselves three questions. Is the proposed technology really feasible and safe? Is it economically viable and consistent with a healthy economy? Would the proposed technology contribute to the goal of full employment for our people? It is the last question that must be satisfactorily answered in a jobs impact statement before large funding of an alternative energy technology is undertaken.

First consideration must be given to the existing energy industries before proceeding to the alternative energy technologies that will be the energy sources of the longer term future. At the present time, the energy consumed in the United States is made up approximately as follows: oil, 43 percent; gas, 32 percent; coal, 19 percent; nuclear, 3 percent; and other (including hydroelectricity) 3 percent. Oil and gas alone account for three-quarter of the energy consumed in the U.S. and, when coal is added, the fossil fuels make up 94 percent of total consumption. These fuels will supply the bulk of our energy during the rest of this century and possibly much longer than that.

The status of oil and gas is different from that of coal. U.S. reserves of coal have been estimated to be sufficient for several hundred years at the present levels of consumption. The potential resources of oil and natural gas are smaller. However, there is no general agreement as to the approximate amounts of the potential resources in the United States or in the world as a whole. The conservative view is that world demand for oil will exceed available supplies by the late 1980's. However, some other qualified observers are of the opinion that oil supplies will be adequate for a much longer time. For instance, Grossling, a geophysicist with the U.S. Geological Survey, says that it is possible that the magnitude of oil resources may turn out to be two or three times conventional estimates. Estimates of natural gas resources are similarly vague. Mobile publicly expresses no concern about oil and gas supplies for the middle term future. All that is needed they say is deregulation to provide the necessary incentives for exploration and development.

The problem of the public being able to determine the probable magnitude of the resources of oil and gas is complicated by the fact that the fundamental geophysical data on which all estimates are based is not public information. All calculations of oil reserves and potential resources rely on generalized information furnished by the oil companies. The detailed geophysical data behind this information are proprietary. The oil companies have successfully resisted all Governmental efforts made so far to obtain these vital data. One thing is clear, however, the commercial interests of the companies are best served by the understatement of both reserves and the probabilities of future discoveries.

The lack of dependable and unbiased estimates of the oil and gas resources of this country and of the world places policy makers in a most difficult position with respect to the funding of alternative energy technologies. If the pessimists are correct that oil and gas will not be available in adequate quantities only ten years hence, the policy response ought to be to place the economy on a wartime footing with respect to the development of alternative sources of energy.

A quasi-wartime basis for energy research, development and commercialization implies the expenditure of vast amounts of money beyond present expectations. It implies haste with all the waste of money that crash programs entail. A longer time before the eventual depletion of oil and gas resources would enable a more deliberate and better considered approach to our energy future. The quantification of our probable resources of oil and gas is therefore one of the most crucial tasks facing this country today.

It is to be emphasized that the present "energy crisis" has turned out to be political and economic rather than one of actual world shortages. The Arab embargo cut off oil supplies for a time, but it did not represent any resource shortage. In fact, the subsequent higher prices for crude oil led to a glut of supplies which still persists and the natural gas shortages of last year in the United States were more due to factors such as poor planning and diversion of interstate gas into intrastate use at higher prices than to insufficient supplies at the wellhead.

The immediate crisis that we face centers around imported oil. Without the quadrupling of the posted prices of OPEC oil in 1973–1974, there would be little public perception of an energy crisis. Had the pre-1973 posted price schedule continued to this day, it would be difficult to persuade the American public that there was any urgency at all about energy supplies. Without the quadrupling of oil prices, it is highly unlikely that the prices of natural gas, coal and uranium would have shot up as they have.

Without the OPEC oil price rises, only a few ecologists would be crying aloud in the wilderness about energy shortages in the long term future. The ecologists are right. Eventually the supplies of all of the fossil fuels will be depleted. But that time has not been convincingly demonstrated to be imminent.

The events of the past five years serve to emphasize the important points that the United States is dependent on imports for almost one-half of its needed oil and that domestic supplies of natural gas may not be overly abundant. As pointed out earlier these two sources make up three-quarters of U.S. energy supply. Oil and gas are at the core of the energy problem and other energy sources are peripheral at the present time.

The remedies to be undertaken are subjects of great controversy. Tens of billions of dollars are involved and thousands of jobs are potentially at stake. Congressional decisions on energy will have major consequences on the general economy which can be beneficial or disastrous depending on the route taken. Under these circumstances, it is essential to look at the history of the past few years as a prelude to energy policy making.

Following the quadrupling of the price of OPEC oil in 1973–1974, most of the countries of the world, including the United States, sank into the deepest recession since the Great Depression. Unemployment in the industrially developed countries rose to the highest level since the 1930's.

There seems to be little disagreement among economists that the higher prices for oil either triggered the recession or were wholly responsible for it. Clearly, the higher prices being charged for energy were not good for business (aside from the energy industry) and not good for workers.

While industrial activity has improved since the 1975 trough of the recession, there has been only a modest improvement in the unemployment situation. In the United States, the unemployment reported by the Bureau of Labor Statistics has dropped by less than a third from the recession maximum. Furthermore, high levels of unemployment still persist in some countries previously noteworthy for their low levels of unemployment.

The United States is the only Western country that has regulated the prices of domestic oil and has successfully kept oil prices below the levels prevailing in other countries. The United States is also the country that has made the most significant recovery from the "oil recession."

Under these circumstances, it is strange that the number one prescription for a new energy policy should be the further raising of energy prices. Higher energy prices were the cause of the post-oil embargo economic decline and worldwide increases in unemployment. Before higher prices for oil and gas in the United States are even considered, critical macroeconomic studies should be carried out to assure ourselves that higher energy prices will not cause a repetition of the 1975 recession. These studies are not being made, at least, not visibly. OCAW fears that the implementation of higher oil and gas prices as an energy policy alternative could be the forerunner of a major recession.

The rationale for higher prices is (1) that producers need additional economic incentives to produce more and (2) that higher prices will promote conservation. We believe that neither of these arguments are valid in the light of the history of the past several years.

With respect to additional price incentives to the oil and gas companies, the present upper tier price of $12.18 for new oil (that developed after 1973) is more than triple its pre-embargo price. The oil companies in 1973 undoubtedly would have regarded a wellhead crude oil price increase of 30% to have been a bonanza. In contrast to the tripling of the crude oil price, the cumulative inflation of the consumers price index between January 1, 1974 and January 1, 1978 was 26 percent. It can be fairly asked what kind of a price increase would the oil and gas companies regard as an adequate incentive. Is there no upper limit?

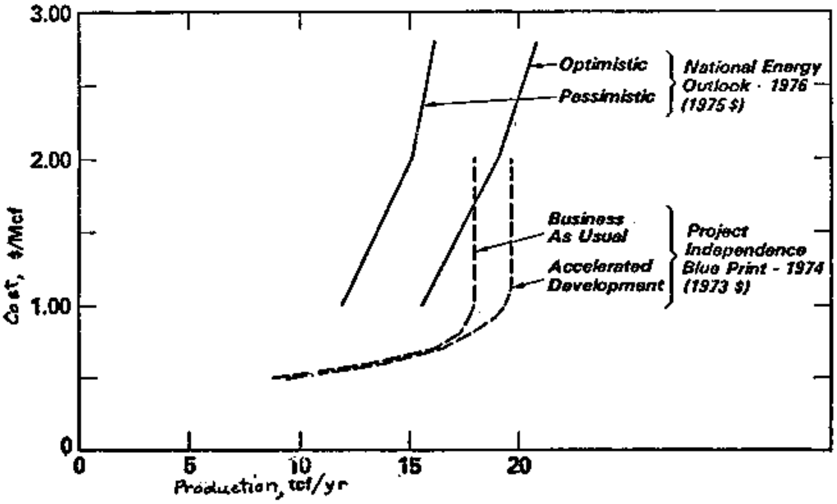
According to the Oil and Gas Journal, $10.5 billion will be invested in U.S. drilling and exploration in 1978, an increase of 12.3 percent over 1977. Expenditures for drilling and exploration in 1977 represented an increase of 17.1 percent over 1976. While some of this was absorbed by inflation, these increases in drilling activity have been sufficient to result in drilling rig shortages. It is not at all clear that still higher prices for crude oil and natural gas would promote much more drilling.

The Subcommittee on Energy of the Congressional Joint Economic Committee has issued a study dated September 19, 1977 entitled "The Economics of the Natural Gas Controversy". The following graph is reproduced from page 45 of this study.

While there is some discrepancy in figures between the Project Independence Blue Print–1973 and the National Energy Outlook–1976, the conclusions are similar. There would be little increase in natural gas production with large price increases in the long term. A further cost-benefit analysis is needed which would relate the benefits of more oil and gas production to the cost of more expensive energy to the consuming public and the recessionary influence of higher fuel prices.

Chart 1

Long Term Effect of Price on Natural Gas Production in 1985 - Non Associated Gas



It should be clear that whatever the outlook for the oil and gas reserves of the United States States, energy conservation is important.

In the long run, conservation of every form of energy will be forced on us by the constraints of nature if we do not succeed in reducing demand by social means. Particularly with respect to the fossil fuels, there is no advantage to unrestrained growth of consumption. This will only hasten the day of eventual depletion.

Energy conservattion is now a matter of national policy. The question remaining is how it is to be effected. Here the oil and gas companies and the Administration are in accord: The main highway to conservation is through much higher prices for energy.

It is true that higher prices for energy will temper demand. Oil demand did lessen after the massive OPEC price boosts, but at the cost of a recession and high unemployment.

The concept of conservation through arbitrarily higher prices is rationing by way of the ability to pay. Poorer workers are forced to cut back while the affluent are untouched. Not only are the poor unable to pay more for energy, but they pay a larger fraction of their income for energy compared to more effluent groups. In a 1972–1973 study (3), the following figures were obtained:

Income status	Average income	Percent spent on energy
Poor	$2,500	15.2
Lower middle	$8,000	7.2
Upper middle	$14,000	5.9
Well off	$20,000	4.1

With respect to individual consumers, the policy of arbitrarily high energy prices is a meat axe approach to conservation. The policy seeks to enforce frugality among a certain fraction of the population. But simply doing without and reducing consumption is a way to recession and unemployment resulting from reduced output.

Pricing, to be sure, has a definite role to play in a conservation policy, but it is one that must be specifically designed to achieve specific results. The existing pricing policy of most utilities, that is, of charging less per unit for using more is a economic policy designed to encourage waste. The effective way to long term energy conservation is to provide realistic and attractive alternatives to the consumption of energy to all consumers. This is also the effective way to promote switching from a fuel in short supply to a more abundant fuel.

Consumers are locked into their pattern of energy consumption, into the way that they heat their homes and commute to their jobs. Pilot lights waste 20 to 30 percent of the gas supplied to cooking stoves, but electronic devices for ignition are not generally available, either on new stoves or for retrofitting. The immediate problem of conservation in today's industrial society is more one of providing technological fixes than one of altering life styles.

Let us illustrate by an example. For the most part, the use of automobiles is unavoidable in most suburban and rural situations. Public transportation does not exist or else is intolerably inconvenient. There is no realistic alternative to driving to work and driving for necessary family business and recreation. The arbitrary raising of gasoline prices for necessary transportation constitutes a new kind of tax on consumers, lessening their purchasing power for other commodities and services, without materially contributing to conservation.

In contrast to the simplistic policy of high gasoline prices to conserve energy, the mandatory improvement of new automobile efficiency under the Energy Policy and Conservation Act of 1975 will reduce gasoline demand on a long term basis without undue consumer hardship. Similarly the provision of a convenient public transportation system by rebuilding and by the creation of new facilities will in time provide a viable alternative to our excessive dependence on the automobile, as well as creating thousands of new jobs.

Throughout, this nation's energy policy must be one of specific programs aimed at specific targets. There are, for example, two methods of approaching the conservation of energy used for space heating. One is to arbitrarily raise the cost of fuel so that the citizens of moderate means must do without, turn down the thermostat and be cold. This is the path to reduction in economic activity and decreased employment. The other way is to insulate and weatherproof by a combination of mandatory regulations for builders and economic incentives for retrofitting, such as guaranteed loans for homeowners. The second is the path to increased employment in the construction and the building materials industries.

As previously pointed out, the current energy crisis is one of high rates of imports of crude oil and high OPEC prices rather than one of actual shortages at the present time. The United States is dependent on imports for almost one-half of its needed oil and these imports are not dependable. Another embargo could be imposed or another series of artificial price increases could be decided on by OPEC.

The growing trade unbalance is primarily due to our large imports of oil and it is responsible for the weakness of the U.S. dollar. At last year's high prices of foreign oil, the United States had an international trade deficit of approximately $28 billion resulting from oil purchases of almost $45 billion. At the old prices of crude oil and the same volume of exports, the U.S. would have had a substantial trade surplus. Returns on American investments in foreign countries reduced the adverse cash unbalance, but the amount of $17 billion was still outstanding.

Imports of crude oil and oil products last year were equivalent to the export of more than 150,000 oil workers jobs overseas. This loss of jobs was partly balanced by the creation of jobs by exports from the United States to all countries. However, the adverse trade balance of $28 billion clearly indicates that more jobs were lost than gained. The first step to creating jobs through energy policy is the reduction of the present high volume of oil imports.

In part, the high volume of imports is due to existing Government policy. Amazing as it may seem, the foreign operations of U.S.-based multinationals are, in effect, subsidized by the U.S. Treasury. These subsidies are in the form of foreign income tax credits, tax deferrals and other benefits not available to domestic operations where State taxes receive no equivalent consideration.

Foreign tax benefits and other favorable tax treatment of the multinational oil corporations by the U.S. Treasury Department, not only reduces employment for U.S. workers, but the Federal tax losses are made up by additional taxes on the workers along with the rest of the taxpaying public. These lost revenues over the years have amounted to many billions of dollars. The foreign tax to the U.S. multinationals for oil produced in Saudi Arabia alone amounted to $2.1 billion in 1975, creditable against U.S. taxes.

The per barrel taxes paid on "equity" crude (that is, crude owned by the multinational) to the OPEC governments should never have been creditable on U.S. tax returns as foreign income taxes at all. These are not income taxes on total operating profits above costs but are some specified fraction of the posted price of a barrel of oil. As a per barrel tax, the socalled income tax has been a royalty, masquerading under another name.

Early in January this year, IRS finally ruled that the per barrel "income tax" was invalid as a basis for a dollar-for-dollar income tax credit and that henceforth it would not be acceptable. Even if this tax credit is not restored by rewriting the tax laws of the various OPEC countries, other U.S. tax credits remain which favor the foreign operations of U.S. multinationals as against their domestic operations.

The deferral of U.S. income tax until foreign profits are repatriated is another tax policy benefitting multinational oil corporations as against domestic companies. If the profits are never repatriated, then the multinational escapes U.S. income tax on the profits completely. Besides the clear subsidization of overseas production by tax deferrals, the deferral policy is an open invitation to the multinationals to capitalize overseas exploration and development instead of bringing the money home to finance these activities here.

President Carter has called upon Congress to pass needed legislation to abolish tax deferrals. It is to be hoped that this necessary legislation will be speedily passed.

As a vitally needed step in a jobs-oriented energy policy, it is essential that all remaining foreign tax benefits to the U.S. multinational oil companies be eliminated by IRS or Congressional action. Otherwise, government energy policy will continue to be in the position of subsidizing multinational operations abroad and subsidizing the export of U.S. jobs.

Let us now turn to the current pricing policy for crude oil. Under the crude oil entitlements program of the Energy Policy and Conservation Act of 1975, refiners pay the same for crude oil regardless of source. At the wellhead, the price for old oil (defined as that first produced before January 1, 1974) is $5.72 per barrel and that of new oil (first produced after January 1, 1974) is $12.18. The average price of foreign oil is $14.61 delivered to an American port. Domestic stripper oil (oil produced from wells with a field average of less than ten barrels per day) has been released from controls and has an average wellhead price of $14.58. North Slope Alaskan oil, because of high Trans-Alaskan Pipe Line transportation costs is handled so as to bring Alaskan oil on the West Coast into approximately parity with imported oil.

The entitlements program establishes a uniform price of crude oil to refiners (currently $12.36) in the following way. Refiners using the old oil buy entitlements costing the difference between $12.36 and the wellhead price of old oil. Refiners using other kinds of oil, receive entitlements benefits equal to the difference in price of the oil that they are buying and $12.36. The uniform price to refiners is calculated so that the entitlements payments and benefits balance each other out. The base prices and the uniform price to refiners are being revised upward each month, with the values of the entitlements being shifted accordingly.

The effect of the entitlements program is to equalize the prices of domestic and foreign crude to refiners. Thus there is no incentive for an independent domestic refiner to buy domestic oil as against foreign oil under existing U.S. policies. The refiner's choice will be controlled by crude quality and transportation costs from the domestic wellhead or from the port of entry in the case of foreign oil.

A domestic refinery owned by a multinational oil company with both foreign and domestic crude oil production facilities may buy from either source. The multinational will charge itself an artificial transfer price for its foreign crude. The transfer price is an internal bookkeeping number and it may set arbitrarily at any figure suiting the convenience of the company. The transfer price need have no relation to actual costs plus fair profit. In general, the multinationals will set the transfer price for foreign crude for their refineries at the prevailing market prices. They may, in fact, determine the market price. The market price for delivered foreign crude may differ considerably from the OPEC "posted price" plus transportation.

Under the entitlements program, the domestic refineries of a multinational will nominally pay the same for crude whether it is domestic or foreign. The decision of a multinational refinery as to whether to buy domestic or foreign will, of course, be determined by which crude yields the highest profits to the company.

With foreign tax credits and other economic benefits, the foregin crude may effectively cost the multinational less than domestic crude. In this case, the profit yield to the oil producing division of the multinational may be expected to be greater in the case of market-priced foreign crude than domestic price-controlled crude, particularly in the case of old oil. This means that there is a substantial economic incentive to the multinationals to import rather than to produce crude domestically.

An energy policy for creating new jobs (and saving present jobs) must be constructed so as to remove the economic incentive for importing oil instead of producing it domestically. One way would be to adjust the entitlements program so that refineries owned by multinationals pay more for foreign oil than for domestic. This would be, in effect, a multinational refiners reverse bias. The principle of the small refineries bias, whereby small refiners pay less for crude than the general refiners uniform price, is now well established so that no new concept is envolved. There are, of course, other ways in which the existing higher profitability of foreign crude to the multinationals might be dealt with.

The crude oil equalizations tax (COET) proposed by the Administration would not solve the problems of the high volume of imports brought about by the greater profitability of foreign crude compared to domestic. The purpose of COET would be to bring domestic crude oil prices up to the world level through the mechanism of wellhead taxes. COET would thus continue the present equalization of the nominal prices of foreign and domestic crude oil using taxation instead of the present entitlements payments. The incentives for the multinationals to import crude oil instead of producing it domestically would remain just as strong as at present. In short, COET would do little or nothing to change the current high levels of crude oil imports. Any reduction of imports as the result of COET would occur only as the result of some consumers being unable to buy oil products at the higher prices.

Imports of crude oil primarily affect employment in the producing end of the petroleum industry. Imports of refined products reduce U.S. employment in both production and refining.

It is a fact that domestic refining is more costly than foreign refining. This is because of higher American wages and other socially desirable benefits such as regulations to protect the health and safety of workers and regulations against environmental pollution. In addition, the foreign refining operations of U.S.-based multinationals receive favored U.S. tax treatment not available to domestic refiners. The tax benefits to foreign refining operations of the multinationals include the foreign income tax credits and tax deferrals mentioned earlier in this statement in connection with foreign crude.

At the present time, around 25 per cent of imported petroleum arrives in the form of refined products. This compares with approximately 60 percent in 1973 before the institution of the crude oil entitlements program. The reason for the decline in the percentage of refined products arises from the operation of the present entitlements program. Imported crude receives a $2.01 entitlements benefit while refined products, with some exceptions, do not receive entitlements benefits. Accordingly, the entitlements program provides a $2.01 advantage for importing crude oil and then refining it in the U.S. over importing the refined products. The $2.01 advantage is sufficient to offset the higher costs of U.S. refining compared to foreign refining.

The abolition of the entitlements program through the adoption of COET, or otherwise, would eliminate the $2.01 advantage for refining oil in the United States. The lower costs of refining abroad would restore the pre-1974 situation with the multinationals bringing in a flood of foreign refined products.

Rather than creating jobs through energy policy, the abolition of the entitlements program would decrease the utilization of domestic refining capacity and eliminate jobs. Therefore, if COET is passed, or if entitlements are abolished through other legislation, it will be necessary for the Congress to take steps to maintain the utilization of U.S. refining capacity and maintain refining jobs. There are several ways that this might be done. The Haskell bill, S. 2012, provides one such avenue. Under this bill, if the Secretary of the Treasury found that imports or refined products were impairing national security related to the maintenance of an economically viable domestic refining capacity, the Administration would be authorized to impose fees or tariffs on oil product imports. OCAW strongly supports S. 2012.

To sum up the OCAW position on jobs and oil policy, we do not see still higher prices for oil as effective either for stimulating new oil production or as a Draconian measure for conservation. The price increases that have already taken place have by now produced a drilling boom. Conservation enforced by higher product prices raises the danger of a new recession and is inequitable, the burden falling on the poorer workers. Conservation of oil is better achieved through the development of realistic alternatives to oil consumption in place of merely cutting back. Conservation through realistic alternatives to consumption would produce jobs, while frugality through higher prices will surely decrease jobs.

The case of natural gas differs considerably from that of crude oil. The United States is nearly independent of gas imports at the present time. In fact, on a BTU basis, one-third more natural gas is produced in the U.S. than crude oil. Imported natural gas consists of some diminishing quantities of pipeline gas from Canada and small quantities of liquefied natural gas (LNG) from overseas. Natural gas, therefore, does not contribute in a significant way to the U.S. unfavorable balance of trade.

As in the case of crude oil, there are fears of inadequate supplies of natural gas in time to come. As in the case of crude oil, it is difficult to come to firm conclusions as to the size of U.S. potential gas resources. This is for the same reason. The basic geophysical data on which estimates are made is regarded by the companies as proprietary information and withheld from the public.

Independent assessment of the actual size of present reserves is impossible in the absence of the detailed geophysical data. Here, the companies have an economic motive for understating reserves since a 1969 Court decision tied allowable FPC wellhead gas prices to the amount of recoverable gas in a field: the smaller amount of recoverable gas, the higher the price. Further, it is even possible to reduce the quantity of recoverable gas previously reported in a reservoir by revising downward the percent recoverable.

The same considerations apply to estimates of the probable size of natural gas resources that may exist in various regions of the country. While no field can be said to be discovered until it is actually successfully drilled, present technology of seismic measurements can yield fair advance estimates of the probability of gas (or oil) being present, and the likely amount. These measurements are not available to policy makers so that gas policy is being made in the dark.

It is not clear how much of the 1976–1977 gas shortages were due to inadequate stored supplies, inadequate pipeline capacity, diversion of interstate gas to intrastate use, illegal industrial use of interstate dedicated gas and newly developed gas withheld from the market in the hope of higher prices. Whatever the cause, the winter gas shortages caused the layoffs of tens of thousands of workers, illustrating the close connection between jobs and continuity of gas supplies.

The pricing and allocation of natural gas has been under regulation for a decade. In contrast, existing regulation of oil prices dates back only to 1974. Thus, legislatively, the case of natural gas has long been recognized to be different from that of oil. Natural gas production, transportation and distribution have been treated as being integral parts of a general public utility. This is for good reason. At no stage do the forces of free market competition effectively come into play.

A local gas utility has a limited or no choice of the pipeline from which it receives its natural gas. The gas pipeline has gathering lines connected to a limited number of gas producers. The local utility has no access to the totality of gas producers in this country. Thus, there can be no general competitive bids from the producing industry as a whole. This situation can be defined as a natural monopoly. It contrasts markedly from the case of coal where a buyer has a much larger choice of sellers.

Up to the present point in time, the Federal Power Commission (FPC) and now the Federal Energy Regulatory Commission (FERC) have established wellhead natural gas prices that are cost-based. This means that the price is set at cost plus a just and reasonable profit reckoned at 15 to 18% before taxes. Deregulation would mean that the producers would be free to charge what the market would bear to distribution systems that have little or no choice of alternative suppliers. There is little recourse available to consumers against unjustifiably high gas prices.

Deregulation of natural gas prices has been strenuously lobbied by the gas producers who argue that additional price incentives are needed to promote exploration and development of new gas supplies. OCAW believes that adequate incentives already exist under the present policy of cost-based pricing. We recognize that gas and oil drilling is a risky business. Dry holes are part of the risk. It is reasonable that losses from these risks be included in the overall balance sheet upon which cost-based pricing is calculated. Additional allowances for risk are possible without abandoning the important principle that wellhead gas prices be established on cost plus fair profit.

As stated in the foregoing, OCAW is opposed to high gas prices as a mechanism for achieving conservation, either by individual consumers or by industry.

Individual consumers, at least on any short-term basis, are locked into their existing uses of gas by their installed appliances. If a program of limiting the residential use of gas is to be established, it must be a program for retrofitting existing appliances to improve their efficiency or for providing for their replacement by appliances using other fuels.

Even for industrial gas users, legislative attempts at enforcing conservation by higher prices or special taxes can easily miscarry. The technology of many industries makes the substitution of gas by coal difficult or impossible. Further, the uncontrolled price of coal may rise in parallel with the price of gas.

These higher costs would naturally be passed on to the ultimate consumers, thus contributing to continuing inflation. In the case of petroleum refining, petrochemicals and some other industries, further rises in prices would make them less competitive against foreign products.

Again, the way to conservation is through specific programs aimed at specific targets. There are wide disparities in the abilities of industries to shift from gas to alternate fuels. The ability of an industry to shift its fuel use will depend on the category of industry, the specific use of gas within the industry and the geographical location of the particular plant. Fuel substitution programs using the regulatory mechanism can be fine-tuned to take due account of these specific factors. A program of higher prices would take account of none of them.

Coal and uranium, as energy sources, are best examined together. Most of the coal consumed outside the steel industry and all of the uranium outside weapons-making and research are used for producing electricity. The jobs impact of coal and uranium are both linked to the jobs impact of electricity as a form of energy. Electric power is both thermodynamically wasteful and highly capital intensive. Both of these facts reduce the number of jobs made available per unit of electricity delivered.

Heat can only be partly converted into mechanical work. The rest of the heat not converted is lost to the environment (thermal pollution). Heat engines, heat turbines and the like have thermal efficiencies ranging from 5 to 40 percent. The generation of electricity is a form of the conversion of heat into the ability to do mechanical work. Approximately two-thirds of the heat used in the generation of electricity by a thermal power plant is typically wasted due to thermodynamic loss.

It follows that the use of electricity as a simple heat source, as in space heating, is very wasteful. The conversion of $12 per barrel oil into electricity at 40% efficiency amounts to a fuel expenditure of $30, not counting the other costs of electricity generation and distribution. The use of heat pumps instead of electrical resistance heaters can eliminate much of the thermodynamic energy loss, but only at the price of an increase of capital intensiveness due to heat pump costs. It is obvious that considerable energy conservation could be obtained by reserving the use of electricity to high grade uses such as driving motors, electrolysis for metallurgy, electric lighting, etc. where fossil fuels cannot be used directly. High grade uses of electricity account for less than 10 percent of U.S. energy consumption compared to a total of 28 percent going into the production of electricity for all uses.

In terms of capital costs per unit of energy delivered, electric power is the most capital intensive form of energy. For the delivery at ten trillion BTU per year of new industrial energy, nuclear electric power requires an investment of $950 million, coal electric power $700 million and natural gas $190 million. (Oil and Gas Journal, May 29, 1978, p. 29) The direct capital expenditures provide jobs for construction workers and workers in the equipment industries. The indirect capital costs, such as interest on borrowed money and profits on equity, may amount to three or four times the cost of the power station over its useful life of 30 to 40 years. Indirect capital costs do not directly provide jobs. From the standpoint of the creation of new jobs, it is clear that the least capital-intensive source of energy is to be preferred.

Whether uranium or coal is the most economical fuel for the generation of electricity is yet to be determined. Fuel costs are lower for nuclear power plants but capital costs are higher, offsetting the lower fuel costs. Uranium, in spite of

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its earlier promise, appears to be now merely competitive with coal instead of being clearly less expensive. Due to recent lessened demand for electricity, planned electric generation has been cut back. Projected nuclear facilities have been cut back more than fossil fueled ones. However, because of the ability of the public utilities to pass on increases in fuels costs, it is likely that decisions involving coal *vs.* nuclear are being made on bases other than direct fuel costs. These include the longer lead-times required for nuclear power stations compared with coal ones and fears regarding political decisions on nuclear weapons proliferation, reprocessing and nuclear waste disposal.

From the standpoint of the health and safety of workers, the question of coal or uranium as the preferable fuel is far from being resolved.

The health and safety hazards of coal are well-known and have been tolerated for centuries. Scores of coal miners die annually from accidents and thousands more die prematurely from black lung and other occupational diseases. The emissions from coal burning plants are deadly, contributing to lung ailments and untimely deaths in industrial areas.

The hazards of the uranium fuel cycle are less clear. The immediate short-term costs in lives and health of nuclear workers are less than coal. But the typical nuclear diseases are leukemia and cancer. These may take 20 to 30 years to develop from exposures to low level radiation. Thus the ultimate costs of nuclear power to the health and safety of workers and of the general public are still undetermined.

The world's resources of the fossil fuels and of uranium are finite in amount. While there may be no imminent dangers of scarcities of these fuels, it is clear that, at some future time, these resources will be depleted. There will be no exact time of depletion. Mineral resources are not like oil in a barrel. Instead, as the exhaustion of a resource nears, real scarcities drive the price upward, making it worthwhile to expend more money and effort in exploring for and extracting lower grade deposits and deposits in more inaccessible locations. Eventually a fuel will become more costly than some new energy source and will be replaced by it.

Interestingly, no fuel in general use has yet been historically replaced by another fuel because of resource depletion. Wood was replaced by coal because coal was more convenient and ultimately cheaper. In turn, coal has been largely replaced by oil and gas, largely on the grounds of convenience, but also because oil and gas can serve purposes for which coal is not suitable. This displacement has taken place in spite of the fact that oil and gas deposits originally in place were less than recoverable coal deposits.

The above raises the point that no energy resource or technology can be a one-to-one replacement for a given energy resource. This means, above all, that no one energy source or technology can be a universal replacement for the several energy sources now in widespread use. Electric power cannot easily serve all of the uses of oil and gas as, for example, the motive power of automobiles. Coal, in many cases, is not a good substitute for gas, no matter the cost.

Because of their physical properties, oil from shale and oil and gas from coal are likely successors to crude oil and natural gas at some future time. Their cost stands in the way of this replacement occurring before the prices of oil and Natural gas are driven up by resource depletion. Coal and oil shale resources are are large, but in the long run, these too will be exhausted.

Eventually, all energy will have to be derived from essentially inexhaustible sources, These include breeder reactors, fusion reactors, solar and geothermal energy. Solar energy, as well as direct radiation, includes indirect solar sources such as biomass, including wood, and the winds. Further, it is quite possible that other inexhaustible energy sources may be discovered and commercially developed in the course of time.

Prototype commercial breeder reactors of the uranium, liquid metal cooled type have been constructed in the U.S., U.K., U.S.S.R. and France. The U.S. Fermi I reactor had a near meltdown because of a construction blunder and was abandoned in 1971. The later breeder reactors in Europe are still in the developmental stages and their economics and safety have not yet been completely demonstrated. At this point in time, it is difficult to say whether breeder reactors will become a viable source of energy. It is clear, however, that breeder reactors would be even more capital intensive than present uranium fission reactors, meaning more interest on borrowed money and profits to owners and fewer jobs.

Nuclear fusion would combine nuclei of hydrogen and its isotopes to produce helium with the release of enormous quantities of energy. The technical feasibility of a sustained fusion reaction has not yet been proven in the laboratory. There is no clear evidence that present experiments are even on the right track. If sustained fusion reactions become successful, it will be probably at some distant point in the future. From present indications, however, fusion reactors would be the most highly capital energy source of all and, therefore, create fewer jobs.

Solar energy in its direct and indirect forms, is being urged as the most promising candidate as an inexhaustible source of energy to replace present declining energy sources. There is much to recommend this point of view. Solar radiation reaching the earth's surface is manyfold larger than all present energy needs, and it is non-polluting.

Solar energy is not a new technology. It is a fundamental part of the ecology within which man and all his works are embedded. We could not exist one day without solar radiation. For thousands of years, our activities have revolved around the use of solar energy. In agriculture, beyond photo-synthesis, the sun has been used for drying crops and many other purposes. Regional housing has been designed to take advantage of natural solar heating and to exclude the sun and to promote air convection cooling in hot weather. The use of solar energy has been greatly reduced during the last century because of the convenience and lower labor costs of energy derived from fossil fuels.

Solar energy, as popularly understood, has two meanings. One is to increase the utilization of traditional uses of the sun. The second is to take advantage of advanced technology to use solar energy in new ways. It is with the second, its advantages and drawbacks, that we are here principally concerned.

The most promising immediate direction for solar energy utilization is for simple heating purposes. More than one-quarter of the energy of fossil fuels is now used for space heating and industrial heating. With the use of comparatively simple technology, much of which already exists, much of this heating could be done by solar energy. Back-up systems would have to be provided where heating may be required at times when solar radiation is not available.

From the technological standpoint, solar cooling is not as straightforward as solar heating. For cooling, a simple solar heat engine is required to power a heat pump to remove heat from space to be cooled into the warmer environment. Again, a back-up system is needed if cooling is required in the absence of sunlight.

In the early uses of the fossil fuels their prime advantage was their easy conversion into motive power, even with low thermodynamic efficiency. This convertibility of heat into motive power laid the basis for the industrial revolution. Direct solar energy is less easily convertible into motive power, while quite feasible.

There are two avenues for this conversion. The first is by way of photo-voltaic cells. Efficiencies of at least 15 percent are obtainable with present devices. This compares quite favorably with the efficiencies of most fossil fueled heat engines. However, at this time the efficiency of photovoltaic cells is less than the efficiency of conventional electric power plants which operate at an efficiency of 30 percent or more. New research findings indicate that the conversion efficiency of solar cells can be greatly improved.

The main difficulty with solar photovoltaic cells is that the electric power that they produce is low voltage direct current. This current must be electronically converted to alternating current and then stepped up to high voltage current by a transformer. This is necessary so that it can be compatible with conventional electric current for its end uses. A second difficulty is that the sun's radiation is variable so that either high cost storage batteries are required or a conventional electric power plant must be used for back-up.

The second way of using direct solar radiation to generate electricity is to concentrate the sun's rays to drive a heat engine which then drives an electric generator. This can be done on a small or a large scale. Here there is no difficulty with the compatibility of the current generated with that from conventional sources. But, again, back-up power is required because of the variability of solar energy inputs.

A highly imaginative proposal for solar electricity is that of a solar power station on a satellite located in a stationary orbit. The power generated would be beamed via microwaves to a terrestrial receiving station. In space, beyond the atmosphere and weather disturbances, the sunlight available for conversion would be much greater than here on earth. From the standpoint of jobs creation, the solar satellite would be highly capital intensive and would provide few jobs per billion dollars invested.

For most of its proposed uses, solar energy is well adapted to local small scale technology and thus avoids the large scale capitalization problems of the fossil fuel and conventional electric power. However, it cannot be denied that solar energy is also capital intensive. The main outlays are for the original costs of construction. Solar equipment requires essentially no operating labor and very little maintenance labor. The scale of most solar installations, as now proposed, is small. Solar technology is thus well adapted to individual ownership as contrasted to large scale corporate ownership.

As pointed out several times in the foregoing, solar energy devices of all kinds present a problem for many of their uses because of variability of solar inputs. Back-up energy systems are thus required for the periods when solar radiation is not available. This means that solar energy introduces the problem of duplicate capitalization: one set of capital requirements for the solar system and one for the back-up system. For electrical systems, the generation of large quantities of solar electricity would place a high fluctuating load on the back-up system. This would mean a low base-load on the back-up system and therefore higher costs of electricity. The capital costs per hour of the conventional electric power plant continue whether the plant is operating at capacity or not.

There are many other alternative energy technologies, such as geothermal. Little purpose would be served in going into them in a statement intended to be brief. Most of these alternative technologies have not been sufficiently developed at this time to permit sound evaluations of their future possibilities for providing mass sources of energy and of their jobs impact.

Senator KENNEDY. Mr. Ruttenberg, we will hear from you.

The one thing I had hoped that you might cover, as former Assistant Secretary of Labor, is whether this kind of information for this labor impact is available. Can it be done? We have heard quite unsafe responses on that, quite frankly, earlier today. Is there at least sufficient information to begin the process? We don't expect it to be definitive, if we have to develop, obviously, the techniques for doing that, it is going to be ongoing and continuing. It has not been done, certainly it has not been done effectively. That kind of information for jobs impact statement, is that available now? I would hope you could refer to that and we could hear from the others. Why don't you proceed with your testimony.

Mr. RUTTENBERG. Yes, thank you.

Senator KENNEDY. Perhaps you could summarize, we are going to vote at twelve and I want to move through and, get to some questions.

STATEMENT OF STANLEY H. RUTTENBERG, PRESIDENT, RUTTENBERG & ASSOCIATE, WASHINGTON, D.C., ON BEHALF OF EDWARD J. CARLOUGH, GENERAL PRESIDENT, SHEET METAL WORKERS' INTERNATIONAL ASSOCIATION

Mr. RUTTENBERG. I am here substituting for Mr. Carlough who would like to have been here, but his general executive council meeting which was supposed to have been over, continued over to today and he asked me at the last minute to substitute for him.

We have a much longer prepared statement which I will submit for the record. There is a much shorter oral statement which Mr. Carlough was going to read and in view of the time factor here today, Senator, I will also try to condense it even further, and then also make a comment about the manpower issue which you have raised.

Let me just read what Mr. Carlough would have said in part.

Mr. Chairman, the Sheet Metal Workers International Association appreciates this opportunity to make our views known about the importance of relating employment policies to our national energy program.

Our position is clear: Full employment and an effective energy plan go hand-in-hand. We can't solve the energy crisis until we first determine the labor impacts of the various energy alternatives before us.

Our union believes that each of these alternatives should be evaluated in terms of its employment impact so that we can choose those which meet both our energy and our employment needs.

I might interrupt to respond to your question briefly, Senator. We do not now have within the Federal Government the basic kind of data and information which is essential to answer the kinds of questions which you were directing this morning to Secretary Marshall and to Assistant Secretary Packer. I think it is vital, that there be some resources placed into the effect to develop the employment impacts of alternatives sources of energy, both geographically and as between the varying types of energy sources.

I would hope that one of the things that would flow from this hearing would be a request, a demand, upon the administration to begin producing this kind of information.

We are also, as the Sheet Metal Workers Union, strong supporters of solar energy as a major part of our national energy policy. Our union wants the Federal Government to give more support to this most promising of energy alternatives.

We are deeply concerned that the administration has chosen to cut Federal expenditures for solar energy at a time when funds should be doubled. The proposed budget for fiscal year 1979 slashes solar heating and cooling—the most promising and the most significant solar technologies—by $20.5 million. When adjusted for inflation, Senator McGovern made the point earlier, it is some $40 million. If the President had his way, a good part of that money will go instead to windmills.

Clearly, the administration has its energy priorities mixed up. I do not deny the usefulness of wind energy, but the need to reduce our dependence on oil and gas demands that we put more Federal money where it will have the most impact—into solar heating and cooling.

To achieve these goals, there are many choices available. We can harness nuclear power, sun power, wind power, ocean power, and much more. Each of these alternatives has its own unique impacts on labor. Unfortunately, very little has been done to provide useful data about those impacts.

It is essential that the administration and Congress get information about the many construction and operational jobs which will be created, what skills will be needed, how long the jobs will last, the availability of manpower, and the regions of the country where the jobs will be created.

Accordingly, Mr. Chairman, we recommend that Congress place the responsibility for measuring the employment impact of energy policy alternatives in the hands of the Federal agency most capable of performing that task. This should be the Bureau of Labor Statistics—which collects a wide variety of labor data—or the Energy Information Administration—which has statutory responsibility for measuring energy employment impacts. And my preference would be the Bureau of Labor Statistics. In addition, we recommend that—in the future—no major energy legislation be adopted until its employment impact has been determined.

As the national energy debate has proceeded, both the President and the Congress have bounced from impasse to impasse without the benefit of much vision. It is time the blindfolds were removed. We need only look up to the sky for what must certainly be the most promising of new energy sources—the Sun.

The sheet metal workers first gave their support to solar power almost 20 years ago. At that time, we noted that the tremendous demands being made on fossil fuels were the best reason to devote our attention to solar energy.

In the years since then, our union has been one of the most vocal proponents of solar energy in the Nation. In 1975, we recommended two studies which showed the positive relationship between energy policy and employment. These studies helped us to adapt our trade to solar technology. We have produced a film and installed all kinds of solar heating around the country which have proved the practicality and efficiency of solar energy. The national training fund of the sheet metal and air-conditioning industry—which is a labor-management training effort jointly supervised and administered by the Sheet Metal and Air Conditioning Contractors' National Association and our union—has cooperated with the Department of Energy in a comparison of the performance of air and liquid residential solar heating systems. Although more research is needed, preliminary results indicate the superiority of air over liquid solar systems.

Mr. Chairman, while we await the final results of this research, it is a misdirection of Federal funds for the Department of Housing and Urban Development to give preference to solar liquid systems. But that is exactly what they have done with grants under a $4.6 million demonstration program announced a year ago.

We urge this committee and Congress to call upon HUD and the Department of Energy to grant equal status to air and liquid solar systems when allocating Federal funds.

Throughout the remainder of this century, our objective must be to reduce our reliance on oil and gas. Both solar and nuclear power are ready and waiting to help us meet that objective. Nuclear technology is already in commercial use. The technology for solar heating and hot water systems is fully developed. And solar cooling and power technology is on the horizon. Both nuclear and solar energy can be an important part of our national energy plan. Solar systems have many advantages which are discussed in our prepared statement.

To harvest the advantages of solar energy will require a strong Federal commitment. That commitment should include the following measures:

(A) We must establish a national solar energy task force to set solar objectives and recommend the policies necessary to achieve those objectives.

(B) We must make a commitment to the maximum possible use of solar energy in new and existing buildings.

(C) We must provide tax credits for the residential and commercial installation of solar equipment, along the lines of legislation now pending before Congress.

In conclusion we recommend that the Federal Government promote energy conservation by encouraging the retrofitting of existing buildings and the installation in new buildings of energy conserving materials and equipment, including heat recovery and variable volume systems.

Mr. Chairman, I am proud of the lead which the Sheet Metal Workers' International Association has taken to actively support energy policies which are good for the American economy and good for the American people. I will be happy to answer any questions which you and the other members of this subcommittee may have.

I have rushed hurriedly through this, Senator McGovern, because I realize the time factor. I skipped over much of the already-reduced condensed statement.

[The prepared statement of Mr. Carlough, submitted by Mr. Ruttenberg, follows:]

PREPARED STATEMENT OF EDWARD J. CARLOUGH

Mr. Chairman, the Sheet Metal Workers' International Association appreciates this opportunity to make our views known about the importance of relating employment policies to our national energy program.

Our position is clear: Full employment and an effective energy plan go hand-in-hand. We can't solve the energy crisis until we first determine the labor impacts of the various energy alternatives before us.

What is needed is a qualitative discussion about the economic impacts of each of these alternatives. Our union believes that each should be evaluated in terms of its jobs impact so that we can choose those which meet both our energy and our employment needs.

We are also strong supporters of solar energy a major part of our national energy policy, and we believe that the Federal government must give more support to this most promising of energy alternatives.

The United States is in the grip of two crises which are closely intertwined. On the one hand, we are relying more and more on scarce energy supplies; on the other, our economy continues to be plagued with high unemployment and increasing inflation. The solution to both of these crises demands equal priority.

Nearly three-fourths of all energy consumed in the United States comes from petroleum and natural gas. During the years which have followed the Arab oil embargo, we have actually increased our reliance on petroleum as a fuel source.[1]

Of even greater significance is our expanding need for oil imports. Prior to the embargo, one out of every four barrels of crude oil refined in the United States came from foreign sources. Today, the figure is approaching one out of every two barrels.[2]

Over the past four years, domestic demand for petroleum has increased by almost 1 million barrels a day while the price of a barrel of imported crude oil has jumped from $2.60 to $13.85.[3]

Most shocking of all is our escalating reliance for oil on the very countries which cut off our supply in 1973. Last year alone, we imported one-third more petroleum from the Arab members of the Organization of Petroleum Exporting Countries (OPEC) than we did in 1976. We are now importing 72 percent more petroleum from the Arab countries than we did in 1973.[4]

The spiraling price of oil since 1973 has fueled inflation, dampened consumer purchasing power, and—most important of all—it has been a direct cause of unacceptably high levels of unemployment.[5]

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[1] See Table 1.
[2] See Table 2.
[3] U.S. Department of Energy, *Monthy Energy Review;* January, 1978.
[4] See Table 3.
[5] See Tables 4A and 4B; See also Congressional Budget Office, *Inflation and Unemployment: A Report on the Economy;* June 30, 1975; pp. 70–73.

There is a close relationship between the price of energy and the price of everything else since all commodities and services depend on energy. Prior to 1973, wholesale commodity prices had been increasing at the modest rate of 2 percent a year. But, since oil prices started to escalate in 1973, commodity prices have been inflating at 10 or more percent a year.[6]

This is a time when America cries out for leadership which will provide us with a bold, but realistic, solution to an energy crisis which has already dealt our economy a series of crippling body blows.

It is ironic that many of the loudest voices in the national energy debate have been urging increased energy prices as a means of encouraging expanded production of oil and gas. Higher prices—and the higher profits which result from them—may encourage the oil industry to produce more, but they will also inevitably lead to higher inflation and higher unemployment.

In arriving at a national energy plan, there is a myth which should be put to rest. It is the myth which places a direct relationship between increased energy consumption and economic growth.

The proponents of this notion are wrong. The history of the last several decades is a record of ever-expanding energy consumption, but that record has been no guarantee of prosperity.[7]

Increasing consumption of energy in specific industries or in specific regions of the country has not necessarily brought about equal increases in employment in those industries or regions. In fact, American industry has used energy to replace labor.

In the steel industry, for example, steel output increased between 1949 and 1969 by 45 percent while the number of production jobs decreased by 20 percent.[8] In the agricultural sector, where unemployment is currently one-third higher than the economy as a whole, the use of energy for fertilizers, chemicals and automated equipment has increased productivity, but it has also led to the loss of more than half of all agricultural jobs over the past 50 years.[9]

A recent newspaper advertisement touted the fact that the petroleum industry has never been shut down, while the coal industry is currently experiencing the longest strike in its history. In support of oil, the ad pointed out that the "petroleum industry is capital intensive. It doesn't need a lot of manpower to extract energy from the earth. [But] it does need large chunks of money to search for and find oil and gas . . . ."[10]

Inherent in this thinking is the notion that petroleum is an attractive form of energy because it saves labor costs. But there are capital costs, too. When these are calculated along with other economic costs, it becomes evident that excessive reliance on petroleum has a staggering price tag: inflation, high unemployment, an outflow of billions of U.S. dollars to foreign bank accounts, the loss of tens of thousands of U.S. jobs to foreign workers, an enormous trade deficit for which oil is largely responsible,[11] and the resultant weakening of the dollar on the world money market.

Mr. Chairman, we want to see economic growth, and we also want to see increased productivity. These are goals which are shared by both labor and management. But the point is that some forms of energy are more efficient and less costly to our economy than others. As we shift away from our reliance on oil and gas, the twin goals of energy efficiency and economic benefit are both equally important.

Each of the energy alternatives before us has its own unique impacts on labor. Unfortunately, very little has been done to provide useful data about those impacts. The shift away from a petroleum-based economy—which must be at the heart of our national energy plan—will result in the loss of jobs in some industries and in some parts of the country. But the shift to other forms of

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[6] U.S. Department of Labor, Bureau of Labor Statistics.

[7] A Resources for the Future study has found that data "do not support the widely-held belief that energy and Gross National Product (GNP) have grown at essentially the same rates. . . . It seems to be questionable to assert a rigid linkage between [the two]." Resources for the Future, Newsletter: Fall, 1976.

[8] Natural Resources Defense Council, *Choosing An Electrical Energy Future for the Pacific Northwest: An Alternative Scenario*: 1977.

[9] Dennis Hayes, Energy: *The Case for Conservation*; Worldwatch Institute 1976.

[10] Advertisement sponsored by the Delta Drilling Company in *The Washington Post*, March 10, 1978.

[11] In testimony before the Energy Subcommittee of the Joint Economic Committee, Assistant Secretary of the Treasury, C. Fred Bergsten said: "The increased price of oil has been the single most important factor underlying the adverse shift in the U.S. trade balance." March 9, 1978.

energy will result in the creation of new jobs in more industries throughout the country.

It is essential that the administration and Congress get information about how many construction and operational jobs will be created, what skills will be needed, how long the jobs will last, the availability of manpower, and the regions of the country where the jobs will be created.

Both the Department of Labor and the Department of Energy currently use a CMDS model to measure labor impacts, but it focuses on construction jobs only. It is equally important to know the operations and maintenance labor impacts.

In addition, there are other models in use by both the government and industry, yet none is able to provide employment impact data for each of the major energy alternatives on a regional basis. Only this type of disaggregated data will be useful to energy policy planners. In addition, this is information which will be valuable to both labor and management in planning for the future. And it will help the American people to better understand what lies ahead as we switch from our dependence on oil and gas.

It is important for all of us to understand that the solution of the energy crisis need not require a reduction in the quality of our lives. Because of the importance which job opportunities and job security have for everyone, data about the employment impacts of energy alternatives is vital.

Accordingly, Mr. Chairman, we recommend that Congress place the responsibility for measuring the employment impact of energy policy alternatives in the hands of the Federal agency most capable of performing that task. This should be either the Bureau of Labor Statistics (which collects a wide variety of labor data) or the Energy Information Administration (which has statutory responsibility for measuring energy employment impacts).

In addition, in order to assure that energy employment impacts are given adequate consideration, we recommend that—in the future—no major energy legislation be adopted until its employment impact has been determined.

As the national energy debate has proceeded, both the President and the Congress have bounced from impasse to impasse without the benefit of much vision. It is time the blindfolds were removed. We need only look up to the sky for what must certainly be the most promising of new energy sources—the sun.

The Sheet Metal Workers first gave their support to solar power almost twenty years ago. At that time, we noted that the tremendous demands being made on fossil fuels were he best reason to devote our attention to solar energy.[12]

In the years since then, we have given our active support to solar power as a source of energy for home heating and cooling. In fact, our union has been one of the most vocal proponents of solar energy in the nation.

In 1975, we commissioned two studies which showed the positive relationship between energy policy and employment.[13] These studies helped us to adapt our trade to solar technology.

Today, we are actively working to promote the expanded use of solar power. We have produced a 23-minute film which explains how we can gather, store and use the sun's energy, and how solar systems operate.[14] And we have produced a wide variety of printed materials to acquaint both our members and the public with the benefits of solar energy.

The Sheet Metal Workers have also initiated or participated in several construction projects which have proved the practicality and efficiency of solar energy. For example:

(1) Local 55 on Long Island, New York, and the Joint Apprentice Building Committee of Local 80 in Michigan have both built solar powered apprenticeship schools;

(2) Members of Local 67 in San Antonio were involved in the installation of the nation's largest solar energy collection system at the physical education complex of Trinity University;

(3) Members of Local 219 in Rockford, Illinois installed a solar heating system for a drive-in bank;

(4) Members of Local 48 in Decatur, Alabama installed 672 solar collectors for use in drying soybeans at the Goldkist Soy Facility.

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[12] Sheet Metal Workers' International Association, *Sheet Metal Workers Journal*, May, 1959.

[13] Mitre Corporation, *Impact of Energy Developments on the Sheet Metal Industry;* Stanford Research Institute, *Strategic Implications of Solar Energy for Employment of Sheet Metal Workers;* June, 1975.

[14] National Training Fund, "Under the Sun."

Mr. Chairman, these are but a few of the examples of the work which our union's members are doing to make solar energy a reality. In addition, the National Training Fund—a labor-management training effort jointly supervised and administered by the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) and our union—has cooperated with the Department of Energy to compare the performance of air and liquid residential solar heating systems.

In the latest report on this on-going comparison project, researchers stated:

"Overall, the flat-plate air heating system provided 40 percent more solar energy for space and domestic water heating based on gross unit collector area than the flatplate liquid-heating system. . . .

"The air system operated over a longer period of the day than the flat-plate liquid system. . . ." [15]

Mr. Chairman, we believe these preliminary results indicate the superiority of solar air over solar liquid systems. While we await the finals results of this research, it is a mis-direction of Federal funds for the Department of Housing and Urban Development to give preference to solar liquid systems; but that is exactly what they have done with grants under a $4.6 million demonstration program announced a year ago.

We urge Congress to call upon HUD and the Department of Energy to grant equal status to air and liquid solar systems when allocating Federal funds.

Throughout the remainder of this century, our objectives must be to reduce our reliance on oil and gas. Both solar and nuclear power are ready and waiting to help us meet that objective. Nuclear technology is already in commercial use. The technology for solar heating and hot water is fully developed. And solar cooling and power technology is on the horizon. Both nuclear and solar energy can be an important part of our national energy plan.

Based on current policies, it has been estimated that all forms of solar power will supply between 22 and 25 percent of U.S. energy demand by the year 2020. Sixty percent of that share will be devoted to the heating and cooling of buildings.[16] With the kind of expanded solar effort which the Sheet Metal Workers support, solar energy could make a far greater contribution to alleviating our reliance on oil and gas.

For example, President Carter has set a goal of two and a half million solar heated homes by 1985. That is a goal which we believe is both highly desirable and attainable. But, we also note that at least one energy expert (who will be appearing before this subcommittee) has stated that California alone will have more solar collectors installed in homes by 1985 than is forecast for the entire nation.[17]

In short, Mr. Chairman, solar energy isn't science fiction. We don't need to waste another day waiting to reap its benefits. Let me list a few of the most important ones:

(1) *Solar energy is available everywhere.*—The sun's energy can be tapped in one form or another everywhere. It can be tapped when the sun shines or when the wind blows. Organic matter can be converted into power, and the temperature differences within oceans can be harvested to produce power. Each of these is a form of solar power.

(2) *Solar energy is renewable.*—Unlike almost all other fuels, solar energy is renewable. In fact, for the next several billion years, it will be inexhaustible.

(3) *Solar energy is not controlled by the giant corporations.*—The solar industry consists primarily of small businesses, unlike oil and gas which are controlled by a few large corporations. By relying more and more on solar energy, we will over time break the monopolistic hold of the oil companies on our national energy policy.

(4) *Solar energy is environmentally sound.*—No form of energy receives more support from environmental organizations than solar energy.

(5) *Solar energy is safe.*—From the standpoint of both the public and those who must work with solar equipment, solar energy is safe.

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[15] Solar Energy Applications Laboratory, Colorado State University, *A Performance Comparison Between Air and Liquid Residential Solar Heating Systems*; January, 1978.

[16] H. Craig Petersen, National Science Foundation, *Sector-Specific Output and Employment Impacts of a Solar Space and Water Heating Industry*; December, 1977; p. 2. Also, General Accounting Office, *The Magnitude of the Federal Solar Energy Program and the Effects on Different Levels of Funding*; February 2, 1978; p. 3.

[17] Wilson Clark, energy adviser to Gov. Jerry Brown of California, as quoted in Dennis Hayes, "We Can Use Solar Energy Now," *The Washington Post*, February 26, 1978.

(6) *Solar energy will let us reduce our oil imports and our trade deficit.*—Our trade deficit for last year amounted to over $30 billion.[18] in the same year, we spent $45 billion on foreign oil. In 1972, our expenditures for foreign oil were less than $5 billion.[19] Not only is our dependency on foreign oil causing a serious capital drain, but we are losing tens of thousands of jobs, as well. Using even the conservative estimates of solar energy's potential, we can reduce our oil imports by five to six percent within the next seven years and we can get back many of the jobs which have beten lost.[20]

(7) *Solar energy makes use of available manpower in regions of the country where jobs are needed the most.*—The skills required for installation of solar equipment are very similar to those required for conventional construction projects.[21] For the fabrication component, work opportunities will include glazing, metal extrusion, and component assembly—all skills which are presently in use within the industry. Our National Training Fund has already undertaken programs to retrain our journeymen and train our apprentices in the techniques required by solar technology.

Initial installations of solar equipment are likely to take place in the South and Southwest. It is precisely in these areas where construction unemployment is high. Over the long run, solar energy is expected to be competitive with other energy forms in all parts of the country. The result will be solar jobs as geographically dispersed as the building industry.[22]

(8) *Solar energy is labor intensive.*—Most solar devices are manufactured from inexpensive materials often using small and relatively uncomplicated equipment. Much of the work involving the installation of solar equipment requires direct, on-site labor. These factors combine to make solar energy more labor intensive than any conventional form of energy.[23] Not only is this greater labor intensity evident in the construction phase, but it actually increases during the operational phase of the solar system.

Mr. Chairman, nationwide, we estimate that about one out of every five sheet metal workers is presently unemployed. In some areas of the country, the jobless rate for our trade is much higher. Unemployment throughout the rest of the construction industry is also quite high. What makes solar energy attractive is that it not only creates jobs, but it also is one of the most effective alternatives available for meeting our energy needs.

Mr. Chairman, I have listed some of solar energy's potential and its advantages. For many years to come, it will be a supplement to oil, natural gas, coal, and nuclear power. What is most important is that we adopt policies which encourage the transition from an economy based on oil and gas to one based on alternative sources of fuel.

In making this transition, energy prices should not be the primary tool. If the decision is made to increase the price of oil and gas to make alternative forms of energy more cost-competitive, it will be moderate and lower income Americans who will bear the burden.

We must, instead, hold down the prices of conventional fuels while, at the same time, providing stronger Federal incentives for alternative energy sources.

With a sustained Federal commitment to solar energy, for example, the day will not be distant when homes, schools and office buildings will be heated and cooled by the sun. Shopping centers and industrial parks will have much of their power needs met by decentralized solar systems; and more centralized systems will provide the power which communities need to turn on lights, operate residential appliances, and run machinery.

Let us understand, however, that we will never reach this goal without strong Federal commitment including the following measures:

(A) We must establish a National Solar Energy Task Force to set solar objectives and recommend the policies necessary to achieve those objectives.—The Task Force should consist of representatives of government, construction labor and management, industrial and commercial consumers, other consumers, the financial and insurance industries, and equipment manufacturers.

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[18] See Bergsten testimony, note [11] *supra*.
[19] *Ibid*. Bergsten also stated that $36 billion of the $45 billion we spent on foreign oil was due to higher prices.
[20] See General Accounting Office, note 16, *supra*.
[21] Office of Technology Assessment, *Application of Solar Technology to Today's Energy Needs*, revised edition.
[22] *Ibid*.
[23] See Table 5 for an example of solar's labor intensity.

(B) We must make a commitment to the maximum possible use of solar energy in new and existing Federal buildings. There could be no greater sign of Federal buildings. There could be no greater sign of Federal support for solar energy than the installation of solar equipment in the White House, in congressional buildings, and in the Supreme Court. Both the Sheet Metal Workers and contractors stand ready to offer their services to this most vital of projects at cost.

(C) We must provide tax credits for the residential and commercial installation of solar equipment along the lines of legislation now pending.

(D) We must establish a National Solar Bank to—

(1) provide cheap loans or grants to lower income families to encourage them to take advantage of solar energy tax credits;

(2) provide low-cost financing to homeowners and small businessmen seeking capital to install solar equipment;

(3) provide low-cost financing to farmers seeking capital for agricultural applications of solar energy.

(E) adopt legislation which encourages the incorporation of both passive and active solar systems in new homes and the retrofitting of existing homes with solar equipment.

(F) make sizable increases in Federal funds for solar energy, with an emphasis on further development and commercialization of solar power for heating and cooling as well as decentralized solar systems.

At a time when we should be expanding energy research and development, the President's proposed budget goes in the opposite direction. In defense of reduced R & D spending, the administration states:

"[The slowdown results from] the need to avoid overtaking activities that are more appropriately those of the private sector such as developing, producing, and marketing new products and processes, as in the case of solar heating. . ."[24]

The same proposed budget puts the administration on record as encouraging technological innovation by American industry. These two statements are contradictory. If we are to encourage technological innovation in American industry, then the Federal government will have to make major increases in its research and development expenditures.

What we need for solar energy is the kind of massive Federal program which produced synthetic rubber, harnessed the power of the atom, and put a man on the moon. Instead, the President has slowed down solar research and development expenditures and reduced overall expenditures for solar energy from $389.9 million to $373.58 million. The most promising of solar technologies—heating and cooling—were slashed by $20.5 million, and a good part of that money was put into windmills.

This is a gross misallocation of Federal resources which can only cripple the national solar energy effort. We urge the Congress to make significant increases in the administration's proposed solar energy budget.

Mr. Chairman, the same dual concern for energy and employment policies which prompt us to support solar energy is also the basis for our support of nuclear power. Solar energy will never be able to supply one hundred percent of our energy needs. Both now and in the years to come, we need expanded sources of electrical power. Nuclear energy stands as a proven, available source of electricity which can help us reduce our reliance on oil and gas.

There is another aspect of our national energy policy which is of special interest to the Sheet Metal Workers. We can make significant energy gains through conservation. By conservation, I mean the efficient use of fuel.

Far too much energy is lost through inefficiency. The sheet metal industry is already making use of skills and technology which have produced impressive conservation results. The use of variable volume systems, for example, has reduced steam consumption by some fifty to sixty percent.[25]

We recommend that the Federal government promote energy conservation by encouraging the retrofitting of existing buildings and the installation in new buildings of energy conserving materials and equipment, including heat recovery and variable volume systems.

Mr. Chairman, I am proud of the lead the Sheet Metal Workers' International Association has taken to actively support energy policies which are good for the American economy and good for the American people.

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[24] *Special Analyses, Budget of the United States Government, Fiscal Year 1979*; p. 307.
[25] *Sheet Metal Workers Journal*, February, 1977: pp. 2–3.

TABLE 1.—DOMESTIC ENERGY CONSUMPTION BY PRIMARY ENERGY TYPE

[In percent]

Year	Coal	Natural gas	Petroleum	Hydro-electric power	Nuclear electric power	Tota
1973	17.8	30.2	46.8	4.0	1.2	100.0
1974	17.8	29.9	46.1	4.5	1.7	100.0
1975	8.2	28.3	46.4	4.6	2.6	[1] 100.1
1976	18.3	27.4	47.3	4.1	2.8	[1] 99.9
1977 [2]	19.3	25.3	48.8	3.1	3.5	100.0

[1] Does not add to 100 due to rounding.
[2] 1st 10 months.

Source: U.S. Department of Energy, Monthly Energy Review; January 1978; p. 46.

TABLE 2.—*Imports as a source of U.S. crude oil requirements*

Year:	*Imports as a percent of demand* [1]
1973	26.1
1974	28.7
1975	33.0
1976	39.4
1977	45.0

[1] Demand measured by Crude Oil Input to Refineries.

Source: U.S. Department of Energy, Monthly Energy Review; January 1978; p. 6.

TABLE 3.—*U.S. direct and indirect oil imports from Arab OPEC countries*

[Thousands of barrels per day]

Year:	*Arab imports*
1973	4,390.9
1974	4,669.3
1975	4,753.0
1976	6,079.9
1977 [1]	7,620.5

[1] First seven months.

Source: U.S.Department of Energy; Monthly Energy Review; January 1978; p. 10.

TABLE 4A.—CONSUMER PRICE INDEX, 1962–77

Year	Index of all items	Average increase per year over incremental period (percent)
1962	90.6	
1973	133.1	4.3
1977	181.5	9.1

Source: U.S. Department of Labor, Bureau of Labor Statistics.

TABLE 4B.—PERSONAL CONSUMPTION EXPENDITURES, 1967–77

Year	Amount [1]	Average increase per year over incremental period (percent)
1967	$603.2	
1973	1,235.0	17.5
1977	1,337.6	2.1

[1] In 1972 dollars.

Source: U.S. Department of Commerce.

TABLE 5.—COMPARISON OF LABOR REQUIREMENTS FOR A CONVENTIONAL COAL PLANT AND 2 TYPES OF SOLAR ENERGY SYSTEMS [1]

[In man-hours per megawatt-year]

Labor function	Construction jobs	Operating and maintenance jobs	Total jobs
COAL PLANT			
800-MWe coal plant	270	320	590
Coal strip mining	20	370	390
Coal transportation	20	150	170
Electric transmission	50	1	51
Electric distribution	140	540	680
Steel and concrete production	10		10
Turbine/generation manufacture	170		170
Total	680	1,380	2,060
SOLAR SYSTEMS			
1. Solar hot water heaters:			
(a) Manufacture collector	800–2,500		800–2,500
(b) Install collector	1,200		1,200
(c) Routine operation and maintenance		1,200	1,200
(d) Total [2]	2,000–3,700	1,200	3,200–4,900
2. Photovoltaic system:			
(a) Manufacture collector and cells	2,600–3,300		2,600–3,300
(b) Install collector	1,800–4,600		1,800–4,600
(c) Operate system		6,800	6,800
(d) Total [2]	4,400–7,900	6,800	11,200–14,700

[1] Systems compared are capable of producing equivalent amounts of energy.
[2] Total does not include manpower requirements for backup systems. In the case of both solar systems, add 340 man-hours for the construction phase.

Sources: Labor requirements for coal plant taken from Bechtel Corp., "Resources Requirement, Impacts, and Potentia Contraints Associated with Various Energy Futures," November 1976. Labor requirements for solar systems taken from Office of Technology Assessment; see footnote 21.

Senator McGOVERN [presiding]. We appreciate that, Mr. Ruttenberg. There are rollcalls slated that we will have to go to in a few minutes.

I just had a few questions that I wanted to direct to members of the panel.

Mr. Winpisinger, on the solar energy question, which intrigues me more and more as a real possibility for energy development in this country, you have made a passing reference to the fact that nobody owns the Sun, that that is the people's source of energy. What, in your view, is the real reason why we have been so slow to move on solar energy development?

Mr. WINPISINGER. I think largely because essentially the people do own it at the moment, Senator, that it has not been committed to.

any private development and as long as public development is in the offing, it is discouraged by the very system in which we live.

Senator McGOVERN. In your view, if we are going to move vigorously in that field, is it going to have to be primarily a Federal initiative?

Mr. WINPISINGER. I think that would be the spur. If the Federal Government were to initiate some moves in that direction, the private capital would be attracted immediately to get a piece of the action, so to speak. But I don't think anyone is going to move in that direction, least of all the current purveyors of energy who own it all at the moment because they have not sold all their oil yet. And a competing form such as solar is going to detract from perhaps the pricing of fossil fuels.

Senator McGOVERN. I noticed yesterday that Mr. Williams working with scientists in Princeton University has developed a proposal calling on the Federal Government to look into the possibility of a solar satellite system that presumably could tap solar energy and beam it to the earth. Are you familiar with that possibility?

Mr. WINPISINGER. Yes, sir. As a matter of fact, I suspect later in this session of the Congress, we will be in testifying on a modest appropriation of money to prove out some preliminary R. & D. on solar power satellites. It is useless to commit huge amounts of money unless you prove out as you go along what you are doing. We encourage its development and the potential conquering of many technological barriers that there may be. Right now, the private interests, nonenergy interests, by the way, tell me it is a very promising concept and they are asking now for $25 million from the Congress to prove out the R. & D.

Senator McGOVERN. I was struck by the statement that some of these scientists seem to be highly regarded people in their field and would say that if their present hopes, their present speculations about this can be proved, our energy problems could be over.

Mr. WINPISINGER. They tell me that we could—that one solar power satellite they have in mind at the moment—of course it is going to get bigger and better as it is proven out—but one they have in mind at the moment, would supply sufficient energy for the State of Florida, or, conversely, the city of Chicago. This satellite could be parked in geosynchronous orbit over the Pacific Ocean and endanger no land mass. It would be a source of the least international controversy, because other nations could park their satellites to bear reflection on their own land mass. Ownership of land mass is not at issue. It has a rather exciting potential.

But there are some technological barriers which I fear are not yet overcome. They have to be fully proven out. This is why we have adopted a posture of caution and have asked the Congress to appropriate enough money to find out if the barriers can be broken. If we get the solar power satellite system nailed down, it promises a nonpolluting renewable energy source which could supply us forever.

Senator McGOVERN. Mr. Mazzocchi, following up on that same general area, you have referred to the solar energy possibilities, too. Do you have the feeling as I do that some of the figures that we are working with on solar energy are out of date? There is a general impression that the cost of going the solar route is so high that it is not feasible. I am wondering if a lot of those figures don't antedate the increase in other sources of fuel going back to the 1973 period. We have had a quadrupling of oil and gas prices since 1973, and do you have any information that maybe we are operating without dated statistics as to comparative costs of solar energy?

Mr. MAZZOCCHI. I don't have statistics. I just have deep suspicions and cynicism. If the energy industry could float a meter up to the Sun, you would have solar energy tomorrow. That's been our experience with the industry.

I think Brother Winpisinger answered that as to why we don't have solar at the moment. I would like to make one other comment on something Senator Kennedy said, he held up an ad which had been placed in the paper. I think it is a classic expression by the industry where it proves it certainly is capital intensive, but there is one subsidy they speak of and that is the subsidy they operate simply because we are subsidizing them with our health. Petroleum refining counties in the United States have the highest incidence of cancer in the country.

That is no coincidence. That is a subsidy the public and workers give the energy industry to produce an abundant product with minimal manpower. In the oil industry, oil refining is cancer producing simply because it went from a higher labor intensitivity to capital intensive, someone is paying. The workers are paying. What we have socialized in the country which no talks about is misery. We are introducing all the people to the health care system which the public generally pays for but their introduction to that health care system is the creature of the energy industry. So that cost has never been figured in on the price of the product. We see it because we live with it. As shown by the petroleum counties' higher cancer incidents, energy workers' cancer is now becoming epidemic, that is a cost somebody is paying for. We are giving 5 and 10 years of our lives and more to produce this product, and if we had a health impact statement, we say you would find out that a lot of the industry is really an industrial welfare basket case. If you would figure that subsidy and you really measured the costs, then you would have some true comparisons with alternate sources of energy.

Senator McGOVERN. I think that is an interesting and valuable observation.

Mr. Ruttenberg, you referred to the need for more information on the labor impact in various energy strategies, the line of questioning Senator Kennedy tried to develop earlier. Are you aware of the fact that we can't get those statistics from the Department af Labor Statistics? I agree with you that that is the office that ought to have them, but inquiries from our office, from my staff and others as to what the labor impact is of various energy strategies have also drawn a retort from the Department that they don't have that information; that they are responsible for construction manpower statistics, but they don't have anything of any consequence relative to the various energy proposals.

Mr. RUTTENBERG. For example, Senator, the CMDS model that's been developed and which the Department of Labor and the Department of Energy both cooperate in working on, measures only the construction jobs involved. It does not measure the secondary impacts of the operations of the programs and the maintenance of the programs. We are sadly lacking in the kind of data which is essential to really get a full picture of the employment impacts of varying types of energy.

It's a sad commentary that really the one basic study which has been made by the Department of Labor is on what the energy impacts were during the embargo back in 1974. And when you look for any further update materials, it is non-existent. That is why Mr. Packer this morning was talking about 1974 and studies back then. We need to put resources into this area. It cannot be done without money, Senator.

Senator McGOVERN. Maybe through the influence of you gentlemen and your associates in the labor movement and through the efforts of this committee and others, we can get a little more efforts focused in that direction.

Mr. RUTTENBERG. We need to get some appropriations for this area.

Senator McGOVERN. Thank you very much, gentlemen.

I would like to call Mr. Nicholas Carbone, the Hartford City Council, to the witness stand. He is one of the most outspoken and one of the most respected spokesmen for the cities. He is a strong advocate of comprehensive planning to meet urban problems and has created in Hartford a new agency to create jobs through energy conservation. I want to congratulate you for your initiatives in this field.

As you gathered in listening to the line of questioning here this morning, this committee is urgently interested in the job impacts of energy conservation and all of the various energy strategies. I want to apologize on behalf of the subcommittee that we kept you so late today and now we have run into a rollcall which is about half way over, but I will stay until the second bell rings and maybe a couple minutes beyond. Could you just give us a summary of your statement and then submit the prepared statement for the record and we will see that it is printed in its entirety.

STATEMENT OF HON. NICHOLAS R. CARBONE, COUNCILMAN, HARTFORD CITY COUNCIL, HARTFORD, CONN.

Mr. CARBONE. Thank you, Senator, and I know you are pressed for time. I would like to say that the energy policy has to be a keystone of an urban policy, as well as a jobs policy. I think the passage of the Humphrey-Hawkins Act is critical to this whole issue; I would just like to state that because I believe so strongly in it. There are three principles we have to look at when we look at an energy policy, and a couple of facts. Waste of energy eliminates jobs; capital intensive production of energy eliminates jobs; lack of a comprehensive national and urban growth policy wastes energy and destroys cities; energy consumption and energy waste affect job loss.

I think the inflation that is taking place in this country since 1974 documents that. Our own city burget went from $94 million to $130 million. That's a 50-percent increase in our budget. But due to inflation, our current budget in terms of 1971 dollars—buys only $64 million worth of goods and services.

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That has caused us to reduce our services to our residents, we've reduced our work force by 20 percent. At the heart of these cutbacks is the inflation which has been caused by the rising cost of energy. It is no accident that double digit inflation started with the price increases of energy in 1971-72.

The second point is, there is a capital shortage in this United States and yet we are wasting the capital that is already in place. It would cost $8 to $10 billion to replace Hartford—our parks, public buildings, private buildings, sewers.

Senator McGOVERN. Just for the city of Hartford?

Mr. CARBONE. Just for the city of Hartford. The capital cost of replacement would be $8 to $10 billion. Yet, we are facing the abandonment of the city because we are unable to maintain our capital investment. Capital has been diverted from the cities and diverted from private investment into the high cost of producing nuclear power. And, as we all know, nuclear powerplant costs have tripled in cost. In Connecticut, the first nuclear powerplant cost $300 million. Today a new nuclear powerplant costs $1.6 billion. That capital used to build the nuclear powerplant is not available for housing and other urban needs.

A Touche Ross study just completed concerns capital investment in inner cities. This study, done by a private sector firm, includes statistics on 66 cities and I recommend that the subcommittee look at that set of statistics.

[The prepared statement of Mr. Carbone follows:]

PREPARED STATEMENT OF HON. NICHOLAS R. CARBONE

I am pleased to join you today to discuss the role of energy policy in job creation. Our national energy policy is new and incomplete. In two weeks President Carter will announce America's first explicit urban policy. Behind both strategies and programs at the Federal, State, and local levels must lie a response to our Cities' greatest need: Jobs. Our urban policy must be an investment strategy which creates employment opportunities.

Energy policy must also be shaped to play a central role in the task of urban job creation. As Congress moves closer to the historic adoption of the Humphrey-Hawkins full employment bill, the planning tools to create full employment must be utilized to shape our energy policy as a powerful instrument for economic growth.

The board principles of an energy/jobs policy must be fashioned at the national level in cooperation between the Congress and the administration. But numerous State and local governments already have developed prototypes of energy programs that are putting people to work. We need to examine those ideas and implement the best of them in other States and local communities. That effort will require a partnership between all three levels of government.

That partnership must work together to redefine the impact of energy policy on Americans. Energy policy has come to imply penalties, sacrifice and prohibitions that affect some people more severely than others. In the atmosphere of mistrust and resentment that follows, it is difficult, if not impossible, to rally public understanding.

Energy policy does not have to mean unequal treatment and an unfair set of personal sacrifices. Energy conservation can be perceived as a positive step towards eliminating waste and creating jobs for Americans. According to Donald Gilligan, former assistant director of the New York State Energy Office: "The Northeast could increase its energy consumption by 40 percent over the next decade without a single new energy source—by simply eliminating waste." Energy conservation offers local officials and individuals opportunities to increase our options to reallocate capital and natural resources away from wasteful energy uses to job creating activities.

There are 3 basic principles which underline this theme.

1. Waste of Energy eliminates jobs.

2. Capital intensive production of energy eliminates jobs.

3. Lack of a comprehensive national and urban growth policy wastes energy and destroys cities.

Energy consumption and energy waste affect job loss.

In order to understand that relationship, let's look at how inflated costs have limited local government's ability to deliver services. Hartford's experience is typical. Since fiscal year 1971–72, Hartford's budget has increased from $94 million to $130 million. During the same period the consumer price index increased 50.5 percent—shrinking the value of today's dollar. Our total current budget would equal only $64 million in 1971–72 dollars, and in 1971–72 we were spending $94 million for city services. We have cut back in several ways. We have cut back through layoffs and attrition; our number of man years has been reduced by 20 percent. We are also delaying replacement of equipment such as street sweepers—which rose in price from $15,000 to $25,000 in five years.

And, at the heart of these inflationary price increases is the rising cost of energy. Since 1971, the cost of fuel oil has gone from 12 cents a gallon to 40 cents a gallon—a 228 percent increase. The price of gasoline has increased by 168 percent and electricity by 71 percent.

As Barry Commoner points out:

"It is no accident that we first experienced double digit inflation when the previous constant price of energy not only drives all prices upwards—it creates uncertainties that delay new industrial investment. It forces economic dislocations that costs jobs. It is a prescription for inflation and unemployment. Here, then is the real meaning of the energy crisis. It is not a distant prospect of someday running out of energy. Rather, it is the immediate prospect of economic catastrophe."

How can we as a nation avoid that economic and social catastrophe? Massive multi-billion dollar projects such as the Alaskan pipeline don't seem to be the answer. Neither do proposals to build networks of huge nuclear power plants. Nuclear powerplants, Commoner points out, have had to meet a whole series of new safety and environmental protection requirements that were not built into the original design. These refinements have helped push up the costs of a nuclear power plant by 130 percent in five years. Since waste and reprocessing problems are still unresolved, nuclear power plant costs will continue to increase. In Commoner's words:

"That explains why nuclear power is the most expensive energy source." and "that is why utilities constantly demand higher rates to raise the huge amounts of capital needed to build nuclear powerplants."

Our country also faces severe limitations in the availability and cost of capital. Given the shortage, we must make a choice—will we use the bulk of our capital to build costly nuclear powerplants to produce costly electrical power? Or will we use our capital in ways that will reduce our energy costs, put our people to work, rebuild our cities and improve the quality of life for most Americans?

If the American people believed that the latter choice were realistic, they would demand that we make it. I believe that that option is realistic, that we can achieve those goals—if we are willing to implement a sensible energy policy.

We must help the American people understand that the lack of a comprehensive national and urban growth policy not only destroys cities, it saps our Nation's strength through unnecessary waste or energy. What are the energy costs of unbalanced growth? What are the energy costs of the destruction of our Northeastern and Midwestern cities? In Hartford, we have estimated that the total capital cost of replacing our city is 8–10 billion dollars including private and public buildings, parks, streets, sewers, etc. It is ironic that the lack of a national urban policy is systematically destroying this capital base—by forcing people to leave to seek employment; and by underfinancing local governments so that we are unable to maintain our capital investment.

It is ironic that while we all decry the waste of energy, and while we decry the shortage of capital, we are wasting these resources and harming our environment through the absence of a growth policy.

The cost of new housing is exploding yet as we all know, the cost of rehabilitation is dramatically less than the cost of new construction. We also see a water crisis is developing, which I believe could someday overtake the energy crisis in importance in parts of our country—and coincidentally provide the Northeast with the advantage of an unparalleled natural resource. We also see the crisis in the mushrooming capital budgets in areas of high growth, placing unnecessary demands on local taxpayers. All of these phenomena are due to a lack of a comprehensive national growth policy.

We need a national growth policy not only to save our Northeastern cities but also to save energy. We must understand that cities are inherently energy conserving. Buildings are closer together, reducing energy costs. Apartment dwellings are lower in energy costs per unit than detached houses. Public transportation is more readily available and financially possible in cities and the commuting from home to job is shorter.

Given the principles that wasted energy elminates jobs, that capital intensive production eliminates jobs, and that the lack of a national urban policy eliminates jobs and hurts our cities, what should we do? Our cities are already taking innovative steps towards a comprehensive energy policy at the local level—but they need assistance from Washington. Unfortunately the Schlesinger plan would shift the emphasis away from local governments and put the responsibility in the hands of state governments. There is a role for the cities, of course, but local government holds the responsibility for building codes, zoning laws and a variety of regulations that have direct impact on energy conservation.

The Schlesinger plan also would place emphasis on the role of private utility companies in retrofitting, weatherization and financing. There are two major flaws in this. First, it does not recognize the role of public utilities in the delivery of water and sewer services. Secondly, electric and gas utility companies need increased revenues to maintain the debt service on existing and future capital expansions. Conservation efforts that have lowered demand also reduced revenues and utilities have responded with rate hikes. Putting conservation in the hands of utility companies would seem to place consumers in the midst of a no-win conflict of interest.

Further, the present winterization effort, deals primarily with middle and upper income people. Tax credits will help the homeowner conserve energy and save money, but the tax credit will not assist the urban poor and the working poor concentrated in apartment dwellings.

As energy costs rose, landlords in Hartford began shifting the cost of energy to their tenants, so that 75 percent of Hartford's tenants now bear the responsibility of paying for their own heat and hot water. This is almost always the case in our poorest neighborhoods. When landlords are not paying heating bills, the tax credit won't motivate them to invest in insulation, storm windows or more efficient boilers. The tenant who is paying the heating bill can't get a tax credit even if he or she can afford to winterize the apartment.

As a result of this situation, at least 50 percent of our multi-family units won't be winterized nor will they utilize new technologies such as solar collectors.

The Community Renewal Team of Hartford, which operates our winterization program for poor people, estimates that we need $10 million to insulate all substandard living units occupied by the poor in the Hartford region. Last year CRT's total budget for insulation was $120,000—approximately 1 percent of the total need.

But, the Schlesinger program is not an energy program for cities nor is it an energy program which places priority on job creation. Let me cite some specific examples of the ways in which energy policy can be used to create jobs. The city of Hartford is establishing a Community Energy Corporation which will hire and train unemployed city residents to retrofit and audit existing structures. We will work on public buildings and hope to branch into homes and apartment buildings in the city and in surrounding suburban communities. We are attempting to change state legislation so that our regional water bureau could contract with the energy corporation to retrofit homes within its jurisdiction. The publicly-managed water bureau can act both as a technical resources and as a capital source for money borrowed at public rates. Secondly, within CEC funds that would be ordinarily considered a profit will be used by the public corporation to conserve energy in poor people's homes and apartments.

It is estimated that the Community Energy Corporation, with a public investment of $125,000, can winterize 1,200 homes on a cost basis. This will create 15 jobs for city residents at a cost per house of $106.00. This results in a total cost per job of public money of $8,400 in the first year. Compare this figure of less than $10,000 per job for CEC with the average cost of job creation for nuclear power. Compare this figure with the $40,000 required in capital to create a manufacturing job. Clearly, energy conservation is job intensive. In addition, the skill profile of winterization makes it a profession accessible to those suffering from structural unemployment.

The second cornerstone of a job creating energy policy must be a massive Federal, State, and local partnership to create a solar industry on a job intensive and decentralized basis.

In California, the campaign for economic democracy has sponsored SOLAR cal—a legislative package submitted to the California Assembly. SOLAR cal is a package of 12 bills of which four are central. SOLAR cal would make available, through the utilities, consumer loans at low interest rates. These rates would be set by the Public Utilities Commission and monthly installments on the loan would be no higher than present monthly utility bills.

SOLAR cal would create a public not-for-profit corporation which would use State and Federal dollars to make loans to small businesses for the production and installation of solar energy. The $10 million in equity would stimulate the growth of solar energy and capital would be made available to small entrepreneurs and community based organizations. Also, SOLAR cal would establish the use of state CETA funds to finance the training of personnel for local community development private corporations that would manufacture and install solar equipment. CETA would be used as a way of allocating jobs in the Solar industry to those who most need them. Finally, SOLAR cal would create a commission to provide a plan to solarize California. The California Center for Public Policy has estimated the net number of jobs that would be created in California alone, through the promotion of solar energy. Let's assume a 75 percent retrofit of homes for solar space and water heating; and 100 percent solar space and water heating in new residential and commercial construction. It is estimated that the SOLAR cal proposal would create a new number of 378,000 new jobs over a 10 year period beginning January 1, 1981.

CEC and SOLAR cal share two basic assumptions. One, public guidance and public control are the cornerstone of the national energy industry. We cannot afford to have ownership of the sun in the same way we have monopolistic ownership of petroleum by an industry unresponsive to the needs of our people or even the controls of our Government. Secondly, SOLAR cal and CEC are based around the principle that energy policy and planning can create jobs for the structurally unemployed.

There are other important national examples. In Springfield VT, local officials plan to use seven old mill dams to generate electricity for that town's 10,000 residents. Local officials predict that a series of hydro-electric plants will cut the town's electric bill in half. This plan could be duplicated in small towns and in big cities all across the country. The U.S. Army Corps of Engineers reports that at least 48,000 untapped dam sites could be used to develop electricity. Just 10 percent of the 3,000 dam sites available in New England could supply enough electricity for the entire city of Boston. Hydro-Electric power is safe, non-polluting, relatively inexpensive, produced from a renewable energy source and can reduce the cost of energy for industrial production—helping to hold down inflation.

Wilton, Maine is looking to relatively new technology of solar energy. Wilton is constructing a sewage treatment plan that would use solar energy to heat the building and fuel the process. Methane gas will be produced as a by-product and stored as a back-up fuel. In addition, Portland, Oregon has studied a capital improvement program to see how long-range physical plans for the city could be developed that would accomplish the two goals of reducing city government energy costs while stimulating energy efficient development patterns. Dallas, Texas has developed a set of energy efficient building design standards for all new facilities and structures that are being renovated.

Since energy affects virtually every aspect of our lives—social, economic, political and cultural—a city comprehensive energy plan needs to touch all levels of municipal policy including zoning, land use building codes, transportation, economic development and education. In Hartford we are looking at how we might revise our zoning and land policies. We plan an economic multiple use of structures so that people can work, shop and entertain themselves in the same complex. We are looking at our building codes to determine whether or not the city could require an energy audit on any building that is sold so that energy deciencies would have to be corrected before transfer of title. The proposal would guarantee that every structure in the city over time would be completely retrofitted.

This city energy policy is being managed by a new standing committee of the council which involves all nine members. They are actively involved in the study of all aspects of our energy policy including zoning, land use, transportation and job creation.

In conclusion, we must examine what we can do next. What should be the roles of the Federal, State and local governments? We need a partnership that involves all three levels of government so that we can create a system which conserves energy, creates jobs and improves the quality of urban life. The National League of Cities has called for Federal assistance to cities in the form of direct Federal subsidies, and energy extension service, a general revenue sharing plan, and local energy conservation and development banks. The SOLAR cal proposal creates a state role in planning, land use management and as a public capital source. The city of Hartford has created a public capital source as an attempt to engage a city in intelligent energy planning. Hopefully, the President's requirement of a State urban strategy as part of the urban policy will create growth policy.

Finally, whatever is done must be based on the following four principles of action. These principles share a common goal. An energy policy should create jobs, not waste capital. An energy policy should create jobs for those in greatest need, the structurally unemployed. These principles for action are:

1. We should utilize energy sources which are job intensive as a strategy for full employment.
2. A new capacity for State and local government to manage an energy service must be created at a level equally important with existing public services, police, fire and education.
3. Energy growth must be based upon the utilization of public capital. Public capital will both lower the cost of energy saving and more importantly public capital will help to decentralize the control of the energy industry.
4. A national growth and urban policy must be made an effective tool of energy. The policy must support the survival of one of our greatest energy resources—our cities.

Senator McGovern. Mr. Carbone, there is an article in the Los Angeles Times that came to my attention recently in which Mr. Schlesinger is telling the State of California that their only practical hope, their only practical alternative to economic stagnation is to go the nuclear route; that plus coal.

Without objection, I would like to place that article in the record at this point.

[The article referred to follows:]

[From the Los Angeles Times, Wednesday, Mar. 15, 1978]

Shift to Atom Power Urged by Schlesinger

(By Bryce Nelson)

COMMENTS ON STATE'S FUEL PROBLEMS ARE IMPLICIT CRITICISM OF BROWN'S POLICIES

Washington.—Declaring that "California energy problems are probably worse than they are elsewhere in the country," Energy Secretary James R. Schlesinger said Tuesday that increased use of nuclear power and coal are the state's only viable alternatives to economic stagnation.

Solar power, larger allocations of available oil and natural gas, and conservation cannot be counted on to provide the increased amounts of electric power needed for future economic growth, he said.

While he did not mention Gov. Brown by name, Schlesinger's comments were an implicit criticism of Brown's opposition to nuclear power and his emphasis on conservation, solar power and other so-called "soft" energy sources, such as geothermal steam.

Schlesinger's comments, in a Times interview, came against a backdrop of rising concern in the Carter Administration that Brown could challenge President Carter for the 1980 Democratic presidential nomination and that the governor might use criticism of the Carter energy program in such a campaign.

Increased reliance of coal and nuclear power is an element in Carter's national energy plan. Both are considered anathema by many Californians, owing to the air pollution problems associated with coal and the safety problems associated with nuclear power.

"It's all very fashionable to pretend that the problems of California's energy supply are going to be resolved by solar energy or by conservation," Schlesinger said, but "if we are going to have electric power supplies, we're going to have to use coal or nuclear energy in California as in other states."

The opinions of many Californians are influenced, Schlesinger said, by the fact that the state has "the most vigorous antinuclear movement in the country."

Also he said, "California's climate is delightful and therefore it leads to the hope and to the near-term illusion that somehow or another solar energy is going to come on quickly enough to wash away the painful aspects of facing up to alternative energy supplies."

Schlesinger said that California will not be able to continue its current reliance on oil to produce electricity—which now provides about 55 percent of the state's electric generation needs, according to Energy Department figures.

"We are not going to continue to import oil to burn in utility boilers—that simply is a given (principle) of national policy," he said.

Nor does Alaskan oil offer the state an alternative to imports, he said. Regardless of the current surplus of North Slope oil in California, Schlesinger said, "oil supplies will not be disproportionately devoted to one section of the country" in the 1980s.

Acknowledging the air pollution problems of burning coal to produce power in California, Schlesinger came down on the side of more nuclear power for the state, which currently gets only about 6 percent of its power from nuclear plants.

"The advantages of nuclear power are probably as great in California as they are anywhere in the country, simply because nuclear power provides the only form of power production that does not contribute to air pollution," he said.

In addition to nuclear power, Schlesinger said that only two other options could provide California with sufficient electric power to meet future needs:

To persuade other Western states to permit construction of coal-fired plants within their borders to provide power for California.

To accept the pollution associated with burning coal in California. "Burning coal extensively in California itself, although that's fairly high cost," would involve "a change in local attitudes toward air pollution," he said.

While solar energy is practical for hot water heating and space heating for homes, Schlesinger said, "this represents a relatively small portion of our energy budget. We do not expect to see the automobiles in California driven around by solar energy, nor would I expect to see the industry in California powered by solar energy.

"Solar energy is not, in the near term, going to be a source of electric power."

Brown has said that he wants California to be a national leader in the use of solar power, but he has also emphasized geothermal energy, coal gassification and coal-fired plants as sources of electricity. Brown also has stressed the need for more conservation.

Schlesinger said that "we can do a great deal through conservation but we are going to continue to need additional energy production, and conservation will only cut the rate of our growth requirements."

Brown has said he will uphold the California law stating that no new nuclear plants will be built until the U.S. government can prove that there is a safe, permanent way to isolate nuclear waste.

Discussing another energy source, Schlesinger expressed strong reservations about California and the nation becoming dependent on imports of liquefied natural gas. "California could be a special case" in having a market for expensive imported LNG, he said, "but that would be a symptom of California's longer term energy problem, if indeed it had to turn increasingly to such high cost sources of energy."

Senator McGovern. Do you think that that is good advice to give to a State or to a city?

Mr. Carbone. I don't believe so. The assistant director of energy policy in New York State has pointed out we could increase our energy consumption by 40 percent in the Northeast without adding any new energy sources—just by eliminating waste.

A study done by the Committee to Save Cities, which is headed by Henry Reuss, found that European cities use 40 to 50 percent less energy per capita than we do to maintain the same quality of life. So, I think energy conservation is the first way we can create jobs and maintain our life style.

Senator McGovern. Mr. Carbone, I have to apologize to you. I do have to race over and answer this rollcall, but would you be willing if the committee submitted some questions to you in writing, to give us some further elaboration and thoughts in addition to what you have developed in your testimony?

Mr. Carbone. I would be more than happy to.

Senator McGovern. I apologize to you, but we are going to have to adjourn the hearing and I have to race to the floor.

Thank you very much.

Mr. Carbone. Thank you, sir.

[Whereupon, at 12:10 p.m., the subcommittee adjourned, subject to the call of the Chair.]

APPENDIX

STATEMENT OF MRS. MARGARET BUSH WILSON, CHAIRMAN, NAACP NATIONAL BOARD OF DIRECTORS

Energy and Black Employment

The NAACP appreciates the opportunity to present its position on the topic of energy and its effects on employment. The logical corollary, which you are also considering and which we agree is appropriate, is the question of how to provide more jobs through the production of energy. We do concur with the observation by the Subcommittee on Energy that energy policy should not be made in a vacuum but ought to evolve from the opinions, experiences, needs and resources of all segments of our society.

Last January, the NAACP National Board of Directors adopted a policy statement on energy. Its primary thrust is to protect as well as foster the creation of jobs for black Americans. The NAACP believes that any national policy that does not stress the development of new and alternative energy sources will increase, rather than reduce, the presently high black jobless rate.

We were heartened by the recent Department of Labor report which showed that the unemployment rate had dropped to 6.1 percent, the lowest since October, 1974. Black unemployment at the same time fell to 11.8 percent. But, no matter how encouraging these statistics are, the fact is that the black jobless rate still remains twice as high as white unemployment.

Furthermore, the current jobless level continues to have a disastrous effect upon black communities nationwide, especially within the big cities where the evidence of poverty and broken lives are most visible. These problems of urban decay and poverty have been aggravated in recent years by the rapid flight of jobs from the older metropolitan centers.

In view of the extent of the current problem, we are especially concerned about any national energy policy that unduly stresses conservation over production and the development of alternative, low-cost fuels.

The NAACP is convinced that America faces a critical energy shortage which will rapidly worsen in coming years. The historical relationship between an abundant and cheap energy supply to a vigorous and expanding economy has been well documented. Without an abundant supply of coal, oil and natural gas, the spectacular growth of American industry in the post-World War II years would not have been possible.

But now, faced with the depletion of oil and natural gas resources, America must seek alternatives. As the 1973–74 Arab oil embargo showed, however, the U.S. has become hostage to trends and developments beyond its borders and over which it has limited control and influence.

A meaningful and lasting response to the question of black unemployment and inner city decay therefore rests to a considerable extent upon the form of our government's response to this question. That the severe black economic problem can be corrected, the NAACP has no doubt. What is needed is the national will.

We need only turn to the period from 1961 to 1969 for an example. That was a period of vigorous economic growth, when new jobs were created at the rate of 2.1 percent a year compared to the 1.7 percent annual expansion of the civilian labor force.

Blacks thus got a moderately large share of the increase in employment without creating sharp competitive pressures with whites. Consequently, black unemployment dropped by 400,000. So, even though unemployment among black teenagers rose sharply, it decreased among adult males and females.

Between 1969 and 1974, however, as a result of deliberately instituted national economic policies and the Arab oil embargo, unemployment rose from 2.8 million to 5.1 million. And blacks, though comprising 11 percent of the population, accounted for 20 percent of this increase.

The advent of another recession, the troubling problems of inflation and slow economic recovery have led many Americans to recognize that very fundamental steps must now be taken to ensure the continuing growth of our nation.

According to some economists, America is now in the trough of a 50-year business cycle. This sluggishness, which is also due to a large extent to natural forces within the economic system, will drag on for as much as two decades. Thus, instead of expanding at a healthy 7 percent a year, which is needed to have a meaningful impact on the extensive black joblessness, economic growth will hover around a sluggish 4 percent at best.

If this is so, and we see no reason to doubt this prognosis and projection, then America should be prepared for considerable social unrest. The patience of black Americans is almost at its limits.

A decade ago, the National Advisory Commission on Civil Disorders warned that America was moving toward two societies, one white, the other black. Today, Mr. Chairman, despite much soul searching, the division between the well-to-do and the very poor seems to have widened. On the average, black Americans are suffering from a jobless rate that is twice as high as that for whites; they also earn half as much as whites on the average.

Although race has been and continues to be a significant factor in the black unemployment picture, another reality has become evident in recent years. That is the economic factor.

Blacks, like whites, are also adversely affected by the growing exportation of U.S. dollars in exchange for foreign oil; blacks too are affected by the inflationary pressures of quadrupled oil prices; blacks too are affected by the battered dollar on world money markets; blacks too are hurt by the widespread case of nerves that permeates the business community and slows capital investment.

And one of the key questions behind this negative economic atmosphere concerns America's ability to deal forthrightly with the energy crisis.

The NAACP sincerely hopes, Mr. Chairman, that your committee will consider these concerns in your deliberations. For the simple fact is that any national energy policy which imposes or tolerates obstacles to various forms of energy development jeopardizes future supplies as a whole. The end result would be, at best, a slow growth economy which would hinder the ability of industry to expand production and job opportunities.

As those who are most likely to be the last hired and the first fired, blacks do have an immense stake in the development of a national energy policy.

We must at this time also express our dismay over the reality that so little attention has been given to providing minorities with opportunities in employment within the energy industry and on the policy making level in government. We trust, therefore, that your subcommittee will give adequate attention to these concerns.

Statement of Clarke Watson, Chairman, American Association of Blacks in Energy

Mr. Chairman, my name is Clarke Watson, and, as Chairman of the American Association of Blacks in Energy, I am pleased to submit this statement to the Committee for its hearings on the very important subject of Energy and Jobs on March 15 and 16, 1978. I have appended a Statement of Purpose of AABE to this statement.

In behalf of our constituency we are especially concerned with employment opportunities for our membership, and the economically-deprived of the United States generally. This concern goes specifically to the younger element of racial minority groups. In one metropolitan area of the United States after another we see our idle youth on street corners, in unemployment lines finding no opportunities to work, drinking, pushing drugs and otherwise whiling away their time in angry or sullen frustration over their lack of job opportunities. This is not a problem that is unique to the Black minority element of our population, but it is found among other racial minorities as well—Chicano, Puerto Rican, Indian and others.

As we see this, one fundamentally important consideration this Committee must keep in mind in its consideration of what path or paths are to be recommended to follow or chart by our government to correct or to give relief to this serious inequity is the need for an economic growth pattern in our country which will afford better chances for employment for these economically-disadvantaged minority elements. A no-growth or limited economic growth policy will only aggravate an already serious situation.

Among other things, this means development and use of our own natural resources for producing electrical power without which our country will stagnate economically, and our unemployment lines will continue, if not grow longer—especially among our racial minorities.

The major sources of electrical power production are: oil, coal, natural gas and uranium. There is potential for electrical power production in the use and development of other sources of power, such as fusion, solar, tidal, geothermal, hydroelectric and wind. However, as major sources of electrical power, this latter group has serious limitations of supply for a long period of time as yet, and our need for economic growth and job opportunities is immediate and urgent. This is not to say that these alternatives should not be explored, developed and utilized as fully as possible, because our country will need every one of them to the fullest extent possible.

In the meantime, each of the four major natural resources requires our full utilization with the recognition that each offers its limitations or problems.

We cannot continue for a long period of time to rely on the current rate of heavy oil imports because of world supply limitations as well as the serious adverse economic impact on our country's trade balance and adverse impact on the value of the U.S. dollar. Nor can we fail to take into account the dangerous circumstance the U.S. would face in a national emergency if these foregin imports were severely curtailed. Better use of our oil supplies for power in the country is essential, however, such as for mass transportation, manufacturing, agriculture and other needed industries.

Continued reliance on the use of oil for our electrical needs will be required, of course. But to seek to reduce our heavy reliance on imports is equally essential in the best interests of the nation's economic future and growth pattern.

As to natural gas, we are all aware of the limitations on supply in the relatively near-term future. As a relatively cheap source of electricity and because of its cleanliness, reliance on its use for electricity is necessary; in doing so, its relative short supply must be kept in mind in seeking to meet our long-term needs.

The United States has an abundant supply of coal, and reliance on its increased use is essential. It is not necessary to dwell on or take the time of the Committee to express at length the concerns about environmental problems in coal use. It is probably our most plentiful natural resource, though, for economical energy production and must be used extensively with environmental safeguards being considered at the same time. Yet our people need work, and we cannot afford to ignore the economic necessity of heavy reliance on its use.

On the need to use this natural resource, it is worthwhile, in my judgment, for this Committee to consider the adequacy of manpower supply for the mining of coal, the need for transportation of coal on safe railroad beds and adequate up-to-date equipment to carry the coal. The costs involved in these improvements are potentially huge, but they must necessarily be taken into account if sufficient consideration is to be given to fuller and better use of this natural resource as it should be.

The current soft coal strike and second severe winter in a row, only serve to highlight dramatically how our people will suffer economically without being able to rely on this natural resource for electrical power. And the first to suffer the impact are the already economically depressed of which our racial minorities bear the disproportionately worst of the hardships encountered.

Our country also has developed its nuclear energy program and use of another major natural resource for producing electrical power. Reliance on increased use of uranium and nuclear power is essential for the economic growth of the United States as the National Association for the Advancement of Colored People (NAACP) emphasized in a recent public position statement which also included support for advancing the development of the breeder reactor program.

Delays encountered in construction of convential nuclear plants concern us because of the corresponding need for increased reliance on imports of resources for fuel supply or a more limited supply of power which reduces in turn, our possibilities for economic growth and jobs.

The use of each of our major resources for producing energy presents its problems, and those problems are not unique to using nuclear power. The supply of uranium in the United States is not unlimited. It too presents environmental and health consideration, just as the use of oil, gas and coal do. We all recognize this. Equally, we recognize its expanded use is necessary, just as other major industrial nations have seen this need.

An important part of the effective use of this natural resource is continued development of the breeder reactor program, and we, along with the NAACP, endorse development of that program without interruption or reduced efforts.

All of this is not to say we can afford to overlook any other source of energy supply whether it be fusion, solar, wind, tidal, geothermal, hydroelectric or others. We need them all and with as little reliance on foreign supply as possible, and development with as little delay as possible.

But we need jobs, and we need them now. Without an adequate energy supply we will not have them. We cannot afford to overlook or be complacent about using all of these sources of power for this urgent and compelling need.

Thank you Mr. Chairman, and members of the Committee for considering the comments in this statement.

American Association of Blacks in Energy (ABE) Statement of Purpose

The basic purpose of American Association of Blacks in Energy hereinafter referred to as ABE is to advance the interests of Blacks in all energy-related matters. These interests include:

1. Encouragement of students at the elementary and secondary level, as well as institutions of higher learning, to pursue careers in energy-related fields.
2. To assist students with these interests with scholarships and other types of aid.
3. Encouragement and development of Black entrepreneurship in energy-related fields.
4. Insure that Blacks are involved at all governmental levels of policy and decision making pertaining to energy-related matters.
5. Serve as a resource to other Black organizations requiring information or assistance in energy-related matters.
6. Conduct seminars on energy.
7. Research and compile the current status of Blacks in energy-related fields and businesses. Such research would include gathering information on employment levels, types and kinds of Black owned energy-related businesses, and economic, social, and political impacts of energy on Black Americans.
8. Act as resource to the private energy sector as it formulates policies and plans.
9. Encourage the private sector to be responsive to Black problems, goals, and aspirations in energy-related fields.
10. Act as a conduit between the public and private sectors in the formulation of energy policy in order to insure full participation of Blacks.

BACKGROUND

The ten points articulated in the "Statement of Purpose" are in response to areas of concern where we, as Blacks, are not yet fully involved. Following the chronological order of the "Statement of Purpose" this portion will take up those specific concerns.

1. Pennsylvania University's Wharton School of Finance in a 1972 hard-bound text numbering some 600 pages entitled Negro Employment in Basic Industries began its section on the petroleum industry with the following observation: "Unless Blacks take it upon themselves to actively encourage student potential in a more technological direction there will only be minimal gains over the current level of employment in this and the utilities industry.

"The highly intricate technology utilized throughout the petroleum industry has virtually eliminated any demand for poorly trained or for uneducated personnel . . The nature of the petroleum industry employment situation, thus, illustrates both an accepted example of the present (Black) employment problem and also an example of possible problems which may arise for low-skill workers as other major industries develop similar levels of technology." Some attempts are currently underway to accomplish this. For example, Eastern Illinois University in Charleston, Illinois, has established a four-year "bachelor of science in business (energy resources management)" program.

The curriculum includes principles of energy management, national energy policy issues, energy consumer problems, international economics, energy finance and incentives, energy and environmental law, energy marketing, chemistry for energy management, physics for energy management, geology for energy resources, alternative energy systems and advanced energy science.

But this is just a beginning. Elementary and secondary school curricula are practically devoid of any materials encouraging Blacks to pursue scholastic avenue aimed at post-educational careers in energy-related fields. The emphasis is still heavily on the social sciences, law, and medicine.

At the university level, there are still too few Blacks pursuing degrees in geology, physics, earth sciences, chemistry, and engineering. The Colorado School of Mines, for example, one of the major energy related schools in the country, currently has six Blacks enrolled in its undergraduate school and one Black working on a masters thesis.

ABE intends to provide the impetus to move considerably more students in this direction.

2. One of the most effective means to accomplish this is through offering scholarships and recognition awards and information seminars for school administrators and teachers.

3. In the entire United States, there are less than ten Black-owner energy related businesses. For purposes of definition, an energy-related business is one engaged in the exploration, development, production, transportation, refining, or marketing of primary energy sources (other than at the retail level such as a filling station); chemical, engineering, geological, and communications consulting firms serving the energy industry or government energy-related agencies as an exclusive or near exclusive endeavor; or research firms engaged in developing alternate energy resources such as shale oil, liquefaction, or gasification of coal, geothermal steam, solar, nuclear technology, wind, ocean thermal energy conversion, and waste conversion (methane).

ABE would foster Black entrepreneurship in these areas.

4. Presently, Blacks have practically no voice at all in the formulation of energy policy at the local, regional, state, multistate, or federal level. For example, a recent energy conference held in Washington at the Rayburn House Office Building, and sponsored by a Black political organization, had only two Black speakers out of seven on the agenda. This dearth of Black input is even more pronounced at lower levels of government such as land use commissions, air and water quality control commissions, and powerful private organizations such as the Sierra Club and Friends of the Earth.

Accordingly, emphasis has been on problem solving for suburban and high income rural and mountain communities while energy and environmental problems of core cities have not received similar prioritization.

ABE would actively pursue much greater participation of Blacks at all these levels.

5. Many Black organizations would like to have dialogue on energy from a Black perspective. This currently is not being provided.

ABE would provide resource persons to organizations with these needs.

6. Black-owned business could appreciably benefit from programs on conservation and other forms of energy-management. Black consumers could benefit from learning techniques to reduce home consumption and automobile fuel consumption.

ABE would provide information and resources in this area.

7. In order to advance the state of the art, we must know its current status. A good deal of research is presently underway and much of the activity here could consist of collecting data gathered elsewhere, verifying data where necessary, and developing data where it does not exist.

This activity is one that ABE would be uniquely suited to perform.

8. The private energy sector should be provided on a continuing basis, and not just at crisis times, with knowledgeable Black perspectives on energy.

ABE would establish and monitor this process.

9. The private sector is in need of assistance in identifying problems, goals, and opportunities for Blacks in energy-related fields. Internal advancement opportunities need further articulation, and external goals need better definition.

ABE would assist the private sector in understanding policies and establishing goals.

10. Recently, the White House approached a civil rights organization for input on energy policy. Energy is an economic and technological/environmental issue

with socio-political overtones. Thus, although Blacks were obstensibly provided socio-political input, we were not involved in the fundamental processes of the development of a national energy policy.

ABE would insure Black input on a more comprehensive and meaningful basis.

PROPOSED STRUCTURE

ABE would be a "not for profit" national organization operating within the framework of a board of directors and officers. All officers would be required to be either owners of energy-related businesses as described in item three of the background section or employees of energy-related industries or agencies of government.

Membership would be restricted to owners (as previously described) and professional and technical employees of energy companies, utilities, and government agencies.

Limited honorary memberships would be granted upon approval of the Executive Committee of the ABE Board of Directors.

At least two executive officers of the ABE Board of Directors must either work in or reside in the Washington, D.C. area.

The executive officers shall consist of a chairperson, vice-chairperson, treasurer, vice-treasurer, and a parliamentarian.

For at least the first two years of the organization's existence, the principal headquarters shall be in Denver, Colorado, with a field address in Washington, D.C. The rationale for this location emerges from the recognition in both the public and private sectors that coal is going to play a significant role in meeting the country's future energy needs. Most recent predictions pinpoint Colorado and neighboring states as containing "40 per cent of the nation's coal deposits." The state and the nation are approaching an intersection in fossil resources dependency with oil and natural gas on the downside angle and coal use rising dramatically. According to the Colorado State Governor's Office, extracted coal tonnage could increase 2½ times byl 1985.

At the same time, according to ERDA, U.S.G.S. and industry sources "the area contains 90 percent of the nation's oil shale deposits." These deposits contain an estimated recovery under existing technology, principally modified in situ, of a potential 1½ trillion barrels of oil.

Additionally, exactly one year ago, the United States Interior Department's Bureau of Mines in IC Circular 8719 noted that: "As of May, 1976, a total of 515 fuels-related projects are planned, proposed, or under construction at locations in the 22 states west of the Mississippi River in the conterminous United States. These projects include future coal mines and expansions to existing mines, electric powerplants and expansions, coal conversion plants, waste-to-fuel conversion plants, oil shale projects, tar sands projects, potential geothermal facilities, coal slurry pipelines, future railroads related to fuels development, uranium mines, uranium mills and enrichment facilities, oil refineries, and natural gas processing plants." Eighty-two of these projects are planned for Colorado, 67 for Wyoming, 57 for Utah, and 54 for Texas. The balance is distributed among the other 18 states.

Taken in the aggregate, these planned or current activities support earlier predictions by government and private sources that 80 percent of the nation's remaining energy supply lies west of the Mississippi. (This, of course, does not include perpetual energy sources such as solar and wind, which are not geographically specific.) Therefore, as Denver emerges as the new hub for energy activity, it would seem crucial that ABE have a major presence there as well.

Two honorary co-chairpersons, who are Black members of Congress, shall be enlisted.

There will be an executive committee consisting of the organization's officers, the two members of Congress, and ten other members including the top-ranking Black person in the new U.S. Department of Energy.

JOBS:

How Many, What Kind, For Whom?

When a new shopping center is proposed or an industrial plant [illegible] area, it is usually promoted by "pro-growth" advocates as being good for the community because it will boost the local economy [illegible] jobs. But developers are often reluctant to say that those new jobs will be taken by outside professionals transferred from other branches of the company, rather than providing jobs for local residents: they may just be promoting an desirable expansion.

For number of jobs to be created directly by the project and other information can be obtained from the project's promoters. Secondary sources include the Censuses of Manufacturing, Retail Trade and Population, Bureau of Census and other Department of Commerce publications. The Department of Labor publishes employment data [illegible] industry and county breakdowns.

Similar publications might be available from state and local government agencies, trade associations, labor unions and the Chamber of Commerce. Local government planning documents usually are supported by statistical compendiums, and local colleges or universities often have studies with unique local data which can be used for the Employment Impact Statement (EmIS).

Do not overlook the importance of [illegible] estimates, so long as there is logic behind them. The fancy "models" used by economists are nothing more than [illegible] although they are dressed up in language and symbols designed to make us think they must be scientific because we don't understand them. Some answers will have to be judgmental by their nature. The important thing is to be consistent in reason and method.

The sample questionnaire presented here goes beyond assessing a project by the number of jobs created; it addresses the qualitative aspects of employment as well. Consequently, the EmIS does not have a built-in judgment about what sorts of impacts are "good."

Some projects or programs, for example, might produce more jobs than others—a quantitative measurement—but may be unacceptable on qualitative grounds. Evaluation of EmIS findings is a matter for local debate based on local values and objectives. The purpose of the EmIS is to provide a consistent and meaningful informational basis for discussion and for rational choosing among options.

Avrom Bendavid-Val

RESOURCES

Several publications of the Center for Advanced Computation, University of Illinois, Urbana, IL 61801 provide interesting data on the net changes in numbers and kinds of employment as well as energy use resulting from reallocation of funds from one kind of program, such as highway construction, to others:

"Job Impacts of Alternatives to Corps of Engineers Projects" by Hannon and Bezdek, ENGINEERING ISSUES, Oct. 1973, pp. 521-31. American Society of Civil Engineers, 345 E. 47th Street, New York, NY 10017. Shows that transfer of funds from ACE projects to national health insurance, social security payments, mass transit development, construction of sewage plants or general tax relief would provide significant increases in employment, and shows that specific Corps projects may not even benefit nearby local communities.

"Options for Energy Conservation," Bruce Hannon, TECHNOLOGY REVIEW, February 1974. Provides information on energy and employment intensity per dollar of product for many industries, for different food products providing equal protein and for household expenditures.

Also

MANPOWER REQUIREMENTS FOR NUCLEAR AND COAL POWER PLANTS, free from CRITICAL MASS, 133 C Street S.E., Washington, DC 20003. Comparison of employment impacts over the lifetime of alternative processes for producing an identical product indicate that coal power will result in 4[illegible] more employment than nuclear power, while costing less.

The higher costs to a community resulting from any kind of economic growth is described in several publications:

"Santa Barbara—The Impacts of Growth," reprinted in the SECOND ALTERNATIVE PUBLIC POLICY READER, Shearer and Webb, ed., $7.50 from the Institute for Policy Studies, 1901 Q Street N.W., Washington DC 20009. A solid and straightforward discussion and analysis of the questions people have about growth and growth management in a community.

THE COST OF URBAN GROWTH: OBSERVATIONS AND JUDGMENTS, Richard Bradley, 1973, $2.32 from Pikes Peak Area Council of Governments, 27 East Vermijo, Colorado Springs, CO 80903. Demonstrates that larger cities and faster growing cities cost more to live in and have fewer amenities.

The economic and community benefit of smaller scale, locally owned business and industry is nicely explained in

SIZE, EFFICIENCY AND COMMUNITY ENTERPRISE, Barry Stein, 1974, $3 from the Center for Community Economic Development, 639 Massachusetts Ave., Suite 316, Cambridge, MA 02139

Recent studies by the Institute for Local Self-Reliance analyze the economic impact on a specific neighborhood of different size businesses, outside ownership of enterprises and the role of banks in directing deposited money out of the neighborhood into other investments.

"The Adams-Morgan Business Sector: Paying for Other People's Development," $1 from the Institute for Local Self-Reliance, 1717 18th Street N.W., Washington, DC 20009

EMPLOYMENT IMPACT STATEMENT

JOBS CREATED

	Proposed Project	Alternative Processes	Alternative Investment

How many new local jobs will be *directly* associated with the proposed new facility (program, project, etc.)?

. How many new local jobs will be created indirectly by local purchases of supplies and services by the new facility?
(This can be roughly calculated by (a) obtaining estimates of the new facility's annual local purchases of supplies, (b) figuring the proportion that will go to pay the wages of new workers that local suppliers will have to hire to handle the increased business, (c) and then dividing by local average wage, to convert the dollar figure to a jobs equivalent. Consistent and reasonable "guesstimates" are OK.)

How many *induced* local jobs will the new facility generate?
(This can be roughly calculated by (a) estimating the percentage of new direct and indirect payrolls that will ultimately become local personal expenditures by workers, (b) figuring the proportion that will go for wages of new workers that local retailers will have to hire to handle the increased business; (c) and dividing by the average local wage to convert the dollars to job estimates.)

Total number of jobs created:
(direct + indirect + induced = total)

. How many jobs will the new facility eliminate—directly or indirectly—in other local businesses?

6. NET number of jobs created
(number of jobs created minus number of jobs eliminated)

ALTERNATIVES

. What are the employment impacts of alternative means of providing the same services?
(These alternatives can be different production processes—such as employing bank tellers instead of computers to process checks—or different institutional arrangements. Small, locally-owned shops keep business profits within a community, where they provide indirect and induced jobs, while large, outside-owned franchises remove profits—and induced jobs—from the community and frequently purchase supplies from outside suppliers they own, reducing indirect jobs in a community.)

What are the employment impacts of alternative uses of the same investment resources? (particularly if public funds)
Almost any expenditure of money creates jobs, but using that money for different purposes may have very different results while providing the same amount of jobs. Building new power plants provides jobs and insulating homes provides jobs, but only the latter eliminates need for unnecessary future expenditures of work, dollars and energy. Expenditure of tax money provides jobs but raises our taxes, giving us each less to spend, which would have provided jobs anyhow. And expenditures for different purposes provides very different numbers of jobs and use of resources. Hospital services provide three times as many jobs per dollar spent as highway construction. Expenditure of funds for waste treatment construction, social security benefits or national health insurance instead of present Army Corps of Engineers projects would provide 30 to almost 40% increases in employment.

COMMUNITY IMPACTS

What special conditions will be required to sustain the activity being planned? (Do the product produced and the proposed rate of resource use indicate sustainable operation? Are special markets, government subsidies, local resources, abnormally low local wages necessary?)

Are the activity and the jobs it creates seasonal or cyclical over a longer period of time?

. How many of the new jobs created will be permanent?

How many of the new jobs will be temporary? (e.g., associated only with construction or initial operation)

5. What will happen to workers in temporary jobs when their work ends?

6. What will be the distribution of new jobs among types and wage levels?

Type of job	Wage	Number	Percent of Total

. Will the income distribution of the jobs provided increase inequality of wealth in the community?

8. How many of the new jobs are likely to be filled by local unemployed people?

9. How many of the new jobs are likely to be filled by workers whose employment has been terminated, directly or indirectly, because of the new facility?

10. How many of the new jobs are likely to be filled by local residents? How many by newcomers?

11. How many of the new jobs are likely to be filled by men? women? minorities?

12. Will the new facility make it harder for people without special education or training to get jobs in the community?

13. Will the new facility make local employment more dependent on outside decisions that don't incorporate the needs of the community?

14. Will the financial base of the new project make it comparatively harder for small local industry to compete fairly for loans?

Prepared by RAIN Magazine from an earlier version by Avrom Bendavid-Val, Center for Growth Alternatives

STATEMENT OF ROBERT A. GEORGINE, PRESIDENT, BUILDING & CONSTRUCTION TRADES DEPARTMENT, AFL-CIO

Mr. Chairman and members of the subcommittee, my name is Robert A. Georgine and I am President of the Building and Construction Trades Department, AFL-CIO, its 17 affiliated International Unions and their 4 million members.

I welcome this opportunity to testify on the subject of the relationship between energy supply, jobs and economic growth.

The nation faces challenges in the coming decades. These same challenges will hang on for our children and grandchildren to face unless those of us occupying this planet now in the 1970's take the necessary actions to meet them.

The challenges I speak of have to do with an adequate national energy supply. Without it, life in the United States will become difficult and painful.

Energy, economic growth and unemployment are foremost on the minds of the American people. Indeed, the President has indicated on many occasions that these issues are among his highest domestic priorities.

The President has addressed the people of this country on two occasions indicating that energy was one of the nation's most severe problems, and that continued economic health was greatly dependent on resolving our rapidly worsening energy situation.

I couldn't agree more with the President. Each passing month, the energy situation becomes more critical—the percent of our oil imports has surpassed the 50 percent level and is steadily on the rise; last year payments for this imported oil (approximately 45 billion dollars) were the major cause of the largest trade deficit in our nation's history—nearly 27 billion dollars; the reliability of this source of supply continues to be reflected in the volatile political situation that exists in the area of our principal suppliers; efforts to curtail the outflow of funds and the drop in the overseas value of the dollar, principally caused by our oil deficits, has resulted in higher interest rates which act as a brake on the economy.

Substantial growth in energy supply is needed to just keep the unemployment level at slightly less than seven percent (7 percent)—much less reduce it. Balanced energy growth for our economy for the past thirty years has averaged nearly four percent (4 percent) when unemployment was lower. Many economists suggest that greater growth will be needed during the next five years to make up for the severe recession in the mid-1970's and the present high level of unemployment. Nevertheless, let's assume a four percent (4 percent) or even slightly lower growth rate.

The Construction Industry is in a depression with unemployment over 18 percent of our total work force. This nation's largest industry, which is so crucial to the entire economy, will not be revived until the construction of energy supply facilities resumes its progress.

Much research has been done on the relationship between economic growth and energy growth. Past history has shown an almost symbiotic relationship. Putting it another way, growth in employment and GNP is directly accompanied by growth in energy use. While some would suggest that this lockstep relationship will be broken in the future, the truth is there is no factual base on which to count on this. Since the oil embargo, energy and economic growth have traced the same paths—declining in 1974–75 and rising with the increased economic activity thereafter.

Last year, electricity demand increased by a substantial six percent (6 percent) margin. While it is possible that some of these relationships might be broken by vigorous conservation measures, which must be undertaken, I believe the Administration's plan for halving these ratios is extremely optimistic.

If the Administration's conservation assumptions are not realized, and if increased energy production is not in place when needed, the result will be lower economic activity. Few knowledgeable individuals would dispute the relationship between economic expansion and unemployment. Without sufficient economic and thus energy growth, higher unemployment is inevitable. For example, according to a National Power Survey Study, 4.4 million jobs would be lost for only a 12 percent shortfall in electrical energy. Over one and a half million layoffs and a three-day work week resulted in a few weeks of coal shortage in Great Britain in 1972. Here in the U.S., about 2 million became unemployed as a direct result of natural gas shortages during the winter of 1977.

The economy today is operating far below its full potential. Much of our industrial capacity and manpower resources are lying idle. This country's economic well-being depends on a plentiful supply of energy at a reasonable cost.

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However, cancellation after cancellation, postponement after postponement of many fossil and nuclear plants by utilities because of intervenor actions, environmental restraints, and high interest rates during the past several years are laying the groundwork for future energy shortages. For example, there is no need for it to take 10 to 12 years to construct a nuclear power plant. Hopefully, the Administration's forthcoming licensing reform legislation is going to alleviate some of these delays with respect to nuclear plants. The construction of much needed nuclear and fossil plants alone would provide employment for many years for many thousands of workers, to say nothing of the jobs that would be available to the economy once the plants are operational. And this is an extremely important point—these facilities are needed to supply energy to other sectors of the economy where other jobs depend on adequate energy supply.

Regarding the increased labor and capital requirements for constructing these electric generating power plants, I have included for the record a recent Department of Labor/Department of Energy Report.

Let me now turn to a subject that must be addressed, that of the no-growth economy. I have tried to detail the direct correlation between energy consumption, employment, and economic growth. The effects of a no-growth, low-energy, spartan life-style will surely result in the fact that there simply won't be enough resources to support our present society—a society that was founded on the principle of freedom of choice. That concept could well find itself in jeopardy.

The AFL-CIO Platform Proposals presented to the Democratic and Republican National Conventions in 1976 included the following statement:

"Organized labor has not wavered in its active and continuous support of legislation and programs to protect and restore the nation's environment. But at the same time we reiterate our conviction that America can have a clean environment and jobs, too. Environmental requirements can and must be reconciled with employment and energy requirements essential to maintaining a strong national economy, without sacrificing either the environment or a healthy economy.

"We, therefore, strongly oppose policies, or programs that would move America into a disastrous no-growth posture."

In short, if the no-growth advocates succeed, energy sources would not be available in sufficient quantities for industries to expand and meet the needs of our growing population. That means that jobs would not be available. There would be countless job layoffs. Moreover, products would rise in price as shortages of energy become apparent.

A shortage of energy supply would not only cut the number of jobs but would reduce workers' earning and living standards. Choices would have to be made between adequate housing, food, and health care. Unemployment also produces significant losses of tax income to state and local governments. It represents wasted human resources, and erodes the skill of the individual and jeopardizes his, or her self-respect.

As a final point, a serious look must be taken at those who will suffer the most by insufficient energy supplies. The unemployed won't necessarily be the wealthy with secure jobs, nor the elitists of society, but rather the "guy on the bottom rung of the ladder"—blacks, women, teenagers, et al who represent the bulk of the unemployed ranks.

The availability of jobs and opportunity for our citizens to enjoy the health and welfare benefits of technological development depends on the economic vitality of the nation. Prosperity and an expanding economy cannot be provided unless an ample supply of reasonably priced energy is assured.

Economic and social losses for the worker, and freezing the poor and low income members of our society into their current status is a situation we must avoid.

STATEMENT OF BARRY COMMONER, DIRECTOR, CENTER FOR THE BIOLOGY OF NATURAL SYSTEMS, WASHINGTON UNIVERSITY, ST. LOUIS, MO.

*Energy and Labor—Job Implications of Energy Development or Shortage**

The theme of this conference—jobs and the environment—is a timely and crucial one. Both are urgent and unsolved problems. Canadian unemployment has jumped from a "normal" rate of 4 or 5 percent to 8.4 percent, the highest

*Presented at the Conference on Jobs and the Environment, sponsored by the Canadian Labour Congress, Ottawa, Canada, Feb. 20, 1978.

since World War II. In the United States, despite a 6.4 percent figure in December, unemployment averaged 7 percent last year. About 15 percent of young workers are unemployed and nearly 40 percent of young, black workers are unemployed. At the same time, in spite of major legislation and a huge effort to clean up the environment, we are still plagued by pollution. Some environmental problems, like toxic chemicals, have become even worse. Their most serious effects, such as sterility and cancer, have been imposed on labor—the workers who produce and use these chemicals.

Now the persistent problems of unemployment and environmental decay have been joined by a third one—the energy crisis. Although there is much confusion about what the energy crisis is, who is to blame for it and even whether it is real, this much is celar: Whatever is done about energy or even if nothing is done, it will have enormous effects on both jobs and the environment, and indeed on all the other issues with which labor is concerned—prices, working conditions and the strength of the economy.

We therefore confront three serious, simultaneous problems: Unemployment, environment and energy. The worst feature of this troublesome triumvirate is that it seems impossible to solve any one problem without making the others worse. When more than 20,000 U.S. steelworkers were laid off in the last six months and steel plants closed, the industry blamed the cost of pollution controls for its inability to compete with steel imports. Here in Canada you are told that to meet the nation's energy needs, much of Alberta's land and water must be diverted to mining tar sands, and that the resulting environmental damage must be borne as a kind of patriotic duty.

People seem ready to accept the notion that there are built-in, insoluble conflicts among the three goals of employment, energy sufficiency and environmental quality. Compromise seems to be the only way out, trading off jobs for environmental quality and energy for agricultural land and clean waters. "There is no free lunch," we are told; we cannot meet all these goals at once, something has to give. Anyone proposing to solve one of the problems is expected to question the importance of solving the others. The oil companies call for strong incentives for oil and natural gas production, but want environmental controls to be "reexamined" and made "more reasonable." Those of us who are seen as "environmentalists" are expected to argue strongly for environmental quality and energy conservation, making only some sympathetic sounds about the plight of the unemployed.

And inevitably, labor is caught in the middle. Utility executives and business leaders pressure labor to join battle against environmentalists, claiming that their opposition to nuclear power plants will throw people out of work. Auto executives pressure the unions to join in condemning gasoline conservation for fear that it will worsen the economic situation in the auto industry.

Before I examine this situation, let me make my own position unambiguosly clear:

If there were in fact a conflict between jobs and environmental quality, or between maintaining the supply of energy and ecological balance, I would personally favor actions that cut unemployment and maintain the flow of energy, and suffer the environmental consequences. I say this because my own interest in the environment and in a sensible energy policy is based on a much more fundamental aim—the improvement of human welfare. And I know of no way to accomplish that aim if people are out of work, if inflation is rampant and the economic system is in a decline.

I'd like to carry this argument even further, and assert that of these three issues, the one which most urgently needs to be solved is unemployment, and the attendant problems of runaway inflation and economic decline. Unless we can solve the unemployment problem, the rest won't matter very much. How long can we tolerate the rejection of one in every five young workers—or two in five if they are black—trying to find their very first job; trying, as every young person must, to discover if they can find a place in society? It is hard to conceive of a nation finding the will to tackle the enormously complex energy crisis or coping wtih thousands of chemical pollutants when the new generation which is supposed to reap the benefits of these improvements is condemned to such despair. Or to put it in more practical terms, an economic system incapable of finding work for such a large proportion of its new generation of workers could hardly be expected to muster the huge financial resources needed to clean up the environment and to weather the energy crisis. On these grounds I am convinced that if we were forced to choose among them, the task of reducing employment and of rebuilding the faltering economy would have to take precedence over the energy and environmental crisis.

But are we in fact forced to make this desperate choice? Must we sacrifice environmental quality—which is, after all, also essential to human welfare—on the altar of high employment and economic stability? My answers is no.

I am aware that this is a strong claim which seems to fly in the face of common wisdom about our trio of crises. And I would agree, if you are convinced that people are unemployed because they don't want to work, that the Arabs are to blame for the energy crisis and that pollution is due to our sloppy habits, it is indeed hard to see any connections among the three issues. Looked at this way, there does not seem to be a way to harmonize the three goals rather than compromise them; to solve all the crises rather than trying to improve one situation by worsening the others.

But if we look for more fundamental reasons why, like ancient Egypt, we have been afflicted with this series of unexpected plagues, we will discover that they are connected. More than that, we will discover that the only way to meet the fundamental needs of labor—to reduce unemployment and inflation and reverse the present economic decline—is to adopt a policy that would at the same time make sense out of the energy crisis and reduce pollution. The reverse is also true: the only sound energy and environmental policy—a policy that can best give the nation a stable energy supply and a clean environment—is one that serves these needs of labor. This is the main point of my remarks, in which I hope to demonstrate why I have reached these conclusions.

To begin with, we must recognize that the place where labor works, where energy is produced and used, and where most environmental problems are created, is the same: the productive enterprise—the mine, the factory, the farm. This means that the relation between the availability of jobs, the production and use of energy and impact on the environment depends on how these productive enterprises are designed and operated—more generally, on the technology of production. In turn, the design and operation of a mine, a factory or farm involves economic factors: the wages paid to labor, the price of energy and other necessary inputs, the amount of capital needed to buy or build the productive machinery, the value of the goods that are produced and the expected rate of profit.

The welfare of labor—the availability of jobs, for example—depends on how this complex system operates, and that, in turn, depends on how all of its different technological and economic elements are connected. What labor requires from this system, simply stated, is that it should operate at its highest possible capacity; that it should provide, for all who can work, decent jobs at decent pay, in conditions that protect safety and health; that the goods which it produces should be sold at prices that labor can afford; that inflation, which erodes the standard of living, should be controlled; that labor should be free to organize and to take part in the decisions which affect its welfare.

Our task here is to learn how the production and use of energy and the quality of the environment affect these requirements which labor—and indeed society as a whole—must place on the production and economic system. Specifically, we need to ask what energy policy will encourage strong economic activity, ample job opportunities, control inflation and enable labor to play its proper role.

The first, most obvious feature of such a policy is that energy must be available. It is a simple, but often overlooked fact that every form of production—in factories, farms, transportation, offices—requires energy and cannot operate without it. This is the inescapable result of the physical laws which govern the production and use of energy. These laws tell us that work must be done if we wish anything to happen that won't happen by itself (for example, producing an auto) and that work can be done only if there is a flow of energy. Any block in the flow of energy means that production stops—and people lose their jobs. And a small interruption in the flow of energy can have a much larger effect on the economy. For example, when the Midwest ran out of natural gas last winter—because Texas producers preferred to make an extra profit of $1 per thousand cubic feet by selling gas within the state rather than shipping it north at a lower, regulated price—the resulting economic dislocation involved losses, in wages alone, many times greater than the cost of the missing fuel. No matter what else is done about energy, it must continue to flow if goods are to be produced and people are to remain at work.

The second basic point is that the availability of energy depends on its price. People have frozen to death because they couldn't afford to pay their utility bill. In turn, the price of energy has a heavy influence on general inflation and worsens its damaging effects: reduced purchasing power, lowered demand for goods, depressed production and unemployment. Because energy is used in producing all goods and services, when the price of energy rises it inevitably drives up the cost of everything else. When the price of energy, which was essentially constant for 25 years, suddenly began escalating in 1973, wholesale commodity prices followed suit. Before 1973 commodity prices had been inflating at a modest rate of about 2 percent a year. After 1973 they took off, going into double-digit figures in 1974, and since then running at more than 10 percent a year.

The prices of goods that are particularly dependent on energy are hardest hit by inflation. Unfortunately, these energy-intensive goods include housing (which depends on the cost of fuel and electricity), clothing (most of which is now made from petroleum-based synthetic fabrics) and food (which now heavily depends on fertilizers and pesticides, chemicals made out of petroleum and natural gas). This puts a particularly heavy burden on the poor. In the United States, the poorest fifth of all families use about 25 percent of their budget to buy such energy-intensive items; the wealthiest fifth of the families use only 5 percent of their budget for this purpose. When the price of energy rises the poor suffer most.

The rising price of energy also damages the economy and increases unemployment because of its influence on economic predictability. This is an important factor in a new industrial investment because an entrepreneur needs a reliable prediction of the long-term cost of the energy needed to operate it. This is how the rate of return on the investment is computed—the famous "bottom line" which determines whether or not an investment will be made. The price of energy is now rising at a rate unprecedented in the history of the United States. In the ten years before 1973 the energy price index increased at about 3.7 percent per year; in 1973–76 it increased at the rate of 25 percent per year. The problem for the businessman is not so much the actual price of energy, since in most cases he can pass the cost—and usually a little more—along to the consumer. What the businessman cannot cope with is the rate of increase, because when the rate is very high it is also uncertain, making future energy costs highly unpredictable. Several business commentators have pointed to such uncertainies as a major cause of the present slow rate of investment—which means that plants are not built, and job opportunities are lost.

Unfortunately, nearly all of our energy now comes from sources that must, inevitably, rapidly increase in price. Nearly all of our energy comes from oil, natural gas, coal and uranium. These are nonrenewable resources. They are limited in amount. We are "running out" of them. At this point some people tend to visualize oil and gas supplies slowing down to a trickle as the underground pools run dry. But that is not the way it works. What happens as oil, for example, is taken out of the ground is that the easiest oil to produce is produced first. As a resul, the cost of producing oil inevitably escalates as more oil is produced. The law of diminishing returns is at work. As production of oil, natural gas and, more recently, uranium, increases it became necessary to drill deeper, to tap smaller deposits and to use more expensive recovery methods. Inescapably, whenever the limited supply of a nonrenewable fuel is sufficiently depleted, its price begins to rise exponentially—that is, the higher the price, the faster the price increases. (In the case of oil this is sometimes blamed on OPEC and the Arab states' embargo. But in fact two years before the embargo, the OPEC oil ministers got their cue from a massive and detailed report published by the U.S. National Petroleum Council. The NPC—which should know, since it is composed of the officers of the U.S. oil companies—predicted that the price of domestic U.S. oil, which had been essentially constant for the previous 25–30 years, would, beginning in 1972–73, need to rise exponentially if the oil companies were to maintain their rate of return on investment. The OPEC oil ministers believed their American colleagues and took steps to see that they were not left behind.)

In sum, the situation is this: As long as we continue to use nonrenewable energy sources, the price of energy will continue to escalate, causing a series of disastrous economic effects—rapid inflation, an erosion on the standard of living of poor families and uncertainties about investments in new production—all of which depresses the economy and worsens unemployment. Continued dependence on nonrenewable energy sources inevitably hurts the country, and labor in particular.

A third basic link between energy and the economy is provided by capital. We now hear frequent complaints in the financial columns that the present weakness of the economy is in good part due to the lag in new capital investment. This is an ominous sign, for a slow rate in investment in new productive enterprises today means much lower productive capacity—and job opportunities—tomorrow. The availability of capital, and the willingness of investors to risk it in new productive enterprises, is a crucial feature of the economy's health.

There is a close connection between the flow of energy and a capital. It is widely recognized that the availability of capital strongly influences energy production. Utilities have been forced to abandon new construction projects (especially nuclear power plants) and investors have been forced to abandon synthetic oil and shale oil projects for lack of the necessary capital. What is less well-known is that the opposite connection is alse important: The ways in which we now produce and use energy strongly influence the availability of capital, and therefore the rate of new investment which depends on it.

Various methods of producing energy differ considerably in their capital productivity—that is, in the amount of energy (for example, BTU's) produced annually per dollar of capital invested. One dollar invested in oil production (in 1974) produced about 17 million BTU's of energy per year. But that same dollar invested in producing strip-mined coal yielded only 2 million BTU per year; in shale oil about 400,000 BTU per year; and nuclear power brings up the rear with the equivalent of 20,000 BTU per year. Thus, any energy policy which emphasizes the production of electricity (particularly from nuclear power plants), rather than direct burning of fuel; which favors the use of coal over oil and natural gas; or which emphasizes the production of synthetic or shale oil, would worsen the energy industry's already serious drain on the availability of capital.

Each of the different ways of producing energy also has its own particular demand for labor. For example, in 1973 for every unit of energy yielded (trillion BTU's), oil and natural gas extraction created six jobs; strip mining, six jobs; deep coal mining, 18 jobs. As a result of these differences, and differences in capital productivity, the same amount of capital invested in different ways of producing energy can have very different effects on unemployment. For example, one calculation shows that a given amount of capital would produce two to four times as many jobs if invested in solar energy rather than electricity generation. A report to the New York State Legislative Commission on Energy Systems calculated that investment in energy conservation would produce about three times as many jobs as the same capital invested in nuclear power.

Finally, the impact of different forms of energy production on working conditions and on the general environment also vary a great deal. The physical dangers of work in coal mines and the risk of diseases such as black lung are well known. In the nuclear power industry, uranium miners are exposed to particularly high risks of radiation-induced cancer. The risks of radiation to other workers in the industry are still poorly understood, but some recent studies suggest that they may be higher than most earlier estimates. Shale oil production and conversion of coal to synthetic fuels produce highly carcinogenic substances; workers in a pilot coal conversion plant operated in West Virginia in the 1960's suffered 16–37 times the incidence of skin cancer as comparable workers in different jobs. There may be similar problems in tar sands operations.

The environmental impact of different energy sources closely parallels their impact on the workers' health. Coal mining, shale oil and tar sands oil production devastate the land and use large amounts of scarce water. Coal conversion operations are heavy polluters of the air. Coal-burning power plants pollute the air with nitrogen oxides, sulfur dioxide and carcinogens. The nuclear power industry has yet to solve its serious environmental problems, such as safe disposal of radioactive wastes. Recent reports show that radiation leaking from reactors has contaminated milk from nearby dairies with unsafe levels of strontium 90. When energy is conserved all of these difficulties are, to that extent, reduced. And if solar energy were used instead of these conventional sources, environmental impact would be very sharply reduced.

From these considerations it is apparent that the effect of energy production on major factors which govern the welfare of the nation, and of labor in particular—inflation, employment, the availability of capital, working conditions and environmental quality—varies greatly depending on the form of energy which is produced. While a continuous flow of energy in some form is essential to keep the production system going and the economy strong, the way the flow is sustained can have the opposite effect. For example, if we were to choose to sustain the necessary flow of energy by relying heavily on very capital-intensive sources of energy (such as nuclear power, shale oil production and the production of synthetic fuels from coal) the enormous drain on capital would hinder investments in the productive enterprises that use the energy and seriously disrupt economic development. It is true that continued production of energy is essential to the economy. But it is also true that we could literally bankrupt the economy by investing heavily in the wrong kinds of energy production.

Perhaps the most striking example of this danger is nuclear power, as Saunders Miller, a prominent utilities investment counselor, has pointed out:

"Based upon thorough in-depth analysis, the conclusion that must be reached is that, from an economic standpoint alone, to rely upon nuclear fission as the primary source of our stationary energy supplies will constitute economic lunacy on a scale unparallelled in recorded history, and may lead to the economic Waterloo of the United States." [1]

If we turn now from the ways in which we produce energy to a consideration of the ways in which we use it, we see once more that there are profound differences which seriously affect both labor and the national welfare. Here we need to consider how efficiently energy, capital and labor are used in production processes. A convenient way to measure these efficiencies is in terms of the productivity of an enterprise, such as a particular manufacturing operation. This measures how much economic gain—usually expressed as value added—is produced per unit of energy, capital or labor used. Thus, three basic productivities need to be considered:

Energy productivity, or how efficiently the enterprise converts the energy that it uses into value added. This is measured as: dollars of value added per BTU used in production.

Capital productivity, or how efficiently the enterprise converts the capital invested in it into value added. This is measured as: dollars of value added per dollar of capital invested.

Labor productivity, or how efficiently labor is converted into value added. This is measured as: dollars of value added per man-hour.

Let us compare the productivities of two industries which produce competing materials: leather products and the chemical industry which produces the plastics that have so heavily replaced leather and other natural materials. Of the two industries, leather production is about 4.5 times more efficient in converting capital into value added, and nearly 13 times fore efficient in its use of energy. This relationship between capital and energy productivity is quite general among different industries. Five industries, petroleum products, chemicals, stone, clay and glass products, primary metals and paper, account for about 59 percent of electricity and 77 percent of the total energy used in manufacturing. They also have the lowest captial and energy productivities of all major sectors of manufacturing. There is a good correlation between energy productivity and capital productivity because energy is used to run the machines purchased by capital; the more capital (machinery) involved in an industry, the more energy it uses. And in many cases, this means fewer jobs, since the energy is often used to replace human labor. For example, for the same economic output the chemical industry uses less than one-fourth the amount of labor than the leather industry.

Another important feature of the relation between energy and the economic system is that—strange as it may seem in the light of supposed economic principles—capital and energy tend to flow toward those enterprises that use them least efficiently. Capital used in industrial production flows heavily toward those sectors which are low in both energy productivity and capital productivity. For example, the five industries cited earlier that use energy and capital least efficiently use nearly one-half of the capital invested in all manufacturing industries. In contrast, the seven most energy-efficient industries (such as leather production) use only 7 percent of the capital invested in manufacturing.

As pointed out earlier, various methods of producing energy also differ significantly in their capital productivity (i.e., how efficiently capital is used to produce energy). Here too capital tends to flow toward those enterprises which use it least efficiently. For example, although electric power represents only 21 percent of the total amount of energy which we use, it consumes 56 percent of the capital in-

[1] *The Economics of Nuclear and Coal Power*, Miller, S.; New York: Praeger Publishers, 1976; p. 109.

vested in energy production. At the same time, due to thermodynamic limitations, no more than one-third of the fuel used to drive a power plant is converted into electricity. Electric power is therefore by far the most expensive form of energy in terms of capital expenditure. When electricity is used to produce space heat, more than 97 percent of the thermodynamic value of the original energy is wasted. Yet about a fifth of U.S. electric power is used in this way—an enormous waste, not only of energy, but also of the capital needed to produce job-generating factories and homes.

In recent years industries with high energy and capital productivity (such as leather) have given way to industries with low capital and energy productivities (such as plastics). This is particularly true of the displacement of natural products (leather, cotton, wool, wood, paper and soap) by synthetic ones (plastics, synthetic fibers and synthetic detergents). For the reasons cited earlier, this displacement not only drains supplies of energy and capital, but also worsens unemployment. In the U.S. about half of the unemployment is "technological"—that is, job opportunities lost when such new production technologies are introduced and cut the overall demand for labor—and usually disproportionally increase the demand for energy and capital.

Now we can see the basic links among energy, the economic system and the environment: The same shifts in production technology that reduced the productivity of capital and energy and have cut the number of jobs usually increased the impact of production on the environment. As synthetic products replaced natural materials more petroleum and natural gas were used both as raw materials and for fuel, polluting the environment with combustion products and toxic chemicals. The petrochemical industry demonstrates the close links among the wasteful use of energy and capital, the assault on the environment and unemployment.

Thus, we find that unemployment is part of the same economic trends that generated the energy crisis and the environmental crisis: Energy has been produced increasingly in forms (especially electric power, and nuclear power in particular) which use a great deal of capital relative to the amount of energy that they yield. As a result, energy production has claimed an increasing proportion of the capital available for business investment, making it less available for investment in new job-creating enterprises. (In 1960, energy production claimed 26 percent of the capital invested in industry; by 1980 it is expected to claim more than a third). At the same time, industries which use energy inefficiently also use capital inefficiently; they also pollute the environment most heavily and are often least effective in creating jobs. In sum, the same economic tendencies—the displacement of labor by energy-driven machines—that have worsened employment carry a good deal of the responsibility for the energy crisis and the environmental crisis. The crises in employment, energy, and the environment are, in this sense, the same crisis.

Against this background what can be said about Carter's National Energy Plan, which is the United States' first effort to establish a comprehensive energy policy? Judged by the standards developed above, most of the plan must be given rather bad marks, especially for its effect on labor. The plan is based on the strategy of raising energy prices as a means of encouraging energy conservation. Leaving aside that the plan would in fact accomplish very little conservation (only 16 percent of the increased demand for energy between now and 1985 would be met by conservation) this approach will only worsen inflation, and with it unemployment and all the economic ills which trouble labor. The plan mandates a sharp increase in the present rate of nuclear power plant construction and in the use of coal—with a resulting doubling in the contribution of electricity to the energy to be acquired between now and 1985. This means heavy reliance on the ways of producing energy that are most wasteful of capital, a step that is certain to add to our present economic difficulties. At the same time, by increasing the availability of electricity (relative to direct use of fuel) the plan would encourage those industries that are power-intensive—and which are thereby likely to use little labor. Finally, the plan would create enormous new environmental difficulties, because it relies so heavily on the two methods of producing energy that most severely threaten the environment—the use of coal and nuclear energy.

In sum, the National Energy Plan is likely to aggravate the energy crisis rather than solve it, for it would worsen the main effects of the energy crisis: inflation, unemployment and economic uncertainty. This means, I fear, that if the plan is enacted in anything remotely resembling its present form, we would be confronted even more by the divisive antagonisms among those concerned with unemployment, energy and the environment that only contribute confusion to a national debate that cries out for clarity.

Is there no way out? There is. There are alternatives to the nuclear power plants, the strip mines, the coal gasification projects, to the continued use of oil and natural gas which will rise in price forever. The alternative is, of course, solar energy.

Now at this point many people will react with a faraway look in their eyes, and perhaps with some impatience and frustration, expecting to hear another one of those pie-in-the-sky schemes about a beautiful solar future. But that is not what I am talking about. I am not going to tell you that all will be well if we do more research on solar energy, set up a few more demonstration houses or learn how to build a solar power plant in space. What I am going to tell you—and not on my own authority, but on the authority of U.S. government agencies—is that for most methods of using solar energy the technology is already in hand, and can be introduced at once in most parts of the country, for a wide variety of uses, at economically competitive costs. To many people, and apparently to some government officials, this is news. But it is good news, for the most important thing about solar energy is that unlike conventional energy sources it will stabilize the price of energy, slow inflation and improve investment planning; it will create rather than destroy jobs; it can turn the country's faltering economy around. It can give us a real energy plan that solves the energy crisis rather than making it worse—the kind of energy plan that meets the needs of labor.

Here are a few reminders about what solar energy is all about.

First, unlike oil, natural gas, coal or uranium, solar energy is renewable; it will never run out (or at least not in the next few billion years). Because solar energy is renewable it is not subject to diminishing returns—which means that its price, instead of escalating like the price of present energy sources, will be stable and even fall as the cost of devices continues to decline. By stabilizing the price of energy, solar energy reduces the threat of inflation and eases the task of planning investments in new productive enterprises, thus relieving two of today's worst economic problems.

Second, the use of solar energy does not depend on any single technique. There are different sources of solar energy, some forms more available in one place and other forms in other places. Everywhere that the sun shines solar energy can be trapped in collectors and used for space heat and hot water. Of course, the amount of sunshine varies from place to place, but not as much as most people think. The sunniest place in the United States, the Southwest, gets only twice as much sunshine as the least sunny place, the Northwest. In some places the most available form of solar energy may be wind (the wind blows because the sun heats the air on the earth's surface unevenly). In agricultural areas solar energy will be available in the form of organic matter (which is produced by plants, through photosynthesis, from sunshine): manure, plant residues, or crops grown to be converted into methane (the fuel of natural gas) or alcohol. In forested areas, waste wood, or even wood grown for the purpose, can be converted into heat, either directly, or by being made into gas. And wherever the sun shines, photovoltaic cells can be used to convert solar energy directly into electricity.

Third, for each of these solar processes the scientific basis is well understood and the technological devices have been built and are in actual use. Solar collectors are used all over the world, and were once (about 30 years ago) common in Florida and California; small windmills used to dot the farm landscape; methane plants are in operation in hundreds of thousands of Indian and Chinese villages; alcohol produced from grain was used extensively, mixed with gasoline, to run cars and trucks during World War II; photovoltaic cells now power satellites and remote weather stations. Of course solar energy needs to be stored during the night or over cloudy periods. This can be done in batteries, in tanks of alcohol or methane, in silos full of grain, as standing timber, or for that matter in piles of manure. All these items exist.

The main questions are, once again, economic: Granted that most solar technology exists, does it pay to introduce it? More precisely the question is not whether it will pay, but when. The cost of conventional nonrenewable fuel is now rising exponentially and will do so indefinitely. Since it is renewable, the cost of solar energy is fixed only by the cost of the equipment, which will fall in price as experience is gained. Place these two curves on the same time scale and inevitably they will sooner or later cross. Solar energy, which a few years ago was more expensive than the conventional alternatives, will inevitably equal them in price and then each year become cheaper relative to conventional energy.

Estimates of when and how solar energy systems become economically advantageous have now been made by the Solar Energy Task Force of the Federal Energy Administration (now part of the new Department of Energy). Here are the main features of the task forces "National Solar Energy Plan":

Solar heating: In most of the central part of the United States, if the government would provide low-cost loans, it would today pay a householder who uses electricity or oil for space heat and hot water to replace about half of it with a solar collector system. Even borrowing all the necessary funds at eight percent interest, with a 15-year amortization period, would cut the average annual heating bill by 19–20 percent.

Photovoltaic electricity: Here is the biggest surprise. For a long time even those of us most optimistic about solar energy were convinced that this technology—a wonderfully simple way to produce electricity from sunshine—was unfortunately so expensive as to remain uncompetitive for some time to come. Now the FEA report shows that the production of electricity from photovoltaic cell systems can compete with conventional power sources and exactly how that can be accomplished. The report shows that, beginning immediately for the more expensive installations such as gasoline-driven field generators, within two years for road and parking lot lighting, and within five years for residential electricity in the Southwest, photovoltaic units can compete, economically, with conventional power. All that is required to achieve this remarkable accomplishment is to invest about $0.5 billion in the purchase of photovoltaic cells by the federal government. This would allow the government to order about 150 million watts capacity of photovoltaic cells. This order would allow the industry to expand its operations sufficiently to reduce the price of the cells from the current price of $15/watt (peak) to $2–3/watt in the first year; to $1/watt in the second year and to $0.50/watt in the fifth year, achieving the competitive positions noted above and succesfully invading the huge market for conventional electricity. A similar federal (or state) purchase plan could bring large-scale power-generating windmills down to a competitive price, according to the FEA report.

Methane and alcohol production from organic matter: While methods of commercializing these sources of solar energy have not yet been worked out by the FEA task force, current research already begins to show how that can be done. Public work funds can be used effectively to rebuild urban garbage and sewage-sludge disposal systems so that they generate methane, which can help meet a city's energy demand. In certain farm operations—such as a dairy with 200 or more cows or a farm raising 5,000 or more chickens—it is already economical to replace current manure-disposal systems with methane generation, using it, for example, to produce electricity to drive farm machinery and heat to warm the barns. In Texas, one company has already begun to sell methane produced from feed-lot manure to the natural gas pipelines. Several Midwestern states are actively developing alcohol production from grain, as a partial substitute for gasoline in cars, trucks and tractors.

The most important aspect of solar energy, I believe, would be its effect on employment and economic recovery, but solar energy has another unique feature—it has no economy of scale. In all conventional energy production, there is a very large economy of scale—the cost of energy falls sharply with the size of the unit. Solar energy is very different. When a farmer wants to produce more corn he does not producer bigger corn plants, but plants more of them over a larger area. And each corn plant operates at the same efficiency, so that one acre of corp traps solar energy as efficiently as 1,000 acres of corn. The same is true of all solar techniques, such as photovoltaic cells. You can run a flashlight or a whole house on photovoltaic cells, at the same energetic efficiency.

In conventional energy production the large economy of scale means that only very large corporations can compete (that explains why the energy corporations are such big ones). In solar energy production a small or middle-sized company (or a household) can do as well as a corporate giant. As a result, huge, centralized solar installations are unneeded. The power can be produced on a scale that matches its use, where it is used, thus eliminating the need for heavy transmission systems (although light ones will be useful to balance our production and demand). It is easy to see that the introduction of solar energy would mean a rebuilding of not only our system of energy production, but also many of the ways in which energy is used in manufacturing, agriculture and transportation; it would create new jobs, and in doing so begin to control inflation.

The point of the foregoing analysis of the economic consequences of different ways of producing and using energy is not so much to support this particular theory about the role of energy in the production and economic system. What I wish to emphasize is the basic point that all energy sources and ways of using energy in production, are not alike in their effects on jobs, inflation and economic stability—and therefore on the interests of labor. Yes, some form of energy must be available if production and the economy is to continue—if goods are to be produced and if people are to have jobs and afford to buy what they need. But it makes a big difference which form of energy is chosen to support production, and how it is used. Choose the wrong form of energy and the effort to support the economy and create jobs will have the reverse effect. The economy will suffer and jobs will be lost.

Consider, for example, the often repeated claim that nuclear power plant construction is a good way to produce energy, support the economy and create jobs. This claim simply does not stand up before the facts. When compared with alternative ways of producing the needed energy it becomes clear that nuclear power is not the best way to sustain the economy and to provide jobs. Here is a concrete example: The Fiat Company, in Italy, has announced the availability of a cogeneration unit ("TOTEM") which uses natural gas, or methane produced from a solar source, to drive a converted gasoline engine, producing electricity and recapturing the normally wasted heat as a source of space heat. About 67,000 TOTEM units would produce a total of about 1,000 megawatts of power—the capacity of a typical U.S. nuclear power plant. However, whereas the nuclear plant would cost about $1 billion, the TOTEM units would cost only $191 million, and they would produce electricity at about one-fourth of the cost of electricity from the nuclear plant.

The economic efficiency of such cogeneration units, as compared with nuclear power means not only lower electricity prices, but also a more effective use of capital, therefore more opportunities for productive investment of capital—and more jobs. Because they can run on methane—a renewable solar fuel—such units can help bridge the gap between our present dependence on nonrenewable fuels and a solar economy. As should be evident from Fiat's accomplishment, such units could readily be manufactured in U.S. and Canadian auto plants, where they could take up the slack created by the disruptive effects of the energy crisis.

It is also informative to compare nuclear power with photovoltaic cells. If the proposed U.S. federal purchase plan were carried out, in five years or so the photovoltaic industry would expand enough to begin to allow local installations to compete economically with nuclear power in many parts of the United States. Again, many more jobs would be created by the solar technology than the nuclear one. The widespread availability of competitive photovoltaic cells would also create many opportunities for new types of industrial production. For example, it would encourage the development of battery operated hand-tools, since batteries could readily be recharged by a photovoltaic unit mounted on the factory roof.

These are only two examples of the choices that are now open to us, and I mention them only to emphasize that there are choices. There is only one way in which the familiar arguments that pit jobs against the environment, that put labor leaders on the side of nuclear utility executives, makes sense. And that is if we accept the assumption that the alternative to a nuclear power plant is no new electricity and that the alternative to massive strip mining is no new sources of heat. In other words, this argument holds only if we give up the right to choose, among the different ways of producing energy, those which best serve the nation's—and labor's—needs. Then, of course, the bitter choice between jobs and the environment must be made, for if the flow of energy is disrupted we will surely suffer massive unemployment and economic disaster.

I am aware that labor groups have often decided to support nuclear power, shale oil production, coal conversion and similar energy sources which, on the basis of the foregoing analysis, seem to be not in labor's interests. But I know of no instance in which such support has been based on an actual comparison with alternative sources of energy. In every case, it is not a matter of making the wrong choice, but of avoiding a choice—in the belief that energy is essential for production and jobs (which is correct) and that all forms of energy will yield the same beneficial effects (which is not correct). Resolutions have been passed by labor groups which in one place strongly urge a fight for jobs and against inflation, and elsewhere urge the development of all forms of energy, listing sources such as nuclear power and coal conversion—which are bound to do employment and inflation more harm than good—alongside solar energy, which is labor's most powerful weapon against energy-driven inflation and unemployment.

If labor is to win its fight for jobs, for reasonable prices, for decent working conditions and for a strong economy, it must accept the responsibility of deciding, for itself, which forms of energy and which ways of using it will best sustain these aims. Up to now these decisions have not been made by labor, but by management. And now that management's choices—for nonrenewable sources such as oil and capital-intensive sources such as nuclear power, rather than the solar alternative—have precipitated the energy crisis, the decisions are being made by government executives and legislators. But, again, labor is on the sidelines.

Unless labor enters into the debate—on its own terms, making its own decisions about what energy policy best serves the needs of society, and labor in particular—we will make the same disastrous mistakes once more. Nor is it enough for labor to rely on "environmentalists" and other people of good will to suggest the right way to produce and use energy. There is no guarantee, for example, that an energy policy will be free of serious economic and social disadvantages just because it is based on solar energy. Devotion to solar energy is not, after all, proof against indifference to social welfare, greed or simple foolishness.

Consider for example two different ways to achieve a transition to solar energy. One option is to deliberately increase the price of conventional energy, so that solar technologies will become more quickly competitive. The other is to hold down the price of conventional energy as much as possible and use public funds to cut the cost of solar alternatives and make them competitive. For the reasons already given, the first approach would place an intolerable economic burden on the people, especially the poor and the minorities, who suffer most from unemployment. At the same time, wealthier people would benefit from the transition. This strategy would increase both the general cost of energy and the price the consumer needs to pay to shift to a solar source. Poor people, unable to afford the high price of the new solar technology, would be forced to pay higher fuel prices, while wealthy people, who could afford the solar investment, could avoid buying the high-priced fuel. The strategy of rising fuel prices in order to encourage solar energy would tax the poor and favor the rich, justifying the suspicion already being voiced that public movements for energy conservation and solar energy are likely to be more in the interest of the wealthy than of the poor and the unemployed.

Perhaps the most serious dangers of this approach arise from a feature which in some quarters would be regarded as a virtue—the strategy relies on the "free marketplace" to govern the introduction of solar technologies. Bluntly stated, this means that the introduction of each solar technology would be governed by a single criterion—that it generate a profit for its producer greater than one he might obtain from an alternative investment. Such a strategy would please the companies now entrenched in the energy field. The oil companies would, of course, benefit from higher oil and natural gas prices. Even if the price increase were generated by taxes, it would make the oil companies' holdings in coal and uranium more valuable, and help support the price of oil in the world market—in which most of the U.S. companies are also involved. Private utilities could also benefit, by using their position in the consumer market and their access to capital to sell or lease to their customers whatever solar technologies are most profitable and least damaging to their centralized operations.

The last to gain from such a solar transition would be the poor. They would need to wait for benefits until, in the course of time, the massive substitution of solar energy for conventional sources stabilized the rising price of energy, and reduced the rate of general inflation. Finally, when the cost of the solar technologies fell far enough, the poor could afford them too. Such a profit-oriented transition would mean that the benefits of solar energy would be allowed, as usual, only to trickle down to the mass of people.

Clearly, it would not serve labor's interests—or for that matter, the nation's—to rely on such an approach to an environmentally-sound system of solar energy. Rather, labor and the nation need an approach which permits rational planning of the development, testing and introduction of solar technologies in keeping with their efficacy in the overall process of transition rather than on the basis of the narrow criterion of profitability. This approach would, of course, challenge the widely fostered notion that private profit is the sole acceptable basis for new productive investments. But this has happened before, in connection with the development of energy resources—notably in the development of hydroelectric projects, in particular the Tennessee Valley Authority, rural electrification and most recently nuclear power. In each case the creation of the system required public initiative and at least the initial investment of public funds. The issue is not necessarily one of public ownership, since in the case of nuclear power, the decision to develop it and the design of the technology was determined socially, while the ownership and operation of most of the industry has been in private hands. The example of nuclear power should also remind us that social governance of such decisions is by no means a guarantee that they will be in the best interest of society. Social governance is a necessary but not sufficient condition for maximizing social welfare.

An independent labor position on energy could provide a powerful remedy for some of the serious economic difficulties in U.S. and Canadian industry. Many industries—auto, steel, textiles, shoes and electronics—are being forced to cut back because they cannot compete with imports. These industries face the enormously difficult job of overcoming the economic advantages of foreign producers, achieved by their more modern productive facilities, in order to regain their share of the market. Meanwhile, plants close and people are thrown out of work. From what has been said earlier it should be evident that to cope with the energy crisis all industrial countries will need to develop new renewable sources of energy and new energy—and capital—efficient production technologies. Promising examples are photovoltaic cells and cogeneration units such as Fiat's TOTEM. Consider this very sobering thought—that U.S. and Canadian industry, still locked in the old pattern of producing and using energy—will not move quickly enough to develop photovoltaic cells and cogeneration units, failing to meet the inevitable demand for them. If that happens we will soon see Japanese photovoltaic cells and Italian cogeneration units capturing not just a part of the North American market, but all of it. We will have been frozen out of a good chunk of the enormous world-wide industrial transformation that is certain to take place under the impetus of the energy crisis.

I believe that labor can protect us from this fate, strengthen economic development and create jobs by taking its rightful place in the decision-making process that will determine our response to the energy crisis. Labor has the most to lose from the wrong decisions, and the most to gain from the right ones. Labor has the experience to understand how old production facilities can be converted to new uses and how to train workers in the new skills. Labor has the experience to defeat the notion, already being heard in some quarters ,that union labor would drive prices up and make the solar transition that much harder, and show that non-union labor would mean shoddy workmanship that could only hold back the new technologies. Finally, only labor has the political strength to break the corporate stranglehold on energy and to help society apply the power of public governance to the creation of a new energy system that can truly serve human welfare.

JOBS & ENERGY

energy and the economy/the substitution of energy for labor/productivity and jobs/ energy growth and prosperity: the myth/ energy inefficiency and waste/capital investment/energy efficiency/energy efficiency and jobs/solar energy/solar energy and jobs/the politics of solar energy/

ENVIRONMENTALISTS FOR FULL EMPLOYMENT

GUIDE TO JOBS AND ENERGY

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Jobs and Energy

Introduction

Corporate energy interests, along with most industrialists and some agencies of the government, are vigorously urging the rapid expansion of energy production. The energy systems they are promoting are large in scale, technologically complex, costly, wasteful, environmentally destructive and dangerous to energy industry employees and the public.

An increasing number of Americans are becoming convinced that these systems—such as nuclear fission and fusion, conversion of coal and shale to gas and oil, expanded coal-fueled electric generation— are too destructive to the public's health—as well as to workplace and natural environments—to be acceptable. These citizens propose instead a large decrease in the nation's waste of energy, plus immediate commercialization of proven solar energy technologies and development of solar technologies almost ready to be commercialized.

Most proponents of the large-scale, complex energy systems concede the systems they are promoting expose the public to a variety of dangers. But, they contend, there is absolutely no other possible way to meet the nation's energy needs, to provide for a strong economy, and to create sufficient numbers of jobs.

Environmentalists For Full Employment disagrees; there is another way.

The increased energy efficiency plus solar energy choice can provide sufficient energy for a prosperous economy. In fact, such a solution to the nation's energy problem *actually leads to a more stable economy and to more jobs* than does the large-scale system scenario. It does so with less pollution, less disease, less social disruption, and less interference with community, labor union and individual rights.

Decisions on the nation's economic, energy and employment futures are being made now. Wrong decisions today will be irreversible: if the nation decides to pin its hopes on inefficient, large-scale energy systems, such a vast quantity of resources and money will be consumed and so much havoc will be generated through all levels of society that energy and job options for the future will be choked off.

In sum, a future based on the visions of America's giant energy corporations and some of the federal agencies charged with planning energy strategies will be neither prosperous nor safe. Americans need to know this; and they need to know there is an alternative approach which will provide the nation with safe energy, with prosperity and with jobs.

For these reasons, EFFE has prepared this "Guide to Jobs and Energy."

I. Energy and the Economy

The latest recession is the 6th since World War II. It is the most severe.[1] Total real unemployment is between 8% and 10%. Women, minorities and young people are out of work in even higher percentages. In the last year, incomes of three million additional Americans fell below the "poverty line." Rural poverty has increased. The nation's largest cities have been experiencing severe financial crises, and have cut back a broad range of vital human services.[2] Industry has been operating at less than full capacity, and inflation has cut deeply into most wage increases of the past decade.

Americans have long been told that ever-increasing energy production was the key to national economic well-being and jobs. It seemed enough to note that as energy production expanded over the years, so did economic growth and total employment. Many in government and industry—in the Energy Research and Development Administration (ERDA), in the Federal Energy Administration (FEA), in Congress, at the Edison Electric Institute, the Atomic Industrial Forum, the oil companies—are therefore advising that unemployment can be ended only by stepping-up energy development to the greatest degree possible, and with the largest systems possible.

Yet, current high unemployment, along with a succession of economic crises, have been taking place *while national energy use has been at an all-time high, and increasing.*

The widening gap between accepted theory and reality has prompted calls for re-evaluation of the relationships between energy expansion, economic health and jobs. Cass Alvin, Director of Public Relations and Education for the United Steelworkers of America, reflected this new outlook recently when he told a Los Angeles Federation of Labor (AFL-CIO) meeting which had been listening to threats of job loss delivered by California utility executives:

> I think we've got to deal with the nature of energy and jobs very carefully, or we'll find ourselves looking to the wrong allies when confronting energy issues. . .[3]

And an economist in the research and education department of the International Woodworkers of America (AFL-CIO/CLC) has warned in a similar vein:

> Unions risk disaster and perform a disservice to their members if they do not attempt to define [energy and job relationships.][4]

It sometimes appears deceptively easy to determine which event causes another, especially when there are some apparent connections. For example, some wags have pointed out that over the years there has been a direct correlation between the salaries of a certain denomination of ministers in Massachusetts and the price of rum in Cuba.[5] Yet, no one seems to be suggesting that a real connection exists between these two occurrences. Similarly, along with energy growth during this century there has been an increase in mental illness. But it is not likely that advocates of energy expansion would say that such tragedy is connected to or necessary for continued energy growth.

To probe the nature of energy-employment relationships, it is instructive to begin with a look into the manner in which energy has been used.

II. The Substitution of Energy For Labor

Historically, industry has sought to substitute energy for human labor. The amount each working person could produce has therefore increased steadily. But after substitution of energy for labor in each process, the total number of workers needed decreased. The only way the total number of workers could increase would be if there were also a rise in the demand for products. In other words, more jobs would have to be created by the increased demand than were eliminated by the energy substitution.

For instance, assume the Lutkus Felt Company discovered it would increase profits by replacing most of its employees with machinery (which involves investment of energy, resources and dollars). Once the machinery is installed, Lutkus can lay off its employees. Rival felt companies need to stay competitive with Lutkus: they also automate and lay off employees.

So after Lutkus and its competitors have finished installing their new machines, the result is:

1. energy consumption in the felt industry is up;
2. employment in the felt industry is down.

Such has been the pattern of American industrial development. (See Art Buchwald's satirical analysis, page 3.) What has kept the "more energy leads to more jobs" myth alive has been that accompanying a growing population has been a very large increase in the use of goods and services per person. There has also been a significant increase in energy use. It has thus appeared as if energy expansion had been causing economic expansion and increases in jobs. But constantly expanding demand has led to constantly expanding production and employment. As Louisiana State University's Professor Herman Daly has concluded:

> Clearly, what is responsible for increasing total employment is the increase in total (goods and services), not the increase in inanimate power production, which by itself must decrease employment.[6]

III. Productivity and Jobs

From industry's point of view, energy and investment dollars have been preferred to human labor. Automated equipment does not complain about unsafe working conditions, seek wage hikes, question the nature of jobs or products, or strike. And energy has been cheap, subsidized by the government and by the American people.

Goods-producing industries have therefore sought to use fewer workers (or at least make their employees work faster). Their goal has been to increase output per worker, or "productivity." This has caused total employment in the manufacturing sector to decline over the last 40 years. Organized labor has supported this emphasis on "productivity," and has allowed the wage scales of skilled labor to be linked to the "productivity index." To management, this index is an important indicator of how well an industry is performing.

But as Hazel Henderson has pointed out, the "productivity index" is really an "automation index"—a guide to tell management how well it is doing in its drive to get rid of employees. Thus, as more and more energy is substituted for labor, automation increases and jobs decrease (unless there is an accompanying switchover to shorter work days, and a basic redistribution of wealth with increased consumer access to goods and services). The "productivity index" goes up, and management knows it is being successful.

Labor's acceptance of "productivity"—that is, automation—as a criterion for wage increases has resulted in a widening of the earnings gap between those employed in high energy industries (who are members of well-organized, powerful unions) and those working in areas where energy (and skill) requirements are low (and whose unions are less powerful).[7]

It has also resulted in the need for more and more energy, and in a decrease in the total number of industrial jobs. In 1971, the five largest manufacturing industries (primary metals; stone, clay and glass; food; chemicals; and paper) provided only 7.3% of the nation's jobs. From 1950-1970, there had been no employment growth in these industries; yet their gross energy consumption during these years increased greatly.[8]

In the steel industry from 1949—1969, the number of production jobs decreased by 20%, while steel output increased by 45%.[9]

The aluminum industries in the Pacific Northwest provide a particularly glaring example of high-energy, low job ratios. According to the Bonneville Power Administration, this industry consumes 25% of the region's electricity, and provides but *one-half of one* percent of the total jobs in that region.[10]

In the agricultural sector, the use of energy—for fertilizers, chemicals and automated equipment—increased the output per worker. But this increase in "productivity" led to a steep decline in the number of people employed. In 1970, agricultural employment was less than half of what it had been in 1920. That year, about 27 billion person-hours of labor were needed, compared with only about 2 billion person-hours 50 years later. Energy input increased more than 4 times over that period.[11]

Between 1950 and 1971, total national employment increased 41%, while jobs in the energy-producing industries increased only 5.5%.[12] And this small increase over twenty years was due primarily to expanded gasoline station employment. (Today, most of these jobs are vanishing, being replaced by customers and self-service gas pumps.)

From 1961-1973, electric utilities increased their kilowatt output about 130%, their revenues about 260%, their construction costs about 340%. But *employment* in electric utilities increased only 21%.[13]

Bruce Hannon, at the University of Illinois' Center for Advanced Computation, has calculated the relative amounts of energy and the units of labor reflected in consumer purchases for 1971. The following table shows that for each consumer dollar spent on electricity, 302,473 British Thermal Units (BTUs) of coal, gas or oil were required. But only 44/1000 of a job unit was necessary. Gas and oil purchases reflect *similarly large energy requirements* per dollars spent by the consumer, and relatively *small* units of labor.

These figures contrast sharply with those relating to expenditures for other categories listed—such as women's and children's clothing, or furniture. These purchases needed far less energy than did production of electricity, gas or oil, and utilized more units of labor per dollar spent:

TABLE I

ENERGY AND LABOR INTENSITIES OF PERSONAL CONSUMPTION ACTIVITIES, 1974[14]

personal consumption expenditure	*energy intensity (BTU's per dollar)*	*labor intensity (labor units per dollar)*
electricity	502,473	.044
gasoline and oil	480,672	.073
kitchen and household appliances	58,724	.073
new and used cars	55,603	.078
food purchases	41,000	.085
furniture	38,654	.092
women's and children's clothing	33,065	.100
religious and welfare activity	27,791	.086
telephone and telegraph	19,043	.055

In all, the major energy-producing and energy-using industries consume ⅓ of the nation's energy. Yet they directly provide only about 10% of the nation's jobs.[15] Energy companies claim that indirect employment created by energy is substantial. But as Professor Daly points out, *any* investment—even in welfare and unemployment compensation—leads to indirect job creation. And as noted above, energy, once available, *generally* ends up replacing jobs.

Where have the new jobs come from? Since World War II, new jobs have been created overwhelmingly in the merchandising and service sectors of the economy. Between 1947 and 1970, employment in these areas increased 95%.[16] These jobs have required relatively low amounts of energy, capital and

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Moving the American Economy

by Art Buchwald

. . . Rootin' Motors is visited by a salesman from Glutton Machinery. The salesman explains to Rootin' that Glutton can now provide machinery that will do the jobs of 1,000 men at a saving of $5 million a year. The president of Rootin' is impressed and decides to install the machinery. A year later the pink slips go out and 1,000 men, including Laidlaw, get one.

The president of Rootin' makes a speech to the departing men and women telling them he is sorry about the layoffs but there was no way Rootin' could stay in business if it did not install the new equipment.

While the new machinery helps Rootin' make 200 more Dolphins a day, sales are way off. The president calls in his dealers. "Why aren't the Dolphins moving?"

"Because Laidlaw is still looking for a job," one of the dealers says.

"Who is Laidlaw?" the president asks.

"He's one of the men you fired when you installed new machinery so you could be in a competitive position in the economy."

"All right," says the president. "Let's forget Laidlaw. Aren't there other customers out there for our Dolphins?"

"Streeter was, but he bugged out.'

"Who is Streeter?"

"He's a bricklayer who was laid off when Laidlaw decided not to build a new house because he didn't have a job. When Streeter was laid off after Laidlaw was fired, Feldman canceled his Dolphin."

"Feldman?"

"The furniture man who was going to sell Mrs. Laidlaw a new dining room and living room set. Not only did Feldman cancel his Dolphin, but he told his brother-in-law not to buy one either, because they were laying off men at the Rootin' plant which was a sure sign of a recession."

"Just when we can make Dolphins at a price people can afford," the president of Rootin' moans, "no one can afford them anymore."

"Wait a minute. What about all the people at Glutton Machinery?" a dealer says. "They're all working."

"Of course," the president replies. "Why didn't we think of them?"

The president of Rootin' calls the president at Glutton and says, "How many people do you have making the machinery you sold us so we could lay off 1,000 men?"

"We had 5,000," the Glutton president says. "But then the Robot Tool Company installed a new plant for us and now we have four. Why do you ask?"

"We're trying to get someone to buy our Dolphins."

"I wouldn't call Robot. They recently developed a new assembly line which requires the services of just one man, and they're waiting for him to retire in six months so they can replace him with a computer."

The president turns to his dealers. "Okay, we have the best factory in the United States but no customers for our cars. What do we do?"

"Why don't you hire back Laidlaw?" someone suggested.

"We can't afford him," the president shouts.

"Maybe instead of hiring Laidlaw back we can give him a tax cut. Then he'll want to buy a car again."

"Laidlaw doesn't pay taxes,' the president says. "He's on unemployment. We've got to find a job for Laidlaw."

"How?" a dealer asks.

The president says, "That's Carter's problem, not ours."

Source: Washington Post, Dec. 21, 1976, reprinted by permission.

resources. They also have caused less pollution and environmental disruption than industrial jobs.

The drive for increased substitution of energy for labor continues. The chief economist of the U.S. Department of Commerce recently testified before Congress that "productivity" will grow faster during 1976-1986 than in the past decade.[a] Indeed, "productivity" is becoming a factor in the service and merchandising sectors—the very areas which have provided new jobs in the past 30 years. Machinery is replacing supermarket clerks, bank tellers, teachers and telephone operators, in order to increase output per remaining employee and avoid dependence upon human labor. The Bell System, for example, is planning to replace 33,000 operators by installing computerized switching and billing systems, at a net annual savings (to them) of $390 million.[a]

IV: Energy Growth and Prosperity: the Myth

It is for good reason that the public has been led to believe that energy expansion has been the springboard to economic growth, the "good life," and jobs.

Industry has been able to replace human labor economically with energy purchased at very low rates from an ever-expanding energy industry which has been accumulating ever-increasing profits. The small consumer has been picking up the tab: industries traditionally have paid less than individual consumers for each unit of energy used. In addition, by bearing most of the environmental and disease costs associated with energy, and by permitting substantial government assistance to energy companies, the public has actually been subsidizing industrial use of cheap energy to replace human labor.

It is thus clearly in the interests of both energy producers and major energy users to continue keeping the public in the dark about energy supplies, production, expansion and use. From their standpoint, it makes sense to dig up the old scare tactic about job loss and economic depression: a line used with much success in the past: against the presidential bid of Populist William Jennings Bryan in 1896, against child labor laws, unemployment insurance, workman's compensation, labor union organizing and pollution control legislation, to cite but a few examples.

Critics of energy policy have been slow to consider the industry-promoted mythology about energy expansion leading to economic prosperity and jobs. But increasingly, reputable organizations and analysts have been examining energy and its relationships to the rest of the economy:

• A number of studies have shown that Americans use as much as two times the energy per person as do West Germans, Swedes and the Swiss. Yet the standards of living in West Germany, Sweden and Switzerland are comparable to or higher than this country's. And unemployment in those European nations is much lower than in the United States. As a recent

Federal Energy Administration report noted:

> This large disparity in energy use between [West Germany and the United States] suggests that continued economic growth and improvement of the standard of living in the United States should be possible without a proportional increase in energy consumption.[19]

• From his studies, Professor Herman Daly has concluded:

> Undeniably, energy is a necessary input to the supplies of nearly all sectors. But it does not necessarily follow that increasing the production of energy will increase the numbers of jobs in those sectors . . . Nor does it always follow that other sectors cannot expand employment without an increase in energy input . . . In general, increasing input of energy to the supply side is neither a necessary nor a sufficient condition for increasing employment.[20]

• A Washington DC-based research group, Resources for the Future, has found that data

> do not support the widely-held belief that energy and Gross National Product (GNP) have grown at essentially the same rates in advanced countries . . . It seems to be questionable to assert a rigid linkage between [the two].[21]

In the latter part of the 19th Century, says this organization, energy use in the United States grew faster than did the GNP. This was because heavy industry was the main factor in national economic growth. But after World War I, when lighter manufacturing plus increasing services began to predominate, energy use increased at a *slower* rate than did GNP.

• The Institute of Ecology, at the University of California at Davis, has concluded that comparison studies of different countries also

> do not support the hypothesis that constantly-increasing energy consumption per capita is a *prerequisite* to increasing economic growth.

The Institute discovered that energy and employment ratios varied in different industrialized countries, "reflecting fundamental differences between structures of economies." In addition,

> . . . beyond an optimal level of energy consumption per person, further increases in energy use leads to a variety of deleterious effects which ultimately lower growth rates.[22]

• The Ford Foundation's massive Energy Policy Project determined that a less than historical rate of increase in energy expansion, accompanied by more efficient use of this energy, would expand the total number of jobs, and improve public health and environmental quality as well. By the year 2000, according to the report, improved energy efficiencies could actually permit a zero energy growth rate. In fact, the nation would be using almost half as much energy as is currently being projected for that date, and would be experiencing an increase in total employment.[23]

• An investigation by the Oak Ridge Institute for Energy Analysis has revealed that energy production could grow at the very low rate of 1.5% through the year 2010 without adversely affecting the economy. The Institute found that there would still be a real GNP growth of between 2.5%-3%.[24] According to Science magazine, this study provides "evidence that low-energy growth forecasts are well on their way to attaining the status of conventional wisdom."[25] And a recent study commissioned by ERDA commented that the data developed by the Institute represent

> a significant break with the proportionality between GNP and energy use which has held approximately even for several decades.[26]

• John Myer, in the *Conference Board Record*, a journal which reports to management on business affairs, wrote that industry can use energy more and more efficiently. To Myers, the connection between energy growth and economic growth

> seems to me more elastic than commonly assumed... To the extent that we can cut down on energy use more cheaply than we can expand domestic supplies, the goal of lessened vulnerability to supply interruptions or sudden drastic price hikes can be more economically achieved. This course would also carry the added benefits of less ecological damage and expense of environmental protection.[27]

• Testifying before the Joint Economic Committee of Congress, Lee Schipper and Thomas V. Long stated:

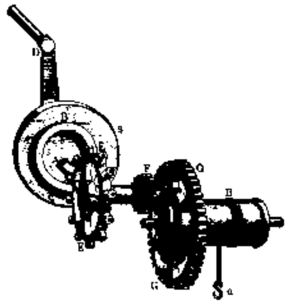
> There does not seem to be an immutable direct proportionality between economic growth and energy use.

Schipper and Long also pointed out that increased capital investment has been substituted for both energy and labor, hence

> energy use has been the tail of the dog, wagged by the interaction of the larger factor costs.[28]

• Even Paul McCracken, a former chairman of the President's Council of Economic Advisors, has confided to *Wall Street Journal* readers his doubts about what the public has been led to believe regarding energy and economic growth:

> the striking thing about the relationship between the rate of growth in output and the rate of increasing energy consumed is not that it obviously exists, but that it is so variable.[29]



Further examination of the myths surrounding energy requires discussions of energy waste, and of capital investment and job creation.

V. Energy Inefficiency and Waste

Individuals waste energy, and there is much each person can do to conserve. But there has been a campaign on the part of the energy industry to mislead the public into believing that the bulk of energy waste is caused by the average citizen who is too lazy to walk, or too pampered to live and work with the thermostat at a low setting.

In fact, energy in this country has been wasted primarily because public and private policies have long promoted energy extravagance in the mistaken belief that this was the best way to achieve a prosperous economy. The "lazy citizen" theory ignores the reality that accurate information on energy matters and alternative methods of energy supply have not been available to the consumer. It also does not take into account that wasteful energy consumption has been encouraged to increase the *profits* of energy-producing companies.

Jimmy Carter has stated:

> Our energy waste in transportation is 85%; in generating electricity, 65%. Overall, 50% of our energy is wasted.[30]

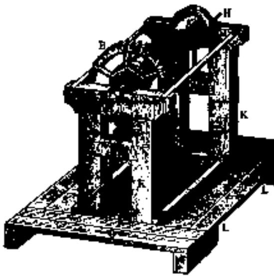
According to Denis Hayes of Worldwatch Institute, Americans wasted more fuel in 1975 than was used by two-thirds of the world's population.

Energy can be wasted during generation, during transmission and at end use. The process of transforming coal, gas or oil to electricity results in the waste of about two-thirds of the energy in the fuel. Conversion of uranium to electricity is even more wasteful. Using coal to make synthetic fuels involves the waste of about one-third of the coal's energy content.

Energy is wasted when it is sent out over long transmission lines, especially over power lines from nuclear power plants which for danger reasons the government has decided must be located far from large concentrations of people. Energy is wasted when appliances and machines are not built to perform at the best possible efficiency levels. Energy is wasted when heavy automobiles with "high performance" engines guzzle fuel to propel the vehicles a few miles per gallon. And energy is wasted when it simply is allowed to leak—through ceilings, walls, pipes, hot water heaters and industrial processes, due to inadequate insulation and design.

Energy is also wasted when it is not matched in "quality" to the intended task. This occurs, for example, when electricity is used for heating buildings and water, and for cooking. Electricity is a very "high quality" and expensive form of energy, most suited to and most economic for special tasks such as rail transportation and some exacting industrial processes. When water is heated by electricity, for example, it is after water at a power plant has already been boiled by the fuel. This fuel, whether fossil, nuclear or solar, has had to boil water to make steam to turn turbines to generate electricity—and in each step there is considerable loss of energy. It is quite apparent that there is a wasteful "mismatch" when nuclear fuel is used to achieve a temperature of several thousand degrees in an expensive and complex reactor in order to boil water to create steam—something which occurs at 212 degrees F. And it makes even less sense to go through all this trouble to heat or cool buildings to 70 degrees when other sources of less troublesome and less expensive heating and cooling are available which utilize air whose temperature is closer to the levels desired. For instance, it has been demonstrated that modern high-rise office buildings could be well-served by heat pumps which move cold air to the warm side of the building exposed to the sun's rays, and return warm air back to the cold side. These heat pumps would replace the waste created by heaters and air conditioning units operating simultaneously throughout the entire structure.

Energy is wasted at industrial sites when steam, which could be reused to generate on-site electricity or put to a variety of successively lower-grade uses ("cascading") is simply released to the atmosphere. Energy is wasted when inaccurate long-range projections lock utilities into building huge, central-station electrical generating plants which are not needed when completed seven to ten years after the decisions to build them were made.



According to Amory Lovins, increased electrical expansion to the 150 quadrillion BTUs by the year 2000 which many in the energy industry and government yearn for, would result in energy waste approximately equal to the nation's total energy consumption in 1971.[31]

And as energy is wasted and thrown away, so are jobs. Bruce Hannon has computed that for each quadrillion BTUs of fuel changed into electricity, 75,000 jobs are lost over the entire economy.[32]

Lastly, all the money invested in wasteful and unnecessary energy production at the expense of other national needs must be considered wasted as well. This is especially serious because money will be in short supply: Lovins doubts whether the nation will even be able to afford to build—or consumers able to buy—all the products which are supposed to be using this wasteful investment in energy.

VI. Capital Investment

The major energy-producing and energy-using industries consume the lion's share of national capital investment.

A recent ERDA report concluded:

> It is probable that the nation's single greatest investment in energy in the future will be in the area of electricity generation, transmission and distribution.[33]

Amory Lovins has calculated that investments in large-scale, centralized energy systems as proposed by people in ERDA, FEA and assorted energy monopolies, would consume three-fourths of all private investment capital in the United States.[34] Estimates of the total amount of money needed through 1985 range from $900 billion to one trillion dollars.[35] The Edison Electric Institute, the public relations arm of the nation's privately-owned utilities, has estimated that these utilities would require $570 billion for construction purposes alone to provide electric power they believe will be necessary over the next fifteen years.[36] The President of Exxon Nuclear Corporation stated last year that at least half a trillion dollars would be needed to build the 500 nuclear power plants he would like to see completed by the year 2000. Another $100 billion, he added, would be required to construct the necessary nuclear fuel cycle facilities.[37] The development of a commercially-usable nuclear breeder reactor, by the latest estimate, will cost $10 billion plus. Storage of radioactive wastes will consume presently-uncalculable billions of dollars over hundreds and hundreds of years (uncalculable because the methods for long-term storage have not yet been devised). The cost of each coal-conversion facility is currently thought to be around $1 billion. Rocky Mountain shale conversion plants will run at least $1 billion each. And the price tag for nuclear fusion electric systems, assuming they can be made commercially available, will be in the billions of dollars.

These large capital investments result in small numbers of very expensive jobs. A 1977 report by *The Conference Board* found that investment to create each job in energy-producing and major energy-using industries was much higher than investment to create a job in areas which use smaller amounts of energy. See Table II:

TABLE II

CAPITAL INVESTMENT PER JOB*

industry	*Capital investment per employee*
petroleum	$108,000
public utilities	105,500
chemicals	41,000
primary metals	31,000
stone, clay, glass	24,000
all manufacturing (average)	19,500
food & kindred products	18,000
textile mill production	11,000
wholesale and retail trade	11,000
services	9,500
apparel and other fabricated textiles	5,000

It is clear from these figures that it takes about 21 times the amount of investment to create a job in the petroleum industry than it does to create one job in the apparel and textile industry. Jobs created by investment in public utilities are the second-most expensive: about $105,500 each. The investment needed to create a manufacturing job on the average is about $19,500, which is about one-half of the amount required for a job in the chemical industry, and about *one-third* of what is required per job by the primary metal industry. Investment in "all manufacturing" is about double that needed to create a job in wholesale and retail trade, or in the service sectors of the economy.

But despite the huge capital investments required, and the small numbers of jobs created; despite the inefficiencies and the waste of non-renewable fuels; and despite threats to human health and local autonomy, industry promotion of their large-scale, complex energy systems continues. [In the past year, for example, over one-half of all new homes constructed had all-electric heating, cooling and cooking systems.] In attempting to fulfill their own propaganda that prosperity and jobs depend on more and more energy—especially electrical energy—these companies will seek to divert more money and more resources their way to create more waste and more pollution.

There will be continuation of the trend toward fewer manufacturing jobs, greater gaps in wage scales through the entire society, increased environmental destruction and citizen protest. Less money will be available for investments in other areas which serve people's needs, provide more jobs

SOCIETAL EFFECTS OF LARGE-SCALE TECHNOLOGIES

Technologies shape social institutions. The use of large-scale, complex, dangerous energy systems such as nuclear fission and coal conversion affects more than just energy matters. Such installations lead to concentrations of political and economic power, as well as to curtailment of individual freedoms and the democratic process.

A recent Rockefeller Brothers Fund report listed the following "unavoidable consequences" of these kinds of energy technologies:

- compulsory governmental diversion of scarce resources (capital, skills, labor, special sites, water, etc.,) from other priorities into the energy sector;
- a need for a central authority (often federal) to impose big energy facilities and their perceived risks on people who want neither;
- conflicts between central authority (often federal) and local autonomy in all energy matters;
- concentration of political power, enabling urban people to obtain the benefits of the energy while inequitably allocating the associated social costs to politically weaker rural minorities, as has already happened in Wyoming, Appalachia, the Brooks Range in Alaska, and Navajo country;
- a tendency to make patterns of energy end-use conform to the needs of the source of supply rather than to people's needs;
- encouragement of horizontally-integrated monopolies;
- isolation and alienation of energy users from the unaccountable elite who supply, price, and regulate the energy;
- commitment by the political authority to support the continued uses of the energy system regardless of any inherent faults, and hence to suppress dissent—or use social engineering to bypass dissent—even in the case of major accidents or technical failures;
- development of strong central bureaucracies and technical establishments that favor the technologies they develop and come to dominate decisions about their use.

Members of the New York State Labor Action Coalition, a group of labor union locals working for municipal takeover of investor owned utilities, have pointed out that increasing the size and concentration of energy systems diminishes the chances of communities *ever* obtaining control of their own energy production and distribution. In addition, centralization and automation of energy systems lead to the closing of existing smaller facilities, and enable industry management to keep their plants running with the use of a handful of supervisory personnel. The consequence will be smaller, and weaker, labor unions.

Source. The Unfinished Agenda, a Task Force Report Sponsored by the Rockefeller Brothers Fund, Crowell Company: N.Y., 1977.

per dollar, consume less energy, and create less environmental and public health havoc. Consumers will be paying increasing prices for unneeded, inefficient and unreliable energy systems which will be unable to provide a return on the money invested in them. Consumers will also be paying higher taxes to protect their health and bail out failed energy systems. (This is happening now: Nuclear Fuel Services' fuel reprocessing plant and a Con Ed nuclear reactor in New York State have already been dumped into the laps of the people of New York.) Higher interest rates will also result because of the money shortage caused by the diversion of so much capital to the energy arena. (Some projections show this shortage may total $915 billion through 1985.)

Surely, there is a better path to prosperity and jobs.

VII. Energy Efficiency

Energy production is not a goal in and of itself. Energy should be utilized to serve people, to provide the freedom for all people to have richer, easier, healthier lives. That a nation uses vast amounts of energy does not reveal to what extent the energy is actually being put to wise, effective use by its people.

The best approach to energy sufficiency, economic prosperity and jobs is that which combines increasing energy efficiencies with a variety of diverse and safe energy-supplying technologies. Each energy-producing technology should be used to do what it does best, and should be matched in scale and energy quality to the way in which its energy will be used. And the more the fuels for these new energy systems are renewable, the better.

This approach is not "anti-technology," as sometimes is alleged by the large energy interests. In fact, technological innovation will be a key to achieving success with this approach . . . but the technologies involved need to be ones which can be controlled by the American people, not ones so elaborate and complex that people have to be kept far away from them or from decisions concerning them.

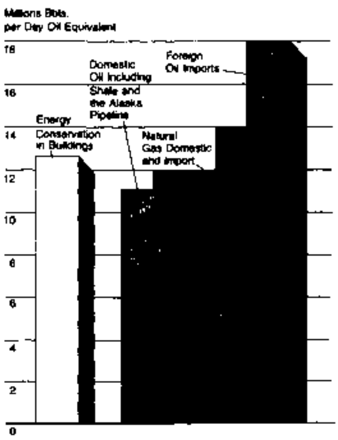
And this is not a "no growth" approach, or one which advocates a return to drudge labor. To the energy industry, "growth" has always meant growth in energy production in order to satisfy its *own* needs, no matter the consequences for the rest of society. But to others, "growth" means a national policy of full employment, improved standards of living, improved job safety and public health, expanded opportunities for leisure activities and the development of rewarding relationships with other people.

How can increasing energy efficiencies (that is, conservation of energy) make a significant contribution to such goals? Here is a brief list of just some of the benefits which result from energy efficiencies:

- To the University of California's John Holdren, the essence of conservation is "extracting more well-being from each gallon of fuel and each kilowatt of electricity."
- *A unit of energy saved is cheaper*—in dollar, energy, public illness and environmental costs—than a unit of energy produced. The Bonneville Power Administration has concluded that saving energy by conservation costs one-sixth of what it costs to deliver an equivalent amount of energy from new thermal power plants.
- "Saving energy," said former Federal Energy Administration Director Frank Zarb, "is synonymous with saving dollars and can, in fact, be one of the least expensive energy supplies this nation has."
- Denis Hayes has calculated that for the next quarter century, the United States could meet all its new energy needs "simply by improving the efficiency of existing use."
- The American Institute of Architects (AIA) has calculated that by 1990, 12.5 million barrels of petroleum per day (equal to one-third the current national energy use) could be saved just by employing energy-efficient systems in old and new buildings. The following chart prepared by the AIA shows that conservation alone in buildings offers an energy supply which by 1990 would be larger than the contribution of any one of the following: domestic oil, conversion of shale to oil, Alaskan North Slope oil, domestic and imported natural gas, and an overly-optimistic prediction of nuclear energy output.

CHART 1

AIA ESTIMATES OF THE RATE OF ENERGY SAVINGS IN BUILDINGS COMPARED WITH THE CAPACITY OF PRODUCTION FROM VARIOUS OPTIONS AS FORECASTED BY THE U.S. GOVERNMENT



In order to supply the energy equivalent of 12.5 million barrels of oil per day in 1990 by traditional centralized energy systems, a capital investment of $415 billion would be required. The customer would pay between $892 billion and $1.4 trillion for this unneeded energy. But investing money in energy efficient buildings, says the AIA, would produce both energy and dollar savings.

- The Bonneville Power Administration has summarized a number of energy-savings estimates calculated by its consultants and a variety of other analysts:

TABLE III[25]

COMPARISON OF ESTIMATED CONSERVATION SAVINGS

BPA Study (1995 savings)	*Other Studies*	
Residential Sector		
14-48%	24.8%	Energy 1990 [City of Seattle, 1976]
	38-49%	U. of Calif. (Goldstein, 1975)
	30-40%	Oak Ridge National Lab. (1973)
	11.3-42.7%	Arthur D. Little, Inc. [1976]
Commercial Sector		
22-44%	30%	Energy 1990 [City of Seattle, 1976]
	30-80%	American Institute of Architects [Stein, 1974)
	30-50%	U.S. General Services Administration [1973]
	59.6%	Arthur D. Little, Inc. (1976)
Industrial Sector		
5-10%	31.7%	Energy 1990 [City of Seattle, 1976]
	24%	West German Industries [Stanford Research Institute, 1975)
	15-30%	National Bureau of Standards [1974)
	30%	Federal Energy Administration [1974)

• General Electric's Evandale, Ohio, jet engine plant has cut its energy use by 45.1% over the last five years, "with nothing more sophisticated than a chicken coop timer." G.E.'s program has saved the company $8.6 million, at an investment of $400,000.[26]

• 1976 cars already average 27% better mileage than 1974 cars. 1977 cars will average 6% better mileage than the 1976 models.[27]

• An energy study commissioned by the City of Seattle influenced that city not to buy into Oregon's nuclear power plants. The study convinced city officials and Seattle citizens that with appropriate energy efficiency measures, **no new electricity generating capacity would be required for Seattle through 1990.** And, the cost per kilowatt hour of electricity would be 1.3¢ *cheaper* without building new energy facilities.[28]

• A Dow-Midland study indicated that by using waste industrial steam to generate electricity—as is done in Sweden and West Germany—energy savings equivalent to 680,000 barrels a day of oil could be saved by 1980. By 1985, this "co-generation," as it is called, could replace the equivalent of 50 large nuclear reactors.[29] The California Energy Commission has determined that the potential for co-generation in that state alone could be as much as 140 billion kilowatt hours per year, the equivalent of the total amount of electricity consumed in California in 1975.[30]

• Energy conservation retrofits have led to a 60% decrease in steam use, and a 30% decrease in electrical consumption, at the Hermann Building of the Massachusetts Institute of Technology.[31]

• The Director of the Massachusetts Energy Policy Office has concluded:

> Energy conservation is not synonymous with deprivation. In fact, just the opposite is true. Saving energy means saving money. For a household, this means more cash for other activities; for a business, this savings means higher profit. For the state in general, this means more jobs, and more income for our citizens.[32]

FOR GOODNESS'

If expansion of large, complex energy systems is so wasteful, causes pollution and disease, gobbles up investment dollars, threatens the democratic process, displaces existing jobs and chokes out large numbers of new jobs, why have utilities and energy industries been so determined to expand, expand, expand?

For regulated utilities, there is a clear, direct relationship between energy growth and profits—*their profits*. A utility's rate of return on investment is set by law at a fixed percentage. The more they invest, the more profits they reap. To attract more investors who will put up the money for more facilities which will return more profits in order to attract more investors, utilities seek to invest in more facilities which will attract more investors and return more profits.

If consumers use decreasing amounts of energy, utilities have a hard time justifying investment in more energy-producing facilities. Less utility money is available for reinvestment, and utilities begin to experience difficulty attracting money from the financial community. Because energy use has decreased (or in some places has increased at a lower rate) since the Arab oil embargo, many utilities have lost large amounts of revenues, and have ended up with unneeded facilities which were planned a decade ago. They have had to seek huge rate increases to pay construction and operation costs of their expensive overbuilding. Thus do consumers rightly complain that it does not make much difference whether or not they turn their thermostats down: they may use less energy, but their bills keep going up anyway.

It is just not in the interests of the utilities to promote energy efficiency very seriously.

Utilities pay some lip service to conservation—especially when there are shortages of fuel or they are having particular problems delivering the energy they are required to deliver. But they do not want to encourage *too much* conservation. A recent Mobil advertisement, for example, had some nice words about conservation, but it strongly stressed the need not to "trade-off" conservation for jobs or GNP growth, and the need to preserve consumers' "freedom of choice" to use energy as they see fit.

Thus, in order to raise their rates to expand and increase profits to expand and raise rates, it has been in the interest of the utilities to have people believe that energy growth

• States are beginning to respond to the Energy Policy and Conservation Act (1975) which provides FEA money to a state which can cut back at least 5% of its energy use projections, beginning in 1980. Colorado plans to save 52.8 trillion BTUs in 1980. Governor Lamm, in his state's energy conservation plan, sums up the rationale:

> Conservation is the only way in the next few years we can bring some manner of economic relief to the millions of our citizens who cannot afford the vastly increased cost of energy. Conservation is the least expensive and most cost-effective way to expand our energy "supply" . . . A conservation program will reduce the impact [of energy production] on the environment .

SAKES WHY?

leads to employment growth and economic prosperity; to persuade large industries to use energy extravagantly by charging the lowest rates to the largest users; to threaten that without nuclear and other exotic energy systems Americans would soon freeze and starve in the dark; and to oppose environmental and public health measures, which interfere with their visions of unlimited expansion without regulation. In addition, utilities have recently become interested in the plight of the poor and disadvantaged: utilities take great advertising pride in having brought them to the threshold of the good life, and are now declaring it is for the sake of these people that more and more giant, dangerous energy facilities should be built.

Some of the nation's largest manufacturers build the equipment used by the utilities. They also build and sell the appliances that people buy, and the machines that industries buy, all of which consume large amounts of energy. Many of the corporations which control energy resources (coal, oil, gas, uranium) are also in the business of finding, obtaining, transforming and delivering these resources in usable form. The profits of these companies increase as the utilities expand their ability to supply energy. Clearly, then, it is in the interest of the energy-production companies and the energy-equipment manufacturers to throw in their lot with the utilities.

The utility industry, with the full support of energy industries and the government (which has provided research, development and demonstration money, along with favorable subsidies and tax incentives), has been very successful at expanding without much caring about the undesirable societal, economic and human consequences of their efforts. This confirms what John Maynard Keynes noted earlier in the century.

> There is no evidence from experience that the investment policy which is socially advantageous coincides with that which is most profitable.

Sources: Ernst & Ernst, *Energy-Economy Relationships*, June, 1976; Ernst & Ernst, *Incentives For Electric Utilities to Overforecast*, July, 1976; Daly, Herman, *Towards A Steady State Economy; Washington Post*, March 12, 1977 (the Mobil advertisement).

> An essential part of any serious program to promote energy efficiency must be a systematic and credible effort to convince the public of the enormous benefits that are possible . . . The economic and energy savings can be calculated, and they are attractive.[53]

• Again, FEA's Zarb:

> Contrary to myth, conservation is vital to our efforts to sustain our high standard of living and rekindle economic growth. Moreover, several recent analyses have shown that reducing the inefficient use of energy would not result in an employment penalty.[54]

• And even Americans for Energy Independence, an energy industry-oriented group which seeks the expansion of large-scale, centralized energy systems, has noted that

> . . . energy conservation and economic well-being are compatible . . . Even the most superficial and immediate measures to cut waste would revive our environment.[55]

• Conservation of energy will supply goods and services at lower total cost than could be supplied by new energy development. The money which might have been spent on energy production would be available to pay for labor, designs and materials for energy efficiency techniques. There will also be money left over for other investments. The result will be more goods, more services, more employment—both direct and indirect, as the Bonneville Power Administration has pointed out. And, as Denis Hayes has observed,

> To the extent that a consumer conserves fuel and spends the money on anything else, he will provide more employment as well as use less energy.[56]

• Energy conservation offers considerable manufacturing flexibility. Most energy conservation technologies will be implemented on a small scale, and on regional bases. Industry will therefore be able to develop improved technologies through competitive trials, then cut production costs by means of mass production. A "balanced" and independent regional economy based on improved energy efficiencies could provide more jobs, with more job security, than an economy dependent upon energy sent in from far away. The reason for this is that the manufacturing base would be varied, would require less energy, and be less sensitive to changes in economic, political and meteorological conditions in other parts of the country.

In addition, raising investment capital would be less of a problem because energy efficiency programs are cheaper than energy-production projects. Their short planning and completion time would mean that cash flow would be speeded up; money for energy efficiency investments could be used several times rather then be tied up in a long-term energy-production project.

And with regard to jobs created by energy conservation, there are significant positive benefits as well.

VIII. Energy Efficiency and Jobs

• A Bonneville Power Administration Study has found that

> High impact conservation programs create more jobs than would be created by building new power plants to generate an equivalent amount of energy.[57]

Amory Lovins has testified to the Senate Select Committee on Small Business that conservation programs which include shifts of investments from energy wasting to social programs create from tens of thousands to nearly a million net jobs per quadrillion BTUs of energy saved.[58]

• A preliminary analysis for the FEA[59] provides specific breakdowns of some energy conservation techniques, costs and resulting employment. This report examined the prospects of limited energy efficiency increases in 34,372 private homes. The technical work called for was simply the installation of ceiling insulation and automatic thermostats, and the retrofit or replacement of furnaces.

The analysis concluded:

> By 1985, natural gas supply would be increased because of the saving of 1,212 billion cubic feet. This is the equivalent of the gas to be obtained from the major discovery at the Alaskan North Slope. It is also about the equivalent of the output of 39 one-thousand megawatt electric thermal power plants. Consumers in these 34,372 homes would save $1.7-$2.3 billion in heating costs.
>
> The work would cost $7-$10 billion, compared with $17-$20 billion for 39 large fossil fuel power plants; 487,000 jobs over 7 years would be created: 122,000 in manufacturing, 366,000 in local installation.

The report also stressed that employment associated with energy conservation techniques is local, low- to moderately-skilled, and concentrated in or near urbanized areas which are experiencing the most acute unemployment problems. In contrast, centralized, expensive energy production complexes usually have to bring in highly-skilled labor from outside the construction area. (These transients create a large amount of disruption: temporary housing and many services must be supplied to meet the problems temporary workers create. In many of the energy "boom towns" of the Western United States, crime, alcoholism, family break-ups are well above average. Serving the needs of transient labor ends up being a drain on the local economies the transients were supposed to be stimulating.)

• The State of Colorado has estimated that 17 million private homes in the nation need ceiling insulation; 20 million need clock thermostats; 20 million need caulking and weatherizing; 10 million need storm windows. In addition, millions of multiple-unit dwellings, apartment houses, commercial and industrial buildings are inadequately insulated and weatherized. If 487,000 jobs are generated by only three simple conservation procedures in a small fraction of the buildings which need work, the potential obviously exists for millions of jobs. Employment for energy specialists, construction of more energy efficient equipment, jobs for architects and engineers will be increased, along with jobs in the fields of insulation, heat pumps, electronic controls and systems analyses, communications and transportation.

• The Senate Commerce Committee Staff has estimated that $1.6 billion in interest subsidies and loan guarantees for conservation retrofits would generate 400,000 jobs.

• The American Institute of Architects' conservation program for new and existing buildings would create half a million to more than a million direct jobs per year through 1990.

• The conservation retrofits on MIT's relatively small—94,000 square feet—Hermann Building, provided 800 person hours for members of the Sheet Metal Workers' International Association.

• A proposal sent to President Carter by the Senate Commerce Subcommittee Staff describes how a $1.65 billion investment in energy conservation, using public service workers, would create a total of 100,470 jobs: 9,600 at $15,000 per year; 74,600 at $10,000; and 16,279 jobs in manufacturing. The staff calculated that each $40,000 investment in materials would create one job in the materials manufacturing industry. The program would focus on the retrofitting of schools, colleges, hospitals, federal buildings, the weatherizing and installation of solar water heaters in HUD-owned single family houses, and the construction of bicycle paths.

• A study by Skip Laitner of Critical Mass computed that manufacturing high efficiency appliances requires the employment of more people than does the manufacturing of inefficient appliances. When buying more efficient items, a consumer is investing in extra labor and materials, and in a more carefully-constructed, longer-lasting product. The purchaser would save money on reduced electricity bills, which would cover the higher initial cost of the appliance. Thereafter, on-going savings in energy can be spent on consumer goods, which as described above, create more jobs than spending on energy generation.

• According to *Americans For Energy Independence,*

> experts have suggested that reducing oil imports by 2 million barrels a day would generate 500,000 to 800,000 new jobs in the U.S.

• And an annual energy savings of 144 trillion BTUs achieved by the nation's switching to refillable-container systems would result in a net job increase of 117,000. Total labor income would increase $936 million, according to a recent FEA study.

In sum, increasing energy efficiencies will supply the nation with a substantial source of energy. The savings of money and the reduction of energy waste will generate a broad range of economic and environmental benefits throughout the country, and create large numbers of safe, socially-useful jobs.

For new energy sources, the nation needs to utilize the unlimited energy which is available from the sun.

IX. Solar Energy

The solar energy reaching the United States in twelve hours is equal to the nation's yearly energy consumption.

Various technologies exist which can utilize this abundant and safe source of energy: solar plate collectors for heating and cooling of buildings, and for heating water; photovoltaic cells for converting sunlight directly into electricity; wind energy systems for producing electricity, pumping fluids or compressing air; biomass conversion for creating fuels from organic matter.

For all solar energy systems, the fuel is renewable. For all except biomass conversion, the fuel is free. If energy quality is matched to its ultimate use, each of these systems except photovoltaic conversion has lower capital requirements per unit of energy delivered to the user than does nuclear fission and production of synthetic fuels from coal. All these solar technologies readily lend themselves to small, decentralized installations.

According to John Quarles, former Deputy Director of the Environmental Protection Agency, some solar energy techniques can be commercialized sooner than can the nuclear breeder reactor, shale or coal conversion systems, or nuclear fusion reactors.

Senator Charles Percy (R-Ill.) recently stated at a solar energy conference he helped organize:

> Solar energy is not an exotic dream of the future. Rather, it is workable today.

The Grumman Corporation "Sunstream" division has advertised: "An answer to OPEC comes up every morning!" With Sunstream's domestic hot water heater,

> you can now capture the sun's energy to heat hot water for your household needs . . . efficiently, quietly and cleanly.

An ERDA report, *A Preliminary Social and Environmental Assessment of the ERDA Solar Energy Program*, has pointed out that solar energy technologies are readily adaptable today for broad scale commercial use.

According to the Federal Energy Administration,

> In general, the application of solar energy techniques does not require establishment of scientific feasibilities."[1]

George Szego, president of Intertechnology Corporation, has stated that savings of five billion barrels of oil could be achieved within 10-15 years if a crash program of solar energy commercialization were begun now.[2]

Edward J. Carlough, General President of the Sheet Metal Workers' International Association, recently noted that almost 25% of all energy used in this country is consumed in heating, ventilating and air-conditioning, and related systems. He went on to say:

> At a relatively low cost, we could make a huge dent in the nation's energy consumption by modifying those systems to use solar energy where it is feasible. The national value of a concerted effort in solar energy and energy conservation would be measured in millions of barrels of oil—resulting in more favorable balances of payments, less inflation, more jobs and energy independence."[3]

The Sheet Metal and Air Conditioning Contractors' Association has affirmed in testimony before Congress:

> We have the skills, shop facilities, manufacturing capability and expertise to embrace this industry now. New tools and processes are not required."[4]

A report prepared in 1952 by the Paley Commission for President Truman concluded that solar energy could play a greater role in energy production than could nuclear fission. The Commission projected that if an aggressive effort were made, 13 million homes and commercial buildings could be heated by solar energy by 1975.[5] And an Atomic Energy Commission study concluded in 1974 that by the year 2000, solar energy could provide 30% of the country's energy needs.[6]

Although efforts to enable these predictions to come true were not made, there is nonetheless a significant amount of solar activity in this country today. The Solaron Corporation of Denver had a half-million dollar order backlog earlier this year, and was installing hot water systems in 60 buildings in 12 states.[7] The Piper Hydro Company installed 1000 dwelling hot water units in 1976, and "hasn't even scratched the surface" of demand.[8] The Federal Energy Administration has announced that commercial production of solar collectors increased 400% in 1975 over 1974. A total of 142 firms are now manufacturing collectors, and the industry seems to be in a trend of quadrupling production annually.[9] Solar energy busi-

Beware Full Employment

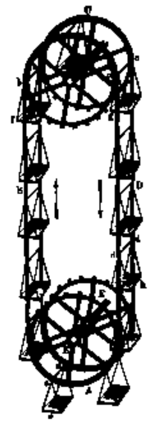
by Robert Lekachman

. . . Unemployment calms the unions and moderates their wage demands. Business periodicals have been noting with unconcealed gratification that last year's contract settlements between major unions and large corporations were considerably less expensive for employers than those of 1975, even though union members were steadily losing ground to inflation. When people are scared about losing their jobs, they work harder and gripe less. In more dignified language, absenteeism declines and productivity ascends.

"Better still, factory and office workers, alert to potential layoffs and plant shutdowns, are unlikely to nag unions and employers to make work more interesting, and less menacing to health and personal safety. It cannot be mere coincidence that in Sweden, where job enrichment and plant democracy have had their greatest success, unemployment is practically zero and astute management of their economy protected Swedes even from the worldwide economic crisis of 1973-1975. The new government, elected on the fortuitous issue of nuclear safety, has promised to extend even further the social benefits for which Sweden has become celebrated. American employers preserve themselves from Swedish experiments in good part by keeping the industrial reserve plentifully manned.

"Nor is this quite the end of the tale. The hunger of communities and regions for jobs and tax revenues has allowed large corporations to extort an endless assortment of valuable concessions from local and state governments, either as blackmail to keep existing installations or bribes to lure new ones. Few major corporations pay their fair share of property taxes. Propaganda by oil, steel, chemical, and paper industries has noticeably slowed the pace of regulation to protect the environment.

"By contrast, full employment on a sustained and assured basis (the system can stand a spell of full employment as long as all parties understand that it is temporary) presents an embarrassment to the movers and shapers of American plutocracy. To begin with, full employment is the most efficient agency of equitable income redistribution which is at all feasible in the United States. Full employment sucks into the labor force men and women who now struggle on welfare, food stamps, social security, and unemployment compensation. It pushes up the wages of low-paid people whose position is scarcely less precarious than that of the unemployed. It is an especial boon to blacks, Hispanics, teenagers, and women -- last hired and first fired in expansion and recession alike. A long spell of full employment would substantially narrow existing wide differentials between earnings of these groups and those of white males. In a time of layoff and business contraction, affirmative action is a mockery, but when there is full employment the cry for justice is heard more sympathetically by members of a majority whose own security is not threatened."



nessman Jerry Plunket has estimated that 100,000 shops, manufacturers and firms are capable now of producing reliable solar energy equipment.[30]

Solar energy studies—even those which suggest that a significant contribution by solar technologies to the nation's energy needs is a long way off—constantly stress how much energy could be obtained from the sun, and how safely. FEA's former director Zarb:

> Solar energy appears to be the safest and most environmentally sound of all energy . . . It is inexhaustible, and it can't be embargoed.[31]

A study by the Oregon Energy Council found:

> A transition to a solar energy economy is desirable and realizable. It involves neither privation nor social deprivation. Life-style changes would be minimal. The rewards would be enormous. Our children would have a totally indigenous, permanent, safe energy system which could be relied on by countless generations for the future.[32]

The ERDA *Social and Environmental Assessment* of solar energy concluded:

> Solar energy is the one source of energy for which there are no fundamental obstacles, no insurmountable barriers, no serious environmental problems, no organized public interest opposition.[33]

The Solar Task Force of the Project Independence Report made clear that:

> A major shift to the utilization of solar energy by the year 2000 and beyond will reduce the effects of rapidly-growing energy consumption on our global climate through a reduction in heat waste rejection at the generating site. Solar energy is the only energy source which presently holds this promise.[34]

And even according to the Exxon Corporation, a multinational company heavily invested in oil, coal and uranium, and which is fond of predicting that solar energy technologies will not be particularly useful until the next century, the sun is

> a source of energy that doesn't in any way pollute the air or water, can't be used up, and is found right in our own backyard.[35]

Here is a brief look at some of the methods solar energy can be utilized to meet the nation's needs:

SOLAR HEATING AND COOLING

Solar heating and cooling involves the use of collectors on site which absorb the sun's energy. This method of heating buildings and water is not new. In fact, it has been utilized in this and other countries for many years.

According to former Congressman Paul Cronin, solar heating and cooling systems

> can have an immediate effect on our overall energy budget . . . Most of the U.S. patents on solar [heating and cooling] were issued in the 1920's. Florida received the majority of its hot water from solar energy until World War II . . . If the government decided to provide a solar hot water heater to everyone in the U.S., which could be done in 3 years, it could save over 1.2 million barrels of oil per day, and create jobs that would pay taxable incomes.[36]

Again, Sheet Metal Workers' Association President Carlough:

> Solar heating/cooling systems using air are no longer a novelty. This is a technology capable of producing energy and jobs.[37]

The Technical Development Corporation (TDC) of Providence, Rhode Island, designed the solar heating system for the swimming pool at the United Auto Workers' (UAW) Family Education Center in Northern Michigan. The installation costs for the UAW system will be paid back in 6½ years. Thereafter, $3000 per year will be saved by the Auto Workers in decreased bills for conventional fuels. TDC studies have confirmed that the use of solar heating for swimming pools, laundries and industries which use large amounts of water, will generate similar rapid returns.[38]

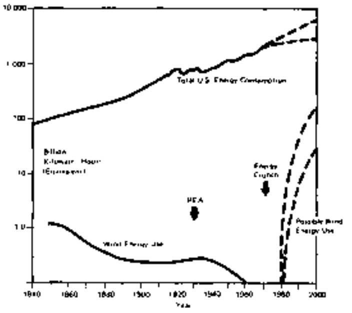
The Energy, Research and Development Administration has recently announced that solar residential hot water and space heating are economically competitive today with electric systems in 12 geographically-dispersed American cities. (Among these cities are Boston, New York, Madison and Washington, D.C.) These kinds of solar units, stated ERDA, could become economically competitive with "most fuel alternatives" by 1980.[39]

WIND ENERGY

Research and development in wind power have been virtually non-existent in this country for about 30 years. But since the mid-19th Century, more than 6 million small windmills have been used to pump water, compress air and generate electricity. Over 150,000 are still in operation. But significant use of wind power was phased out in the 1930's when the Rural Electrification Administration (REA) introduced centralized electric power, as shown in the chart below:

CHART II[40]

COMPARISON OF WIND ENERGY AND TOTAL U.S. ENERGY CONSUMPTION



According to a 1972 National Science Foundation-National Aeronautics and Space Administration report, wind energy systems could be installed in a very short period of time—less than two years. Companies such as Boeing, Kaman, General Electric and Lockheed, along with a growing number of smaller firms, have indicated they are willing and able to provide wind energy systems this rapidly.

Wind power expert Lorin Johnson has testified:

> Wind energy systems not only give a utility [company] more flexibility than do conventional thermal power plants due to shorter lead times, they also allow new technological innovations to be easily and rapidly incorporated as they occur . . . The failure of one wind energy system will not force the shutdown of another . . . The failure of one wind energy system in a large array is . . not a major thousand megawatt catastrophe.

The Project Independence "accelerated development" scenario, which many experts consider to be quite conservative, estimates that 23% of the nation's electricity could be generated by wind power by the year 1990. And a National Science Foundation-Mitre Corporation study found that electricity produced by wind power would be competitive with conventional diesel fuel electrical generating plants which use oil priced at $10-$11 per barrel, a price which exists today.

The Technology Development Corporation has calculated that wind generation of electricity is currently economically competitive with other systems on the seacoast of the Northeastern states. As complementary energy systems, they are "immediately viable." The wind machine this company built for the United Auto Workers will shortly be producing power in cooperation with a Northern Michigan utility.

The New York State Energy, Research and Development Authority has announced the installation of a demonstration wind generator on a working dairy farm in Northern New York. Said the Authority's Chairman: "Cost-effective use of new [wind] energy technologies is available today."

BIOMASS CONVERSION

Biomass conversion involves the changing of organic matter into useful fuels, such as gas or oil, or directly into heat.

The various biomass techniques include utilizing urban and industrial wastes, agricultural and forest residues, along with farming on land or in the ocean.

According to Senator Peter Domenici (R-New Mexico), the advantages of obtaining energy from biomass conversion are many: sources are forever renewable; the environmental impacts are minimal; marginally useful lands and waters can be put to use; a range of assorted bioconversion products can be developed differing in kind and quality which can be matched to physical and economic needs.

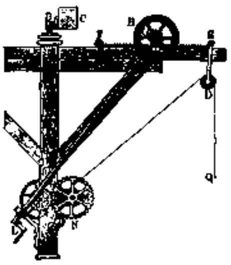
About 80% of the total annual municipal waste is combustible, said Domenici, and could be used to generate energy equivalent to more than half the 1970 oil imports from the Middle East. Some American cities are burning refuse to generate energy, and over 100 cities are actively studying the process and looking to rapid installation of a variety of systems.

Harvest and bioconversion of ocean kelp into methane gas would generate 23 trillion cubic feet of gas per year. (This is equal to the current national annual gas demand.) Land plantations could generate 8-11 trillion cubic feet of gas per year. Some gas companies are presently experimenting with ocean- and land-cultivated kelp production.

China has built one-half million methane gas digesters since 1970. India is constructing 100,000 of them.

Bioconversion techniques are especially conducive to dispersed, flexible, low-capital enterprises which create many jobs. The chairman of the American Gas Association has said:

> From a social or political standpoint, it appears desirable that gas be generated on a local basis from such sources as urban refuse, industrial wastes, sewage sludge and miscellaneous wastes.



PHOTOVOLTAIC CONVERSION

Solar photovoltaic cells convert sunlight directly into electricity at the place where the electricity is to be used. They are already cost-competitive with other energy systems in remote areas. Their efficiency has been going up, and their price going down, despite limited federal and industrial interest. In the early 1960's, energy from photovoltaics cost about $200 per peak watt. By the early 1970's, the cost had dropped to $100. By 1973, it was $30; and in 1975, $17. Recently, the energy from photovoltaic cells has been available for $10 per peak watt.

Since photovoltaic cells convert solar energy to electricity on site, there is no need for long-distance transmission lines, and therefore no energy loss along these lines. Solar cells, like wind systems, can be installed in small units, and added on to when needed. The use of photovoltaic cells allows energy planners to avoid having to predict years in advance what the specific energy demand of a region will be.

A 1975 National Science Foundation report found that by the year 2000, photovoltaic electricity could supply 9% of the nation's needs—a figure which many today consider understated.

The evidence is overwhelming that solar energy technologies are available today, and that they offer many technical, environmental and financial advantages over other energy systems.

They also provide significant employment benefits.

X. Solar Energy and Jobs

Frank Zarb has said:

> A strong solar industry means more jobs for Americans, who will be needed to design, manufacture and install and maintain solar equipment.

The Sheet Metal Workers' President Carlough:

> . . . even figured conservatively, energy-saving modification work and an expanded use of solar energy could put all unemployed sheet metal workers back to work.

The Massachusetts Energy Policy Office recently concluded that if by 1985 one-half of all buildings in that state were to use solar energy for hot water production, 32,000 jobs would be created. In addition, 600 million gallons of oil would be saved per year, and $480 million retained for spending within Massachusetts. The report stated:

> The potential for solar energy seems virtually unlimited. With widespread adoption of solar power, Massachusetts citizens could cut their collective fuel bills by $120 million annually by 1985. Furthermore, solar energy has vast potential for new job opportunities, especially in the plumbing, construction and research and development areas . . . It's safe to say that by 1985 more jobs could be available from solar power (directly and indirectly) than from offshore oil and new nuclear construction combined.[99]

Frank Mills, of the Sheet Metal and Air Conditioning Contractor's Association, has reported that retrofitting just 3 million private homes to 60% reliance apiece on solar energy for heating and cooling would lead to 12.2 million hours per year of work for 10 years. And putting solar heat in 2.3 million new homes, at 60% reliance, would create another 12.2 million hours per year of work for ten years . . . for sheet metal fabricators, sheet metal installers, asbestos workers, carpenters, plumbers and pipefitters. Increasing the number of installations to half of all private homes would mean about 5 times the number of hours of work. In addition, thousands of jobs would be created in retrofitting and new installations of solar systems in commercial buildings, apartment houses and government buildings.[100]

A 1975 study for the Sheet Metal Workers' International Association found that heating and cooling could provide a $2 billion market annually by 1990. Installation labor would cost half a billion dollars, of which $240 to $300 million per year is expected to be paid to sheet metal workers (about 15,000 jobs at $20,000 per year).[101]

The Laborer, a journal of the Laborer's International Union (AFL-CIO), found that jobs for its members in the solar energy field "could well mount into the hundreds of thousands." The union has begun a course in San Diego to train laborers in the installation and maintenance of solar and wind systems. Union President Angelo Fosco has said:

> Experts estimate the annual market for installing solar systems and converting existing structures to solar systems has a potential of $77 billion alone . . . not including maintenance . . . That translates into a goodly number of jobs for construction workers in our jurisdiction.[102]

The President of the International Association of Machinists and Aerospace Workers (IAM), Floyd Smith, told delegates at an IAM-United Auto Workers legislative conference in January, 1975:

> If, for example, the government launched a program tomorrow morning to equip each home in America with a rooftop solar water heater, scores of factories would be retooled and reopened. Thousands of jobs would be created for unemployed machinists and auto workers.[103]

The IAM Grand Lodge Convention in Florida last year passed the following resolution:

> An all-out federally-sponsored program to convert home water and space heating to solar would not only decrease America's dependence on foreign oil, but create millions of needed jobs for construction workers, machinists, metal workers and other industrial workers.[104]

The IAM newspaper, *The Machinist*, quoted one solar advocate as saying: "Using local solar energy makes much more sense than carting oil halfway around the world." And *Machinist* associate editor Dean Ruth wrote:

> Millions of Americans are jobless. Other millions face the threat of unemployment. Solar energy, as a new industry, can provide a vast amount of work to help get America moving forward again.[105]

An economist with the International Woodworkers of America (AFL-CIO/CLC) has written:

> Employment opportunities exist with the development and construction of alternate energy sources such as solar, tidal, geothermal and wind . . . . sound conservation methods and the development of alternate [to nuclear] sources will not adversely affect job opportunities in the economy. The job impact would, in fact, be positive.[106]

An article in *Worklife*, a magazine published by the U.S. Department of Labor,[107] was titled "Solar Energy: Potential

GNP

The selection of Gross National Product (GNP) as a main criterion for evaluating the nation's economic health has served to mislead the public on energy and employment issues.

GNP is the market value of all goods and services produced in the economy over the course of a year. As far as GNP is concerned, everything that costs money is considered a benefit. GNP includes expenditures for desirable items—such as for energy, housing, education, food, etc., but without taking into account whether they are made available efficiently or safely. GNP also includes costs of items not generally considered to be beneficial to the nation: disease treatment, pollution clean-up, weapons production and sales, wars, as well as unemployment insurance, workman's compensation, welfare payments, etc.

Some analysts believe that the only part of the GNP which is actually increasing these days is that part created by the costs of pollution, environmental degradation and human suffering caused by wasteful, inefficient and dangerous methods of production (especially of energy).

A recent Harris poll has indicated that a growing number of people believe the quality of life has generally deteriorated over the past decade. But the GNP has been increasing, despite some temporary decreases in "growth" rates during the '74-'75 recession. Thus, although individuals believe the quality of life has gotten worse, according to the GNP, the economy has gotten bigger and better.

For the United States to be striving for ever larger and larger GNP, to be basing energy, employment and other strategies on a deceptive criterion which conceals what is actually taking place in terms of unemployment, energy waste, work-related illness and public morbidity, does not appear to be the height of wisdom.

Powerhouse For Jobs." It listed some of the skilled workers needed to build and maintain solar units: carpenters, cement masons, electricians, plumbers, sheet metal workers, air conditioning, heating and refrigeration technicians, glaziers, crane operators. New jobs, the article says, will have to be created and ground broken in solar engineering, architecture, law, real estate and appraisal, sales, zoning, assessment and consumer protection.

The FEA Project Independence Task Force found that 3 to 4 million person-years of direct jobs would be needed in solar energy development and operation by 2000.[108] This figure is probably an underestimation, since FEA's 1974 "accelerated" rate of solar development is thought by analysts today to be too conservative. Among other things, it is based on oil selling at $11 per barrel when it is now selling for as high as $16—and going up; also, some of the solar technologies were considered for only certain parts of the country, i.e., the Southwest, which many believe an unnecessary limitation. Dr. Jerold Noel, for example, a physicist at Mobil-Tyco solar labs, has stated:

> The roof of an average house around Philadelphia could produce enough energy to supply the needs of a home, with enough energy left over, say, to charge an electric car.[109]

The jobs, according to the Federal Energy Administration, would be for the skilled tradespeople listed in *Worklife*, as well as for welders, bricklayers, concrete finishers, painters, iron and insulation workers, electrical and mechanical engineers, technicians, scientists and surveyors.

Fred Dubin, president of an engineering, planning and management firm which has conducted comprehensive energy analyses for many parts of the country, found that two billion dollars invested in energy conservation and solar power provides four times as many jobs as if it were invested in nuclear reactors (64,000 to 15,000).[110] Skip Laitner has shown that about 2½ more jobs are required for solar-developed energy than for the same amount of energy produced by nuclear fission.[111]

The job mix for the various technologies is different. Nuclear energy utilizes fewer tradespeople per professional scientist or technician than does solar energy; for nuclear, the ratio is about 2 to 1; for solar, it is 9 to 1.[112] In addition, a broader array of skills are necessary for building and maintaining solar systems than for building and maintaining nuclear plants. And, as an *ERDA* report stated:

> Solar systems provide much more room for small business and geographically dispersed businesses and workers than do some of the more complex systems.[113]

A report to the New York State Legislative Commission on Energy Systems calculated that the operation and maintenance of large wind systems require 2-4 times the labor force on a continuous basis than do nuclear fission or coal-fired systems. And the building of wind systems, said the report, would provide employment in generator and electrical component manufacture; sheet metal and structural steel fabrication; cement and wire production. The combined continuous labor requirements for construction and operation of wind systems without storage, according to the report, is 7000 person-years more than for an equivalent nuclear plant. For wind systems with storage, 19,000 more person-years of work are created than are created by an equivalent nuclear plant. The report emphasized:

> The National Indian Youth Council is opposing construction of six commercial coal gasification plants on the Navajo Reservation in New Mexico. The Council points out that each plant will cost $1 billion, and will be obsolete in 25 years: "In 25 years, when the investment is paid off and the profits pocketed -- the coal and the water gone -- the remains will be a wasteland . . . The Reservation will be forced to accept unmanageable boom towns. . . . the plants will give labor to a few of the Indians -- a doubtful benefit, considering the inevitable losses to the whole life and posterity of the tribe. . . . El Paso Natural Gas Company and Western Gasification Company will make the profit, but the consumer and taxpayer will pay for it all. Every dollar spent on the development of strip mines and gasification plants is another dollar that will not be spent on permanent and non-destructive alternate energy sources."
>
> Source: National Indian Youth Council
> Albuquerque, New Mexico

> The construction phase for both wind with storage and wind without storage would employ thousands of electricians, engineers, heavy equipment operators, laborers, steel workers and other construction personnel.[114]

MIT Professor David R. Inglis has determined that if windpower had a share of federal financial support commensurate with its promise, and if the money were spent "to encourage the rapid growth of a wind-turbine building industry," such an effort would utilize industrial facilities which already exist: motor companies which make gears, aircraft companies which make blades, electric companies which make generators.[115] The FEA Project Independence Study estimated that to generate 23% of the nation's electricity with wind power, 140,000 person-years of employment would be created by 1985, and 245,000 by 1990.[116]

That same report estimated that even a low level of electrical production by photovoltaic conversion would result in 3,344,000 jobs by the year 2000.

Carlough of the Sheet Metal Workers' Association reflected the frustrations of many regarding the slow pace of solar energy commercialization when he said:

> Dollars now being spent on fossil fuels from abroad would be better spent reducing joblessness by harnessing less expensive, inexhaustible energies at home. It is a national folly that, while the need for energy conservation and solar energy is so great, our sheet metal craftsmen, who can make energy-efficient buildings a reality, sit idle.[117]

Why, with the promise of solar energy so great, has progress been so slow?

XI. The Politics of Solar Energy

In 1952, the Paley Commission noted:

> Efforts made to date to harness solar energy economically are infinitessimal. It's time for aggressive research in the whole field of solar energy—an effort in which the U.S. could make an immense contribution to the welfare of the whole world.[118]

SUDDEN ENERGY CUTOFFS AND JOBS

This winter's job layoffs due to natural gas curtailments provide unfortunate but revealing examples of what happens without sound energy planning and local control of energy sources.

The disruptions which occurred highlight how vulnerable the American people are to interruptions in energy systems which are controlled by corporate interests from far away. Although energy industries try hard to blame job losses due to closed businesses on government regulations and on environmentalists, it is clear that the shortages and job layoffs have been due to the gas industry's desire for higher profits. The gas companies simply have learned a lesson from the oil companies. (Or more accurately, from themselves. The five largest natural gas producers are Exxon, Texaco, Phillips, Gulf and Mobil; 18 of the nation's top gas producers are oil companies.)

Representative Clifford Allen (D-Tenn.) has observed that the gas industry is

> essentially a monopoly, controlled by a few rich, 19th Century-type robber barons—a monopoly that has no viable competition and permits no alternatives to which people can turn during these cold winter months.

There is increasing evidence of ample gas. Paul E. Reicherdt, Chairman of the Washington Gas Light Company, said recently:

> The gas industry has reserves, proved and potential, to carry it well into the 21st Century.

But the gas was not made available to the public when it was needed most.

Charles Armin, Director of the Oil, Chemical and Atomic Workers District 1, recently told Southern California labor leaders that he is

> really disturbed that Industrial people are blackmailing us, saying that unless you pay more, we'll not provide the energy anymore . . . A lot of our problems of job dislocations are caused by the fact that we haven't met someone's price. We need to be careful we don't create windfall profits for the oil and gas companies. Look how much industry can increase profits by little price manipulations.

Indeed, gas company profits are up considerably. They are up because of the increased use of gas and the higher costs for gas over the past six months. Gas company profits have been increasing almost as much as the oil company profits increased following the 1974 Arab oil embargo.

Gas producers do not seem to be reluctant to admit what is going on. David H. Foster, executive Vice President of the Natural Gas Supply Committee, an industry lobby group, has said:

> There are 7000 natural gas producers out there waiting for a signal that will provide them with the incentive to get out the rigs and lease the land.

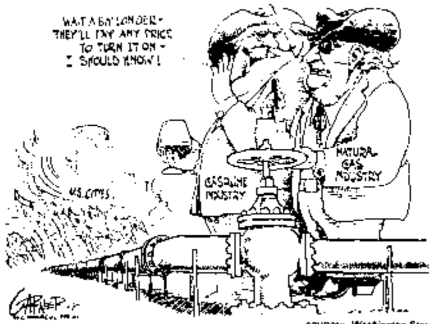
The implication of this statement is that frozen people, closed factories and a disrupted economy are somehow not "incentive" enough.

One of those gas producers, Antonio Sánchez of Texas, expressed his views on the naiveté of the public:

> What amazes me is why people in the East cannot understand the simple economics of it. Why should I sell my gas out of state at $1.42 [per thousand cubic feet] when Texas buyers are waiting in line to pay $2 for it?

The lesson for the public from all this is that local and regional energy systems must be developed which are responsive to the needs of consumers, and which cannot be interrupted when absentee corporate leaders decide to increase their profits, or indulge in any of their other whims.

Sources: *Washington Post*, February 7, 1977; Los Angeles Federation of Labor Energy Conference, Jan. 1977; *New York Times*, January 21, 1977; *Wall Street Journal*, February 3, 1977; *Dollars & Cents*, March, 1977.



courtesy *Washington Star*

According to the Senate Select Committee on Small Business, the Paley Commission's enthusiastic predictions and their recommendations went "tragically unheeded." And more than 20 years later, new studies for the government done by the General Electric Corporation, by Westinghouse, and by another large energy company—TRW—predicted that the energy contributions of solar technologies by the year 2000 would be minimal: General Electric's figure for solar heating and cooling was 1.6%; Westinghouse's was 3.14%; TRW's was 5.77%.[119]

Senator Gaylord Nelson (D-Wis.), noting that these solar projection studies were performed by companies heavily invested in nuclear power, coal, natural gas and oil, commented:

> The suspicion is unavoidable that these and other absurdly low estimates of the solar contribution during the next 25 years are not of what the estimators think the country *could* do if it put forward anything like the money and effort that went into nuclear development or moonshots, but rather what they hope the country *will* do. Not because doing so little is in the best interests of the great majority of Americans and other people of the world, but because doing so could possibly threaten existing investment in other technologies.[120]

James Piper, President of the Piper Hydro Company, testified before Senator Nelson's Committee on Small Business:

> I do not think Westinghouse can put its heart and soul into producing a good solar system.[121]

Jerry Plunket, a solar businessman from Colorado, noted the difficulties of dealing with the federal government on solar energy matters:

> Rather than assisting us, we have found federal employees unable to understand the solar-state-of-the-technology, unable to formulate reasonable plans for moving solar technology ahead, and in fact engaging in projects that were designed to keep university professors employed and off the street, and to use study contracts granted to large firms to make solar energy appear long term, remote and unlikely to respond to our current energy crisis. Further, incredibly expensive solar heating experiments were conducted that seemed designed to explore the upper bounds of costs—not to demonstrate cost effectiveness.[122]

The FEA Project Independence Task Force found that among "factors which have inhibited" the growth of solar systems were: (1) a lack of federal or private industry interest, and (2) underpriced, taxpayer subsidized fuels.[123]

An excellent example of federal indifference to solar energy development occurred recently in Fairfax County, Virginia. A school was completed there which is 100% heated and cooled by solar energy—the nation's first. Fairfax was unable to obtain government assistance for this project, so it sought money for a long time from other sources. Finally, the county received some funds from a university—in Saudi Arabia.[124]

Government officials frequently say that modest sums appropriated for solar energy are as much as can be prudently spent, given the state of the art. They say that a "new" industry can progress only a little at a time. But on some occasions when this country needed vigorous action, even the federal bureaucracies and private industry responded. For example, when specialized aircraft were needed during World War II, the fledgling aircraft industry was able to increase production from 3,623 in 1938 to 96,318 in 1944. See table IV:

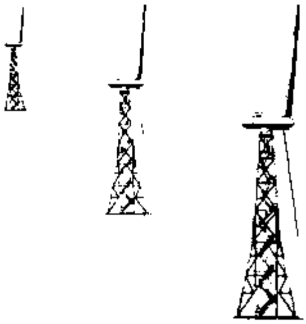
TABLE IV[125]

AIRCRAFT PRODUCTION IN THE U.S., 1938-1944

Year	*Number of Aircraft Produced*
1938	3,623
1939	5,856
1940	12,804
1941	26,277
1942	47,836
1943	85,898
1944	96,318

The FEA concluded:

> It is assumed that wind energy systems are not more difficult and probably far less difficult to produce than World War II aircraft.



No federal funds went to solar research and development prior to 1970. Since then, the solar budget has been increased each year. See table V:

TABLE V[126]

FEDERAL SOLAR BUDGET, 1970-1977

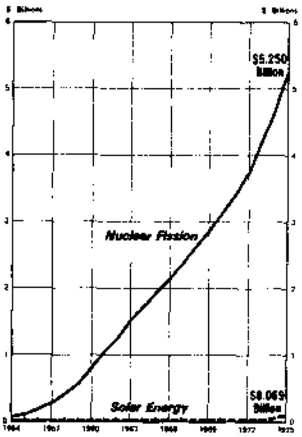
year	*allocation*
1970	$ .2 million
1971	1.2 million
1972	1.7 million
1973	4.0 million
1974	15.0 million
1975	43.0 million
1976	114.6 million
1977	290.0 million

Although the percentage increases of each year may seem large, the total dollar amounts allotted are nonetheless puny, especially compared to federal allocations for other energy areas.

The following chart compares allocations of federal funds to solar and nuclear technologies:

CHART III

FEDERAL EXPENDITURES FOR SOLAR ENERGY AND NUCLEAR FISSION



The proposed fiscal year 1978 ERDA budget of the Carter Administration provides clear indication of federal priorities in energy research and development:

TABLE VI

PROPOSED ERDA BUDGET FOR FISCAL YEAR 1978

program	*budget outlay*
conservation	$244 million
fossil fuels	519 million
solar heating and cooling	86 million
solar electric and others (mostly centralized solar thermal technologies)	164 million
nuclear fusion	392 million
nuclear fission	137 million
nuclear fuel cycle and dangerguards	486 million
liquid metal fast breeder nuclear reactor	651 million
management and support (ERDA bureaucracy)	306 million
uranium enrichment	441 million
nuclear weaponry	1 billion, 913 million

If one combines the various categories involving nuclear fission and solar energy, the total ERDA energy research and development budget looks like this:

TABLE VII

technologies	*budget outlays*
conservation	$244 million
fossil fuels	522 million
solar	250 million
fusion	392 million
fission	one billion, 715 million

The Carter Administration has doubled the outlays requested for conservation, increased the solar request slightly, and decreased the funds requested for the liquid metal fast breeder nuclear reactor demonstration project by about one-third, compared to the Ford Administration's fiscal year 1977 budget. But other categories of nuclear fission were increased, and nuclear fission absorbed about 40% of ERDA's budget increase, according to Tom Cochran of the Natural Resources

SOLAR STRATEGY AT ERDA

Some ERDA officials have expressed concern about investing taxpayer money in solar technologies without being sure what the returns will be. They—along with multinational energy corporations—seem to be suggesting that if the nation is going to put money into solar energy, at least it should be directed toward developing huge, centralized, expensive energy systems which only the corporate energy industry can handle.

The Carter Administration has bestowed on the new ERDA solar budget a mere cost-of-living increase over Ford Administration fiscal year 1977 budget levels. The majority of the new solar budget is directed to research and development of centralized solar electric systems (with some new funds for biomass conversion programs). The money for centralized solar research and bioconversion is not being taken from the vast sums alotted to nuclear fission, fusion or synthetic fuel development. Instead, the money is being withheld from research and development of other solar technologies which could be put to use more quickly, provide greater quantities of energy, and could be installed and controlled by small business, communities and individuals: heating and cooling of water and buildings, along with wind energy and photovoltaic systems.

It is commendable that ERDA is concerned about its responsibility for taxpayer dollars, and that it is seeking to evaluate how its solar programs are doing. After twenty-five years and tens of billions of taxpayer dollars have been poured into nuclear fission and fusion development, it would be nice to see similar concerns expressed about continuing investment in these realms as well.

But wishful thinking aside, ERDA needs to be prevented from playing musical chairs with the solar energy budget, alternately sacrificing one advantageous solar technology for another, while investing in centralized solar systems and continuing to pour vast sums into nuclear and other exotic technologies.

Source: Robert Hirsch, former Assistant ERDA Administrator for Solar Energy; Tom Cochran, Natural Resources Defense Council, *An Analysis of the Carter Administration's FY 1978 ERDA Budget,* Washington, D.C.: February 7, 1977.

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Defense Council.

President Carter's proposed funding of nuclear fission and nuclear fusion technologies thus ends up about **four times** that of conservation and solar technologies combined, despite the significant advantages in economy, employment, safety, and near-term feasibility of conservation and solar energy.

Conclusion

A recent perceptive ERDA report has recognized that among other aspects of the nation's energy dilemma, unwarranted "fear of unemployment is a key political fact."[20] This will be true as long as energy monopolies insist on threatening economic depression and unemployment if their expansion of vast, complex, costly and centralized energy systems is not permitted to continue.

To be sure, jobs will trickle down as a result of investment in wasteful and dangerous energy systems. ERDA has estimated that the current total employment in nuclear fission electric activities is about 80,000 people: mostly engineers, mathematicians, physical and earth scientists, technicians, welders, plus "all other employees."[21] Getty Oil Company's Nuclear Fuel Service Facility, between 1966-1971, employed an average of 1400 temporary workers each year at radioactive "hot spots." To locate, repair and insulate six 4½ inch hot water pipes in radioactive areas of a nuclear reactor, Consolidated Edison Company brought in 1500 welders, each of whom worked 15 minutes until he had received his maximum permissible dose of radiation. Professor Irwin C. Bupp of MIT has calculated that proposed floating nuclear power plants will create jobs beyond those created by land-based nuclear plants—jobs in hull scraping and ferrying.

Promoters of ever-expanding deployment of nuclear and other huge energy systems as the primary means of providing employment and prosperity (such as *Americans for Energy Independence*) try hard to portray those seeking energy efficiency and the commercialization of solar technologies as being against "economic growth . . . workers, the poor, and the disadvantaged."[22]

But it is the energy expansion scenario, which wastes both capital and resources, provides only limited jobs and unreliable energy sources, which causes disease and environmental destruction, which is not in the interests of "workers, the poor and the disadvantaged," or in the interests of anyone else except the large energy corporations themselves. There are more jobs by far—and safer jobs, and there will be greater prosperity more evenly distributed if the nation cuts back significantly on energy waste and moves vigorously toward solar energy. There will also be much less social and political havoc arising from this path to energy sufficiency.

Clearly, those who seek this solution do not seek an era of freezing and starving in the dark. They envision just the opposite: a time of decreasing dependence on foreign countries and on vulnerable and speculative energy systems; a time of abundant jobs and healthier people who live amidst cleaner air and water; and a time when people have greater control over their own lives and more resources with which to obtain the goods and services which make living easier and more enjoyable for all. A fair and equitable transition to a conservation and solar economy, during which no group or class of people will be made to bear the burdens of changing social values and technological innovations, would mean that the entire society would benefit greatly.

Energy corporation supporters try to suggest that the average American has no business getting involved in energy problems and solutions. *Americans For Energy Independence*, for example, advises citizens to defer to "representatives" in government, labor and industry:

> But [proponents of limited energy growth] do not hold positions that would make them accountable for the consequences of limiting the country's economic growth . . . On the other hand, those representatives of government, labor and industry who have personal responsibility for maintaining the economic well-being of the nation and improving the quality of life for the workers, the poor, and the disadvantaged, are firmly convinced that economic growth should not be limited at all.[23]

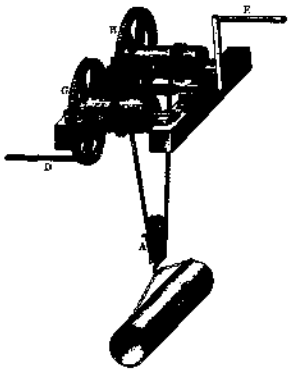
As has been demonstrated in the above analysis of energy and employment, there *are* representatives of government, labor and industry who know the great value of decreasing energy waste and maximizing the use of solar technologies, especially for the benefit of "the workers, the poor, and the disadvantaged."

But beyond this, the "responsibility" for the economic well-being of the country cannot be the special province of the country's leaders, as the fiscal year 1978 ERDA budget makes clear. On the contrary, *all Americans* share such responsibility. As the ERDA assessment of solar energy stresses:

> Solar energy is part of a broad societal choice involving much more than the selection of an energy technology.[24]

Indeed, these energy and jobs issues are components of basic struggles over political and economic power.

Many Americans are ahead of their leaders in understanding the causes of the nation's energy and unemployment problems. They are willing to seek solutions which may not necessarily coincide with corporate myths. They realize that energy efficiency and solar technologies are the methods by which the public can be assured that enough safe energy will be available; that the people will be able to control its production and use; and that there will be sufficient numbers of jobs available in diverse activities throughout a prosperous nation.



On the Poor and Disadvantaged

Energy industries say they must expend for the sake of the poor and disadvantaged. If energy industries were truly concerned about these people, they would be spending money to develop inexpensive, energy-efficient and long-lasting appliances. Yet, as Professor Herman Daly has pointed out, the industry spends *eight times* as much money on advertising as it does on research and development of energy-efficient consumer goods.

In addition, utilities would not be opposing affordable 'lifeline' utility rates, and would not be charging higher rates to the smaller users. They would not be opposing clean air and clean water regulations, since foul air and polluted water affect the poor more than those who can afford to escape to cleaner realms. They would not be fighting commercialization of safer, cleaner, cheaper solar energy systems and energy-efficiency techniques (which they usually fight with rate-payer money). They would not constantly be playing down the danger aspects of complex technologies like nuclear fission, coal conversion, the liquifaction and transportation of natural gas, which threaten the poor first and most. And they would not be misleading about where the jobs are.

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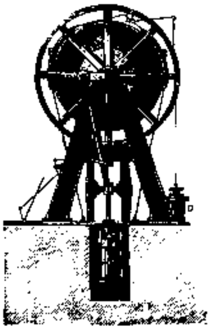

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[From In These Times, Sept. 21–27, 1977]

BLUE COLLAR SUN

(By David Moberg)

Can the sun light a new political path for the nation's labor unions?

Consider these minor examples. The Sheet Metal Workers union is trying to convince the Chicago Board of Education jointly to finance the conversion of one floor of the city's skilled trades teaching center to solar heat. Already the union has helped to build and finance solar heating of experimental homes and of other schools, on Long Island and in Detroit, where sheet metal workers learn their craft.

The United Auto Workers uses solar heat for the swimming pool at its Black Lake, Mich. educational center, partly as a way of demonstrating the feasibility of solar power.

The Los Angeles Federation of Labor after listening to ecologist Barry Commoner address a special meeting, has been working with environmentalists to research and promote solar energy possibilities for their area, despite differences between the two groups over many other issues, including nuclear power.

Observers throughout the country sense a new, although still indecisive union interest in solar energy as an immediate option and not just a dream technology of the future.

AN IMPORTANT ALLIANCE

If that interest quickens, the impact on the labor movement might extend far beyond immediate energy politics. Although environmentalist and labor unions might still be at odds over bottle bills, redwood logging, tuna fishing, nuclear power plants, offshore oil wells, leniency on auto emission standards and other issues, unity behind more vigorous development of solar power might help strengthen the potentially important political alliance of labor and the ecological movement—an alliance that might have deep appeal for young blue-collar workers as well as students and intellectuals.

Active pursuit of a solar course would mark a significant new independent initiative by labor unions. They've tended to play follow-the-corporate-leader on energy issues—except on immediate pricing policies that reduce working class standards of living. A major push toward solar energy would also require labor unions to buck present AFL-CIO policies and to take initiative in developing and promoting legislation that the Carter administration has not offered.

By backing solar energy, however, unions might become, in the words of West Coast director of the Oil, Chemical and Atomic Workers Charles Armin, more "politically responsible."

The support for solar energy reflects a growing interest in some quarters of the labor movement in the quality as well as the quantity of economic growth.

Pro-solar unionists often not only accept the argument that solar development will offer more jobs than coal and nuclear power but also believe that the jobs may be more desirable. Solar energy projects, for example, may benefit a wide range of workers and provide jobs in the immediate community rather than in remote mining or drilling locations.

UAW and Machinist representatives even talk about bringing more stable, socially beneficial jobs to their members by converting much of the aerospace industry from military production to solar manufacturing.

Such possibilities for a new political thrust, which might include an independent labor movement working in coalition with environmentalists to plan more consciously the country's economic future, are still remote, however.

SUPPORT BUBBLING UP

At present one union stands out as the most active proponent of solar power, the Sheet Metal Workers International Association, a 160,000-member construction trades union.

Yet there is also strong support for solar power from various levels of the UAW, the Machinists (IAM), and the Laborers International Union. (The Operating Engineers, Ironworkers, Carpenters and Teamsters have jointly with the Laborers behind a common energy program.)

Elsewhere, support for solar energy comes bubbling up from officials at local and regional levels, and occasionally is expressed at the international level in such unions as the Plumbers and Pipefitters, the State, County and Municipal

Employers (AFSCME), United Electrical Workers (UE), Service Employees (SEIU) the West Coast Longshoremen and the Oil, Chemical and Atomic Workers.

Official AFL–CIO policy, however, lumps solar with diverse "other sources" that "will be neither cheap nor be developed overnight," as a February 17 Executive Council memorandum stated.

MORE AND BETTER JOBS

When most labor leaders take time to think about energy policies one of the main things on their minds is jobs. "Where exactly the energy comes from [for these jobs] is not a big issue with trade unions," Tom Donahue, executive assistant to AFL-CIO president George Meany, told a conference of unionists and environmentalists at the UAW Black Lake retreat in May 1976.

Cracks are emerging in that hard-line attitude.

Perhaps most importantly, preliminary estimates suggest that solar energy programs will generate far more work for a broader range of unions than nuclear power plants will.

The Congressional Office of Technology Assessment, for example, compared the labor requirements for building and operating a conventional coal-fired electrical generating plant with those for solar hot water heaters and for a photovoltaic system, directly producing electricity from sunlight. The figures in the comparison were expressed in man-hours per megawatt-year, the labor time needed to produce the equivalent of a million watts of electricity for one year.

The coal-fired plant would require 2,050 man-hours per megawatt-year but the solar hot water heaters would require 4,440 to 6,040 man-hours. The photovoltaic system would require between 6,240 and 10,040 man-hours for the same amount of energy.

That would mean the two solar technologies would produce twice to five times as many jobs as a coal-fired generating plant in generating the same amount of energy. Since capital and material costs for solar energy production are less than for coal or nuclear production, greater labor costs could be absorbed while still offering energy at competitive costs.

The Sheet Metal Workers and their Training Fund, jointly administered with the national contractors association, have already begun promotion of solar home heating as an immediate answer to high unemployment among their members.

"Under the Sun," a half-hour film, tells about the Fund's involvement in pilot solar projects and promotes solar home heating to workers and contractors. Besides encouraging and funding pilot projects, the union and Training Fund have expanded specialized training in solar technology for sheet metal workers.

CRACKS IN NUCLEAR FRONT

The appeal of solar power to labor leaders has grown not only as it appeared to offer more jobs than oil, coal and nuclear options but also as leaders became more aware of the economic and safety problems of nuclear power.

Workers in the nuclear industry "know there are problems in nuclear fission," OCAW district director Armin says. "We realize there's a danger of accidents and disposal of wastes. Also we are quite aware that the people we represent also live in those communities."

No international union has so far come out against nuclear power. However, the UAW opposed the breeder reactor and several unions have stopped saying or doing anything in favor of nuclear power, although officially abiding by the pro-nuclear AFL-CIO position. The non-AFL-CIO United Electrical Workers (UE) appears closest of any union to abandoning support of nuclear energy.

Even unions strongly supporting solar energy still back nuclear expansion, even if a bit cautiosuly. "We're very much for developing alternative sources," says Dean Ruth, editor of the Machinist union newspaper, which has prominently written about solar power. "But we're not against development of nuclear power. We think it's important to bridge the gap of the immediate present with that source which is known, and we don't see any substitute [for nuclear power] for the immediate, short-term future."

AN EASIER PATH

Yet as the anti-nuclear movement grows and obstacles to new power plants multiply, unions may be weaned from their attachment to nuclear—especially if they realize there is a practical, desirable alternative.

"We can't burn any more fossil fuel [in the Los Angeles area] because of air quality problems," Scott Franklin, 46, a Firefighters union local officer who is vice-president of the Los Angeles County Federation of Labor and chairman of the Jobs and Environment Committee, said. "We're subjected to earthquakes. So that rules out nuclear energy. So we're looking at solar. Our climate is mild enough to take advantage of it."

Alvin Duskin, co-director of the Solar-Cal project for a California state public solar development fund, says that "the unions in California are seeing that insofar as they want to deliver jobs, if they go nucelar they'll run into ten years of court battles, but on solar they'll get support from environmentalists."

RANK AND FILE INTEREST

Union leaders are also sensitive to growing popular support, among younger union members as well as the general public, for ecologically sound policies. Solar energy "is a good, clean, inexhaustible source of energy," Bernard McMonigle, associate director of research for the Sheet Metal Workers says. "Building tradesmen like the environment as much as anybody."

Half of young blue-collar workers rank environmental issues as very important to them, according to a survey published in 1972 in Where Have All the Robots Gone?, three times the rate of interest expressed by workers over 55 years old.

Along with this growing wave of environmental consciousness is a strong public sentiment for solar energy despite the prevailing public image presented of an exotic, futuristic solution of little immediate impact. Thirty-eight percent of the public believes that the sun will be the most important energy source for the country in 25 years, according to a survey made last May by Cambridge Reports, the firm headed by President Carter's political advisor, Patrick Caddell.

More exchanges between environmentalist scientists and union leaders could alone made a great difference. A great deal of ignorance still exists about the possibilities with solar energy. "We're not engineers," James R. Sheets, research director for the Laborers International Union, says, "So we tend to generalize on the non-conventional energy sources. We don't quite understand how far the technology has advanced. We're in a position that we might be buying a pig in a poke."

MONEY AND IDEAS

Unions generally look to others as well to introduce new legislation, which can then become a convenient and concrete focus of political support. "Unions are more reactive than anything else," Sheets says. "We support solar energy and we'll support proposals that develop it. We don't have the capacities to make such proposals other than to say, 'Get off your butt and do something.' "

One major obstacle to union support of solar power, according to Gail Danker of the Environmentalists for Full Employment is that they "don't see the capital formation that is necessary." Although Carter's program does very little to capitalize solar energy, a proposal by Rep. Stephen L. Neal (D-N.C.) for a $5 billion, low-interest Solar Development Bank might be made a rallying point for pro-solar unions and environmentalists.

Environmentalists and unionists would both benefit from a new alliance. John Yolton, administrative assistant to UAW vice-president Odessa Komer, speculates, "Solar energy could be the vehicle to bring the people together."

STATEMENT OF R. DENNY SCOTT,* ECONOMIST, INTERNATIONAL WOODWORKERS OF AMERICA, AFL–CIO & CLC

The Energy Dilemma—What it Means to Jobs

FUTURE ENERGY NEEDS AND THE EMPLOYMENT PICTURE

Projected shortfalls of petroleum, natural gas, fossil fuels and even hydroelectric power and unprecedented increases in energy prices are causing a national

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*R. Denny Scott is an economist in the Research and Education Department of the International Woodworkers of America, Portland, Oregon. Assisting in the preparation of this paper were Roy A. Ockert, Coordinator of the Department and Margaret A. Honey, a student at Hampshire College, Amherst, Massachusetts.

reassessment of energy policies. The federal government is deeply involved in energy-related legislation and regulations. Industry is rushing around trying to guarantee future energy supplies, and heightening the drama are ballot measures in several states related to the construction and operation of safe nuclear power generating plants.

Sometimes lost in the swirl of debate over oil price regulation, the technicalities of generating an extra million BTU's of power, and the pros and cons of safe nuclear waste disposal is the important question of how energy relates to jobs. If future energy needs are not met, will plants be forced to cut back operations, thereby causing layoffs and unemployment? Just what is the relationship between non-human energy and jobs for working people?

The International Woodworkers of America expressed concern over U.S. and Canadian energy policies in a 1973 Resolution at the convention in Vancouver, B.C. The resolution called upon the International Union to study energy problems and the potential effects they might have on IWA members.

Although there are many questions that should be addressed when viewing U.S. and Canadian energy policies, this paper will concentrate on the employment implications. The paper will review and analyze current literature which draws the parallel between energy and jobs. What kind of future energy supplies are needed to sustain an adequate number of job opportunities for people already working and to create enough new jobs for people who will be entering the labor market in the future?

Government, labor, engineers, scientists and others who have studied the energy problem have acknowledged that nuclear fission power is, at best, a temporary solution and nuclear fusion power, if achievable, is a long way off—that the long-run solution must be the alternative sources: sun, wind, tides, geothermal, etc. What do the alternatives imply for jobs?

Unions risk disaster and perform a disservice to their members if they do not attempt to define these problem areas, develop the questions and postulate the possible answers.

GNP, GROWTH AND EMPLOYMENT

One of the underlying assumptions in the energy supply debate is that the United States gross national product (GNP)—the total of goods and services produced each year—must grow at least as fast as it has in the past in order to assure "full" employment. Some argue that increases in energy must be available in order to sustain an average annual GNP growth rate of about 3.5 per cent. However, a major Ford Foundation study released in 1974 brings into question the validity and wisdom of projecting future energy needs and employment trends on the basis of past performance. While in the past there has been a defined relationship between GNP growth, energy growth and employment growth, it cannot be assumed that the same ratios will apply in the future. The study points out that if we continue to increase U.S. energy consumption as we have during the last 20 years we would need to add the equivalent of one Alaska pipeline each year. At historical growth rates, energy in residential, commercial and transportation uses would roughly double between now and the year 2000. It would triple for industrial use.

In more concrete terms, the historical growth of energy consumption would mean that every home in the United States in the year 2000 would be heated, have central air conditioning, have enough energy for heating water and cooking, plus a freezer, a dishwasher, and a large frost-free refrigerator. The trend towards more suburban living would continue with the accompanying dependence on the automobile. Historical energy growth would give us enough fuel to power 138 million automobiles with worse than mediocre fuel economy. Automobile travel would increase by 15 per cent if historical growth rates bear out. Air travel would increase more than five times, and air freight would be up eighteen-fold.

The Ford Foundation study explored the relationships between energy prices, energy growth and economic prosperity. Growth in energy consumption depends primarily on prices which tend to influence consumer demand. Despite the assumptions of many people, numerous studies indicate that the demand for energy declines as the price advances. Government policies play an important role in the energy demand situation by promoting an attitude of consumption or of conservation.

The most plausible circumstances for a continuation of historical rates of growth in energy consumption would be unexpected good fortune in keeping energy prices down, combined with government policies that promote consumption. According to the estimates of the econometric model, fuel prices have to stabilize at 1971 levels between 1985 and 2000 to be consistent with historical rates of energy growth. In the past, energy represented a small fraction of industrial and residential expenses. As a result, there was little economic incentive to explore attractive conservation measures.

The Ford Foundation study concludes that price trends implicit in historical growth projections are not realistic in view of current expectations about future energy prices. On the basis of information now available, continued growth of energy consumption at rates approaching those of the past is unlikely without a large scale government commitment.

If it is unlikely that historical rates of energy growth can be sustained, is it possible to obtain continued GNP growth and employment growth while consuming less energy?

The Ford Foundation also approached this problem by using the econometric model to test whether or not the economy could grow and prosper with energy growth rates lower than historical levels. The annual average energy growth rate over the past 20 years has been 3.4 percent. This study tested a 1.9 percent annual consumption rate and a zero growth rate in energy use.

If energy growth were cut from an average annual rate of 3.4 percent to 1.9 percent and certain known energy saving technologies, such as better insulation and better auto fuel economy, were introduced, the lower energy budget would provide essentially the same level of energy services as are provided in the historical growth model (i.e., miles of travel, quality of housing, levels of heating and cooling, manufacturing output, etc.).

The calculations assume that in the future, users in the industrial sector will be more aware of energy costs (and therefore more responsive to using energy in an economically efficient way), and that the market imperfections that inhibit investment to save energy in the residential, commerical and transportation sectors can be removed by specific government action.

Zero energy growth, as envisioned by the Ford Foundation study, represents a modest departure from the circumstances and conditions projected for the historical growth model. It includes all the energy saving devices of the 1.9 percent average annual growth rate plus extra emphasis on efficiency. The main difference would be in a distinct redirection of economic growth away from energy-intensive industrial toward economic activities that require less energy and more workers. Zero energy growth would be achieved in steps to avoid serious dislocation so that actual zero growth would not be a fact until about 1985.

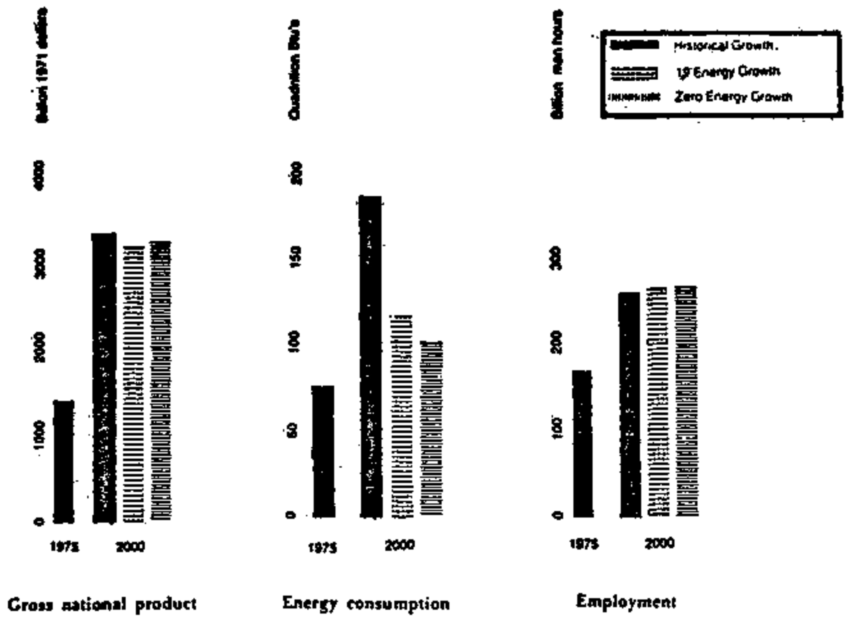
"Generate Less Energy? Sure, and Generate Galloping Unemployment".

These are the words of a utility company advertisement designed to correlate the need for energy with jobs.

There is much talk—and considerable anxiety—about the supposedly close and unbreakable relationship between energy consumption and employment. Both the econometric model and the analytical work of the Ford Foundation project reveal that such commonly held fears are unfounded. While it is true that a sudden and unexpected energy shortage can cause, and has caused, major unemployment, the study concludes that a long-term slowing of energy growth signalled by clear policy commitments, slowly rising prices, and appropriate compensatory policies could actually increase employment.

Researchers in the Institute of Ecology at the University of California at Davis have compiled international comparisons of economic growth and energy consumption and have found that a country passes through various phases of energy efficiency in its industrial development. In the early stages of development, large gains in economic growth are achieved with large increases in energy consumption. There are limits, however, to the amount of growth that can be stimulated by adding an extra million pounds of energy to the country's total supply. Certain negative factors set in and the rate of economic growth actually begins to fall as energy consumption rates climb at an accelerated pace.

Projections of alternate energy growth rates and the effects on gross national product, energy consumption, and employment, 1975–2000



The Ford Foundation energy study entitled *A Time to Choose* tested the effects of differing energy growth rates on GNP and employment. But cutting the annual energy growth rate from the historical figure of 3.4 percent to 1.9 percent, GNP in the year 2000 would be slightly lower but employment would be slightly higher than if historical energy growth rates were maintained. As the United States approaches zero growth, employment opportunities increase—not decline.

The Davis research team concluded that an inverse relationship exists between energy consumption and the per capita economic growth rate. In other words, the more energy consumed on a per capita basis, the lower the economic growth rate. The U.S. is on the downside of this curve.

To further illustrate this finding, it is useful to examine the relative position of several countries. The 1968–72 economic growth figures for twenty nations were correlated with 1972 per capita energy consumption rates. One of the lesser developed countries, Portugal, showed a growth rate of 7.5 percent with only a 2,000 pound (in coal equivalents) per capita energy consumption. In contrast to Portugal, Sweden's energy use was 13,000 pounds, but the GNP growth rate was only 2.7 percent. Finally, the U.S. growth rate was about the same as Sweeden's, but energy consumption was more than twice as high.

New job opportunities would be created in an economy using lower rates of energy growth. The energy and manufacturing industries that are the most energy intensive employ relatively few people. Slower growth rates in these sectors could be offset by more jobs in the service sector.

AUTOMATION REDUCES EMPLOYMENT

The five largest manufacturing groups are primary metals; stone, clay and glass; food and kindred products; chemicals and allied products; and paper and allied products. They annually consume two-thirds of the energy used by U.S. manufacturing. In 1971, they employed 4.8 million workers—7.3 percent of the total employment in the United States. Total U.S. employment increased 41 percent between 1950 and 1971, but total employment in these five industries remained static.

The Ford Foundation study concluded that adjustment to a less energy-intensive economy would not reduce employment but would, in fact, result in a slight increase in the demand for labor. Other studies also support the conclusion that we can safely uncouple energy and economic growth rates.

For example, the Conference Board and the Thermo Electron Corporation have completed studies showing that the ratio between energy use and industrial output in U.S. manufacturing is expected to fall rapidly in the future. Some energy-intensive industries such as steel could maintain current levels of output with one-third less energy than is now used.

Significant savings in energy use have been realized by the manufacturing sector in the past. Energy use per unit of product declined at a 1.6 percent rate from 1954 to 1967. As a result, while total manufacturing output rose 87 percent, total energy use rose by only 53 percent. This was achieved in a period of stable or declining energy prices.

An Oregon Task Force on Energy Report released in 1973 presented some useful figures showing the quantity of energy used in differing industrial sectors and the production and employment relationship to the energy expended. Oregon industry consumed 121.5 trillion BTU's of energy in 1972 and it was divided as follows: natural gas—48 percent; electricity—34 percent; and oil—18 percent. By far the state's largest industrial user was the paper and allied products sector which used 60 percent more energy than the next largest consumer—primary metals. Lumber and wood products is the state's third largest energy user.

When energy is viewed as an expenditure, it is apparent from the accompanying table that different production and employment "returns" are achieved with a given expenditure of energy. For example, a billion BTU's consumed by the paper industry translates into $4,900 of product output and two-tenths of one person employed. This is certainly an energy-intensive industry when compared to the estimates for all manufacturing where $25,400 of output and one and one-half jobs is achieved with each billion BTU's. The lumber and wood products industry is roughly twice as efficient in energy use as the average for all manufacturing, obtaining 3.1 jobs per billion BTU's and $48,000 worth of finished goods.

The high energy-use industries are also the industries requiring the largest investment in capital equipment. It costs a great deal more to build a pulp mill or aluminum smelter than it does to build a sawmill or food cannery. Cheap energy prices in the past have provided one incentive for increased capital expenditures. Advances in technology and automation, fed by cheap fuel, have enabled industry to substitute capital for more expensive labor. This has been the predominant method of increasing labor productivity.

The trend in all manufacturing industries has been towards replacing labor with energy-consuming capital equipment. This trend is seen most dramatically in highly automated industries such as pulp and primary metals. As the price of capital increases because of rising interest rates, and as the price of running the expensive equipment spirals because of energy prices, the economic returns of those large investments are diminishing. Economic returns in the past have been derived from reducing labor cost per unit of output but the evidence is that these returns are falling off. It takes a larger and larger outlay for automated machines to reduce labor cost. We may even have reached the point in some sectors where it would be wiser to reverse the historical trend and begin substituting human energy for non-human energy. Revised technology would be necessary to begin the move towards reducing the capital and BTU need per unit of output.

Past employment gains have not occurred in the industrial sectors consuming large quantities of energy. Herman Daly, an economist from Louisiana State University, puts it this way:

"As non-human energy has replaced human energy in agriculture . . [and in] industry, even with large increases in total output of the [agricultural and] industrial sector[s], the new major source of employment has been the 'new' service sector. Of the total net increment of 14 million jobs between 1947 and 1965, the service sector accounted for an increase of 13 million, industry and increase of 4 million, and agriculture a decrease of 3 million. Thus, the alleged need for large increases in energy input to provide more jobs pre-supposes that the average new worker will work in a steel or aluminum plant. This is counter-factual. The person will more likely work in [schools, hospitals, stores or banks, jobs which are not energy-intensive]. . ."

ESTIMATED PRODUCTION AND EMPLOYMENT LEVELS RELATED TO ENERGY CONSUMED IN OREGON MANUFACTURING INDUSTRIES, 1972

Industry	Value added in manufacture	Employment	Billion Btu's of energy	Value added per billion Btu's	Employment per billion Btu's
Food and kindred products	$386,200,000	23,500	4,500	$85,800	5.2
Lumber and wood	1,234,700,000	78,600	25,500	48,400	3.1
Paper and allied products	217,500,000	9,500	44,500	4,900	.2
Chemicals	64,100,000	2,140	5,900	10,900	.4
Stone, clay, and glass	71,400,000	3,400	5,300	13,500	.6
Primary metal	151,300,000	7,200	27,800	5,400	.2
Fabrication metals and machinery	500,400,000	28,200	2,100	238,300	13.4
Total manufacturing	3,093,200,000	183,200	121,500	25,400	1.5

Source: Report by Gov. Tom McCall's Task Force on Energy, June 5, 1973.

The Ford Foundation study examined the energy industry itself and the economy's most energy-intensive industries and found that these industries have become increasingly capital intensive, thus providing a smaller share of the nation's jobs. As a group they consume about one-third of total U.S. energy, account for about 45 per cent of U.S. industrial production and provide only about 10 percent of total employment. As a group they account for one-half of all new capital requirements in the industrial sector. In a historical review of the top fifteen energy-intensive industries, the study found that no new jobs have been created by this group over the past two decades. These industries, in fact, showed significant energy savings over the past twenty years and this was achieved even as energy prices fell. Given much higher energy prices, fear of future shortages, and appropriate government actions, even greater energy savings are likely in the future.

The relationship between higher energy consumption and fewer man-hours worked is partially demonstrated in a 1975 report issued by the Interior Department Bonneville Power Administration. Electric power consumed by manufacturing industries in the United States amounted to 325 billion kilowatt hours in 1957. Electricity use rose to 600 billion kilowatt hours by 1971, but man-hours worked between 1957 and 1971 remained unchanged at 25 billion. Manufacturing output went up by 75 percent. In 1957, 13 kilowatt hours were expended for each man-hour of labor whereas in 1971—just 14 years later—each man-hour was accompanied by 24 kilowatt hours.

Some of this increase in electrical power usage can be explained by the subsitution of electricity for petroleum fuels, but clearly the predominant view must be that production increases were generated by non-human energy at the expense of human energy.

Research done at the University of California, Davis, reinforces the proposition that low energy prices contribute to unemployment. High unemployment rates in countries such as the United States and Canada are associated with low energy prices, whereas higher energy prices in countries such as Sweden and Japan are tied to lower unemployment rates. When confronted with cheap energy and expensive labor, business managers will pursue a policy of substitution of energy for labor—namely, automation.

There has, however, been a complicating factor that has obscured the relationship between cheap energy and unemployment. The substitution of non-human energy for labor does not cause unemployment until the market demand for the product being produced becomes saturated. This can happen as consumer purchasing power dwindles due to unemployment or because products are produced at a lower cost with foreign labor. Before the market has become saturated, increased automation reduces employment, but since the market is still expanding, additional plant capacity is built and more workers are hired to keep pace with product demand. Once the market is saturated and can no longer be expanded, increased labor productivity brought about by automation can only result in unemployment.

The only way to break out of the downward cycle would be to promote labor-intensive activities and technology instead of energy-intensive activities and technology.

CONSERVATION

Professor John P. Holdren, a specialist in energy and resources at the University of California, comments on the opportunity for energy conservation in the United States and its relationship to our standard of living:

The notion of a one-to-one link between energy use and well-being is the most dangerous delusion in the energy-policy arena. Sweden, Denmark and Switzerland all had higher gross national products per capita in 1974 than did the United States, despite energy use per capita around half that in the United States or less.

It is time we studied how the frugal Europeans get so much prosperity from so little energy. By carving the fat from our energy budget and wisely applying these savings, we probably could hold United States energy growth between now and the year 2000 to 1 per cent per year, instead of te 3 to 4 percent so widely forecast. If our goal is to maximize human well-being, accounting both for the benefits of energy use and the likely costs, we should not aim at more energy growth than this, and I believe it possible we should aim at less.

More than one-half the current U.S. energy budget is waste. For the next quarter century the United States could meet all its new energy needs simply by improving the efficiency of existing uses. The energy saved could be used for other purposes and relieve us of the immediate pressure to commit enormous resources to dangerous energy sources before we have fully explored all alternatives. Energy derived from conservation would be safer, more reliable, and less polluting than energy from any other source. Moreover, a strong energy conservation program would save consumers billions of dollars each year.

In 1975, Americans wasted more fuel than was used by two-thirds of the world's population. We annually consume more than twice as much fuel as we need to maintain our standard of living. We could lead lives as rich, healthy, and fulfilling—with as much comfort, and with more employment—using less than half of the energy now used.

A recent study looking at potential conservation strategies that would have application in the Pacific Northwest found that a high-impact energy conservation program in the residential and commercial sectors would provide more regional employment than could be created through the construction of new power plants—nuclear or otherwise—to generate the equivalent amount of energy. Furthermore, the jobs created would benefit semiskilled and unskilled workers as opposed to the technical and highly skilled jobs called for in the construction and operation of a nuclear plant.

According to the study, a conservation program designed to reduce 1995 energy consumption by 27 per cent would generate employment opportunities in the manufacture and installation of insulation and double-pane windows. There is no reason to believe that similar measures taken in the industrial sector would not also create new jobs.

PER CAPITA ENERGY CONSUMPTION, UNEMPLOYMENT RATES AND PER CAPITA GROSS NATIONAL PRODUCT FOR 9 INDUSTRIAL NATIONS, 1974

	Energy consumption per capita (in tons of oil equivalent)	Unemployment rate (adjusted to U.S. concepts) (percent)	Gross national product per capita (in U.S. dollars)
Canada	8.56	5.4	$5,372
United States	8.09	5.6	6,155
Sweden	5.45	2.0	6,155
Australia	4.39	2.2	3,998
Germany	4.25	2.1	5,618
Great Britain	3.82	3.0	3,120
France	3.39	3.1	4,851
Japan	3.05	1.4	3,812
Italy	2.47	3.1	2,502

Sources: Organization for Economic Cooperation and Development, U.S. Department of Labor, Bureau of Labor Statistics, and Agency for International Development.

The opportunities for energy savings in U.S. industry are vast. Manufacturers, for example, produce large quantities of steam in-house while purchasing almost all their electricity from utilities. If the steam were first used to generate electricity and then used as steam for its original purpose, more electricity could be produced than the entire industrial sector now uses. This transition, obviously, calls for the construction and manufacture of steam-powered electricity generating plants.

Aluminium refining is an exceedingly energy-intensive operation, and the industry has therefore situated its major installations near sources of cheap energy. Technical advances in the traditional refining method, however, can reduce energy requirements by almost one-third. By far the greatest opportunities for energy savings lie with recycling aluminum. Refining scrap aluminum requires only 5 per cent as much energy as the traditional process and it creates and preserves employment as well.

Using the best available technology, the paper industry could reduce fuel demands by 50 per cent and fossil fuels could be reduced further with greater utilization of wood wastes as fuel.

In a 1974 editorial, a writer for The Oregonian newspaper discussed the potential for using sawmill residues and scraps as a substitute for propane and natural gas fuels in the wood products industry. He estimated that approximately 50 lumber and plywood mills in Oregon might consider converting from gas and oil to wood residue furnaces. These mills would save the equivalent of 75 million gallons of oil a year.

In recent years, large corporations in the forest products industry have been making major investments in hog fuel furnaces to conserve traditional fossil fuels and to utilize a cheaper energy source.

Transportation presently accounts for about 24 per cent of our direct fuel consumption. Another 18 per cent of our energy budget is used indirectly—to build and maintain vehicles, construct roads, etc. Sixteen per cent of our direct fuel consumption and an additional 6 per cent of our indirect consumption could be saved by gradually tripling the mileage performance of individual vehicles, substantially reducing average vehicle size, transferring half of commuter traffic to multiple passenger modes while reducing the number of automobiles accordingly, and systematically shifting freight to more efficient modes. These savings could be phased in over the next 25 years.

ALTERNATE ENERGY SOURCES

A great deal has been written lately about alternate energy sources—the motion of waves in the ocean and the tidal action on shore, the sun, the wind, the heat of the earth and the steam it generates.

Unfortunately, studies have not been conducted on the relationship between these alternate energy sources and jobs. It is safe to postulate, however, that many jobs would be created in the process of planning, constructing, maintaining and operating such facilities. There is no reason to believe that just as many jobs would not be created in these endeavors as are being generated by the construction and operation of nuclear plants.

Because of their interest in solar energy systems, the Sheet Metal Workers Union commissioned a study to estimate the potential for solar heating and cooling over the next 15 years and the resulting effects on their membership. The study assumed that the present low government priority given to alternate energy sources would continue. Even with this low level estimate it was estimated that the solar heating and cooling industry would mushroom into a $2 billion per year operation by 1990. According to very rough estimates the study indicated modest growth of this power source would increase dollars spent for sheet metal work by 1.5 per cent to 3 per cent. For an eccelated solar energy program, sheet metal work could go up from four to seven per cent. Regretfully, this study makes no attempt to translate this increased spending on sheet metal work into numbers of actual job opportunities.

Facilities built to generate alternate forms of energy are likely to be dispersed—located near the tides, in windy areas and where geothermal activity exists. This dispersal represents a departure from the current method of concentrating huge generating facilities at a location and transporting the power. Such dispersal has substantial economic and sociological advantages.

NUCLEAR POWER PLANTS AND EMPLOYMENT

The biggest thrust for adding energy supplies to our traditional forms of energy is in the field of nuclear generated electricity. Presently, nuclear plants generate less than two per cent of the nation's energy, but at the planned rate of expansion this energy source will account for nearly one-quarter of U.S. power consumption by the year 2000. The high priority given nuclear power by the government is also seen in the budget for the Energy Research and Development Administration—an agency created in 1974 to conduct research on energy sources and to increase efficiency in the use of energy. About 75 per cent of ERDA's $4.3 billion budget is concentrated on nuclear research and only ten per cent of the budget is devoted to non-nuclear research such as fossil, solar, geothermal, wind and others.

Surprisingly, less than two per cent of the ERDA budget is going towards conservation programs. This is unrealistic in view of the superior energy consumption performance achieved by other advanced countries.

The nuclear industry is presently creating a large number of construction and manufacturing jobs. An estimate made by the Contractors Mutual Association indicated that during 1975 from 31,000 to 32,000 construction workers were employed at nuclear power plants construction sites.

A more detailed study of employment associated with nuclear plants was prepared by Skip Laitner, editor of Critical Mass newspaper. His study, in fact, compares the manpower requirements of a 1,000 megawatt nuclear and coal plant over the lifetime of the facility. The lifetime includes the construction phase as well as operation and maintenance over a 30-year period. The nuclear plant required 5,600 12-month jobs (called man-years) to construct and 16,300 man-years to operate and maintain over its 30-year life.

Undeniably, this represents a significant number of jobs, but the Laitner study finds that more man-years are needed to build and operate a coal-fired plant. While the manhour requirement for the construction of the coal-powered plant is slightly lower than for the nuclear plant, the employment generated over the 30-year operating life is far greater in coal plants than in nuclear. The coal plant requires 26,000 man-years to operate over its 30-year life while the nuclear plant requires only 16,300. When the construction and operation man-years are added together for the two plants we find that the coal plant requires 40 per cent more man-years over its lifetime than the nuclear plant.

Every two years the U.S. Department of Labor surveys employment in the nuclear energy industry. The most recent survey, conducted in July 1975, showed that a total of 197,500 persons worked in the field and about one-half of the jobs were in scientific, engineering and technical occupations. This survey did not include people engaged in construction or uranium mining.

EMPLOYMENT IN NUCLEAR ENERGY FIELD BY OCCUPATION, JULY 1975

	Employment	Percent
Engineers	43,200	21.9
Mathematicians, Earth and physical scientists	11,800	6.0
Life scientists	3,300	1.7
Technicians	37,100	18.8
Other employees	102,000	51.6
Total	197,500	100.0

Source: USDL News Release 76-959, June 28, 1976.

This high concentration of specialized, highly-educated people has made recruiting a difficult proposition for the nuclear industry. Fourteen per cent of the establishments surveyed reported difficulty in hiring personnel. This problem has even wider implications if the United States moves rapidly forward with more nuclear-powered electricity generating plants. It will be increasingly difficult to obtain the quantity of qualified scientific engineering and technical personnel necessary to sustain the massive building program projected by many.

The Labor Department survey also points out that 16 percent of the people working in nuclear energy are working on weapons systems instead of reactors and other facilities designed to generate electric power. As might be expected, the industry is heavily subsidized. Four out of ten scientists and engineers are supported with federal funds.

The emphasis on nuclear power in the United States is based on the assumption that the increased energy will be necessary to meet future demands of industrial, commercial and residential users. In addition to the employment implications of constructing and operating nuclear plants, we must also consider whether or not we will have sufficient energy for power-using industries in the future in order to sustain a growing labor force. Studies that equate future energy needs with employment are not numerous, but it is useful to examine one particular study carried out specifically for the Pacific Northwest—especially since the study puts forth the alarming conclusion that 330,000 industrial workers will be layed off by 1986 if the nuclear plants now planned for the region aren't built.

The study was released in April 1976 and is entitled Analyzing the Effects of Anti-Nuclear Initiatives on Northwest Employment. Bonneville Power Administration energy projections were used to guage the amount of industrial energy that would be needed by 1986–87. These projections were based on historical energy growth figures for the years 1950 to 1973. The projections estimate that industrial power consumption (includes manufacturing and mining) will grow by 80 per cent from 1974 to 1986—from 50 billion kilowatt hours to 90 billion kilowatt hours. This is an astounding projection itself and assumes that energy growth must continue just as it has in the past. The study assumes further that the only significant addition to Northwest energy supplies between now and 1987 can come from the seven nuclear plants on the drawing boards for the region. This fails to recognize alternate energy sources such as geothermal and solar and it fails to allow for the large potential for conserving energy. A barrel of oil not consumed due to effective conservation techniques is the same as a new barrel brought in through the Alaskan pipeline. The study does say that 1986–87 energy needs can be reduced by conservation methods but suggests that the maximum achievable savings would be only four per cent.

The amount of electricity that would have been generated by the seven nuclear plants (which the author of the study assumes would be halted if the nuclear safeguard ballot measures were passed) was deducted from the BPA projections, producing a net energy shortage of 6,500 megawatts by the year 1986–87. Since this indicated 59 per cent less energy than BPA estimated would be needed, the study concluded that the number of jobs in the industrial sector would also be 59 per cent lower than the employment projections. Logic, however, doesn't support the conclusion.

Stated differently the study says that industrial energy use must increase by 80 per cent from now until 1986–87 in order to support and sustain a 12 per cent increase in employment. The entire study is based on the assumption that historical growth rates in employment and energy consumption are inexorably tied to one another and cannot be disconnected. We think this assumption is fundamentally incorrect. Employment growth can occur with lower energy growth. The Ford Foundation study demonstrates that government sponsored conservation measures, the changing mix of energy-intensive industries versus labor-intensive industries and the development of a more balanced approach to energy supply can in fact stimulate, not depress, employment growth.

Short-sighted studies such as this shed very little light on a highly charged subject and have the undesirable effect of setting off loud false alarms. Sound studies are still needed.

CONCLUSIONS

In this review of the literature and the studies dealing with the need for energy and the need to provide an adequate number of job opportunities, we can summarize our conclusions as follows:

Economic and employment growth can occur in sufficient quantity to accommodate an expanding workforce without a corresponding, historical increase in energy consumption. In other words, the relationship between employment growth and energy growth is not one-to-one as many observers assume.

Introduction of highly automated energy consuming machinery has replaced human energy with non-human energy. Energy-intensive industries have reduced the number of jobs.

As energy prices continue to rise it may be wiser, from an economic and social point of view, to begin substituting human-energy for non-human energy with a redesign of the workplace.

The large potential for energy conservation is receiving very little attention. The experience of other industrialized nations demonstrates that economic prosperity and energy savings can go hand in hand. A high priority government program to find ways to implement energy conservation techniques is not only needed, but would also create employment.

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Employment opportunities exist with the development and construction of alternate energy sources such as solar, tidal, geothermal and wind. More research funds are needed in these areas to speed their introduction.

The construction of nuclear power plants creates a great many jobs, but once constructed, they provide a relatively few number of technical and scientific jobs for their operation. More employment can be created with the construction and 30-year operation of a coal-fired plant than a nuclear plant generating the same electricity.

Studies thus far conducted to correlate the need for nuclear plants with growth in the workforce have been formulated on historical relationships between energy growth rates and employment growth. Historical ratios have little validity for projecting the amount of future energy needed to support an enlarging labor force. Strong evidence suggests that more people can be maintained at their jobs with a lower per capita expenditure of non-human energy.

The U.S. is stressing nuclear power very heavily in the current drive to meet future energy demands. A more balanced approach utilizing sound conservation methods and the development of alternate sources will not adversely affect job opportunities in the economy. The job impact would, in fact, be positive.

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[From the International Woodworker, July 21, 1976]

ENERGY AND THE FOREST PRODUCTS INDUSTRY

(By Denny Scott)

NOTE: The following article is a revised version of a section in the Economic Report to the Internationl Convention in Montreal last March. It is in partial response to a resolution adopted by the 1973 Convention which called for "a study of energy problems" and the effect on IWA members. The staff of the Research and Education Department is working currently on a more detailed study of the energy dilemma and what it means to labor.

Declining energy supplies and unprecedented increases in energy costs in recent years has forced lumber and wood products corporations to reexamine and analyze the impact of the "energy crisis" on their principal market—residential housing. In addition, these corporations are taking a hard look at the cost and efficiency of energy consumption in the manufacturing process itself.

Energy prices have far outpaced price increases for other industrial commodities. Four years ago, when few people recognized the impending fossil fuel shortage or the negative impact that the Fall 1973 Arab oil embargo would have, energy prices were increasing no faster than other prices. Since that time, however, wholesale prices of refined oil products have risen very rapidly. Other industrial commodities experienced an inflationary rate of increase over the period, but the price rise didn't approach that of petroleum. The table below shows the percentage increase in wholesale prices for various energy sources from March 1972 to March 1976. Although none of these energy sources have increased in price to the extent that petroleum products have, all have far outstripped price increases of "non-energy" commodities.

High energy prices are not temporary. Long-run scarcities and increasing pressure on fossil fuel alternatives make high energy prices a fact of life for the foreseeable future. What will be the effect on the residential housing industry and, thus, the lumber and wood products industry?

ENERGY CONSERVATION IN HOUSING

Housing planners are devoting a great deal of attention to designs and materials that conserve energy. Residential housing that wastes energy by permitting heat loss through the roof, the floor or through poorly engineered windows is being modified. Much of the short term solution has concentrated on increasing the amount of insulation material in the attic or beneath the floor. New insulation requirements have been set by the government for FHA-insured housing that call for 3½ inches of insulation instead of 2 inches for exterior wood walls. Wood frame homes have an advantage in this regard since the extra 1½ inches is easily added to the space between studs. The insulation standards pose problems for masonry walls and for walls framed in steel or aluminum. Without a redesign of the masonry block 2¼ inches of insulation material would have to be compressed into a space of 1½ inches and which would greatly reduce its insulation value. The high heat transfer characteristics of steel and aluminum framing tend to negate the effect of additional insulation since the metal conducts heat through the wall even though heavy insulation is inserted between the framing members.

Intensified research will produce sweeping innovations on ways to make housing energy efficient. One example of present wasted energy in the hot water that escapes a home through the sewer system. Designers are experimenting with closed systems that would recycle hot water once it left the bathtub or washing machine and put it to use as a heat source. Another important area of investigation is the use of solar power and the development of devices that would permit collection and storage of such energy in the home. But these systems cannot function properly if energy is wasted. Here again wood stands out as the most efficient insulator when compared to other building materials. Wood is 4 times as efficient an insulator as cinder block; 6 times as efficient as brick; 15 times as efficient as concrete; 400 times as efficient as steel; and 1,770 times as efficient as aluminum. The move toward energy conservation in residential construction, therefore, favors the increased use of wood products.

FUEL IS A COST OF PRODUCTION

Higher energy costs have aready made a major impact on the operation of lumber and plywood mills. Energy represents a cost of production just as timber, labor or rent. While we do not have information on what portion of total operating costs in a sawmill is devoted to energy, a survey of pulp and paper firms by the American Paper Institute serves to illustrate the magnitude of increasing energy prices on the corporate cost structure. The pulp and paper industry is the fourth largest manufacturing consumer of energy and fuel in the U.S. Energy costs rose from about 7.8 percent of total manufacturing costs in 1968 to 10.4 percent in 1973 and probably are even higher today. Fuel and energy costs for logging, lumber mills, plywood mills and other wood manufacturing operations are probably smaller than for pulp and paper mills but wood products firms are no less concerned with rising energy costs.

The National Forest Products Association surveyed its members to determine the types of energy used, the experience with shortages and the ability of mills to convert to alternate energy sources. Electricity predominates in sawmilling, softwood plywood, wood preserving and particleboard. Logging is the only major wood products sector that doesn't depend heavily on electrical power. Logging makes heavy use of fuel oil and gasoline. Fuel oils and natural gas were also used extensively in wood manufacturing.

When NFPA asked firms if they had experienced an interruption of regular energy supplies, the "yes" answers ranged from 34 percent in logging to 89 percent for particleboard firms. This is quite surprising since the survey was taken one month prior to the Arab oil embargo and the severe shortage of petroleum products had not yet surfaced. The NFPA asked whether companies had the capability to convert from one energy source to another and the answers indicate that a significant share of the U.S. industry possesses some measure of energy flexibility.

Percent of companies with capability to convert to other energy sources

	Percent
Logging	22
Sawmills	22
Softwood plywood	31
Preserving	14
Particleboard	16

A study of forest industry energy use in Washington State indicates that a major source of energy is hog fuel and spent liquors. These by-products furnish nearly 60 percent of all energy used in the manufacture of lumber, plywood, shakes and shingles, and pulp and paper in the state. These fuels are not as efficient as petroleum-based fuels, nor as environmentally clean, but they are cheaper and not subject to periodic and seasonal shortfalls as are fossil fuels. The industry is moving rapidly to make full utilization of hog fuel supplies and to cut energy costs. Modifications are being made in boilers to accommodate hog fuel, storage and conveying systems; ash handling facilities and gas recycling systems are being installed to collect and route hot exhaust gases through driers. A large lumber company in Texas reports that a conversion in an electric power plant will permit the use of wood waste as the sole fuel instead of natural gas. The equipment includes wet scrubbers to eliminate air pollution problems. Although the installation costs about $750,000, the company expects to reduce its fuel bill by approximately 60 percent annually.

Another major forest products firm boasts that boiler modifications and the construction of a stack gas recycling system will cut fossil fuel use by 75 per cent in a North Carolina particleboard plant. The wood waste that has been piling up outside the plant for years will be burned instead of heavy reliance on expensive and sometimes unavailable natural gas and oil. No loss in particleboard output was experienced in this changeover to hog fuel.

These examples merely point out the national trend in the wood manufacturing industry to convert from expensive fossil fuels to cheap and available alternate energy sources. Even though large capital outlays are sometimes required to accomplish the conversion and to meet pollution control standards, corporations are eager to make the expenditure. The expenditure pays for itself in energy cost savings.

Georgia-Pacific answered the energy crisis in its own unique way—they merged with an oil and gas company in the spring of 1975. The Exchange Oil & Gas Corporation is based in New Orleans and its major oil and gas reserves are located in Louisiana, Mississippi, Florida and the Gulf of Mexico. The transaction was worth about $60 million in the exchange of stock. This further G-P diversification into the energy field will make it possible for this company to stabilize the price of natural gas and fuel oil to its southern plywood and wood manufacturing facilities and to help guarantee an uninterrupted supply.

ENERGY SOLUTIONS AND WORKERS

What effect will these energy problems and the solutions being implemented by the lumber and wood products industry have on the workers in the industry? Firstly, it is quite apparent that wood products manufacturers are not now concentrating on solutions that would allow plants to run with less net energy. Instead of stressing conservation, the emphasis has been on the substitution of an expensive scarce energy source for one that is more abundant and cheaper. The industry is opting for the high energy-consuming technology—some call it automation—instead of searching for ways to reorganize work and machines to reduce net energy use per unit of output. The industry and its machine suppliers continue to build faster, more automated and more energy-wasting equipment in order to eliminate as many jobs as possible and, thus, reduce labor costs.

There are limits to the solution of substituting one power source for another. The use of sawmill waste products as fuel is indeed beneficial from many viewpoints, but like other fuels, wood waste is not in unlimited supply. What happens when mills need more hog fuel than is available internally and from local purchases? The price of hog fuel certainly will rise, but if the shortage is more than temporary, another fuel must be found and the likely replacement will be high priced nuclear generated power. The alternative is to pursue a policy of intense conservation and to reverse the current process of substituting technology for human energy. Instead of automating people out of work, the energy crisis could be bringing about a major reexamination of work, a reorganized human workload and a reengineered workplace to use people more efficiently and to reduce dependency on high energy consuming machinery. The industry has not yet shown an inclination to move in that direction.

Wholesale Price Index percentage increases for energy, March 1972 to March 1976

[1967=100]

4-year percentage increase:	*Percent*
All industrial commodities	53.2
Coal	91.2
Natural gas	111.3
Electric power	67.9
Refined petroleum products	153.6

Statement of Ralph Nader

Energy Efficiency, the Economy, and Jobs

One dollar invested in producing energy by building electric generating plants or drilling for oil creates fewer jobs than a dollar invested in almost any other manufacturing activity. It takes over five times the investment to create one job in the petroleum or electric utility industries as to create one job in manufacturing industries, on the average.[1] Producing energy is not an effective way of producing jobs.

Low income and other citizens should understand that energy policies which line the pockets of large corporations do not help the ordinary citizen. On the other hand, energy efficiency—which means reducing the wasted use of energy—is the option which can provide an integrated attack on energy, economic, and employment problems. It is the option which can benefit the largest number of consumers in the largest number of ways. Improved efficiency can save more energy than any single production option can supply, and can do it quicker; it is much more cost-effective to save energy than to build production facilities to supply it; and energy efficiency creates more jobs per dollar invested than the supply options.

In the past few weeks, black leaders have reaffirmed their recognition of energy efficiency policy as sound economic and employment policy. On January 20, 1978, Vernon E. Jordan, president of the National Urban League, noted that:

The major attraction of conservation is that it offers the greatest savings at the least cost. Some experts claim that conservation and application of low-cost technical aids could nearly double the efficiency with which we use energy. Changes in building design and modification of existing structures could save significant portions of our energy use while saving huge capital sums that would

[1] "Jobs and Energy," Environmentalists for Full Employment, Washington, D.C., Spring 1977, p. 6. The Table on that page comes from the Conference Board, which reports to management on business affairs.

otherwise be expended on non-productive fuel costs. In general, sound conservation policies could lead to efficient use of energy at no loss of jobs or major life-style compromises, while avoiding the inflationary impact of energy costs.[2]

On January 23, the Congressional Black Caucus underscored Mr. Jordan's comments when it reported that:

The Congressional Black Caucus further believes that an energy policy which will assure the long term health of the economy will include a strong emphasis on energy conservation. It is a fallacy that continued expansion of energy producing industries and of traditionally wasteful practices in commercial and industrial operations is the only way to assure real economic growth and expanded employment. Energy production is a capital intensive enterprise which employs not only few workers but even fewer minority or disadvantaged workers entering the labor force .

The development of alternative energy sources such as energy conservation and a solar energy industry will provide more permanent jobs and will be more environmentally sound than nuclear energy. On the other hand, development of these new sources and conservation programs will create jobs in fields so new that the labor market may be open to new groups of workers. The kind of energy waste which has characterized the American economy is of no benefit to any worker. But programs to end energy waste would benefit workers by creating jobs throughout the nation.[3]

Low-income consumers are disproportionately burdened by wasted energy, particularly in their own homes. A staff report to the House of Representatives Committee on the Budget in November 1977 found that 43 percent of all low-income households have no insulation at all. The comparable figures for middle- and high-income households were 13 and 7 percent, respectively. As a result of such disparities, the report found that wage earners receiving under $3,000 per year pay nearly one quarter of their salaries in energy costs. By comparison, persons in the income range of $25,000 or over pay only 4 percent of their earnings to energy costs. Moreover, the rise in energy prices between 1973 and 1976 fell most heavily on the poor: Persons earning less than $3,000 saw the increase in energy expenditures over those years take 4 percent of their paychecks. Increased energy costs between 1973 and 1976 represented only 0.6 percent of income for the person making over $25,000 per year.[4] Raising energy prices clearly will not help poor citizens. But implementing energy efficiency improvements will.

Architects and builders already know how to save energy in cost-effective ways. In 1974, Ohio State University retrofitted six campus buildings to make them more energy efficient. By investing $209,000, the University cut back electricity use in the six buildings by 36 percent, and natural gas consumption by 61 percent. The University repaid its initial investment in lower energy costs in eight months, and is now saving over $330,000 per year in reduced energy costs at the six buildings.[5] The Toledo Edison Building was constructed with double-paned, coated glass to reflect heat. The glass cost $122,000 more than standard plate glass, but its improved insulation properties allowed the building's heating, cooling and distribution systems to be reduced by 50 percent or more, saving $123,000. The energy-conserving glass thus reduced initial costs by $1,000, and is saving $40,000 per year in energy operating costs.[6]

These economical improvements can be repeated at the community level, but such savings are not ordinarily available to low-income consumers because of the high investment costs. So policies are needed to guide funds in a manner that will benefit consumers. Low-income citizens can be protected from higher energy costs by mandatory energy efficiency standards for appliances and new buildings, and low-interest loans or weatherization programs to reduce energy use in old buildings.

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[2] Vernon E. Jordan, Jr., President, National Urban League, "Energy Policy and Black People," Speech, Minneapolis, Minnesota, January 20, 1978, p. 9.

[3] Congressional Black Caucus Statement on Natural Gas Deregulation and Conservation, Washington, D.C., January 23, 1978.

[4] Rising Energy Prices and Alternative Energy Policies: Burdens and Benefits, Committee on the Budget, U.S. House of Representatives, November 1977, pp. 5, 13.

[5] Telephone conversation between Garry DeLoss, Public Interest Research Group, Washington, D.C., and Robert H. Fuller, Mechanical Engineering Department, Ohio State University, January 30, 1976. The information can also be derived from quarterly reports for the listed buildings provided by Mr. Fuller.

[6] Denis Hayes, "Rays of Hope," W. W. Norton & Company, New York, 1977, p. 131.

Estimates produced by the Federal Energy Administration (FEA) in 1977 give an idea of the economic and employment benefits of making homes more energy efficient. FEA looked at three energy conservation measures: ceiling insulation, automatic thermostat controls, and furnace modifications. An investment of $8.3 billion in these improvements in residences would save between 1.4 billion and 2.9 billion dollars annually in reduced energy costs—the equivalent of 39,000 Megawatts-electric in fossil and nuclear power plants. The investment to build those same power plants would be at least $20 billion. Investing the $8 billion to save energy would also create 72,200 jobs per year, over the seven-year period to implement the residential energy improvements.[7]

Similar energy savings and job production could be expected from a massive weatherization program. The Community Services Administration has reported that roughly 10 million low-income dwellings need some form of weatherization. As the House Budget Committee staff noted, making the dwellings more energy efficient could provide significant employment benefits in local areas:

Because the work involved does not require extensive training, because it is of high social value, and because it represents a new activity which does not seriously impinge upon the job markets of employed workers, it offers unusual promise as an area of training and employment.[8]

In addition to its direct employment effects, weatherization by reducing the money that the poor spend on energy, would leave more to be spent within the community.

The Budget Committee staff also found that low-income households owning automobiles pay even a larger portion of their income for energy than other low-income citizens. "For the auto-owning groups, rising energy prices will be considerably more problematic than for the low-income group as a whole."[9] Automotive fuel efficiency standards, since they translate to lower consumer prices at the marketplace, protect the low-income consumer. The money saved on gasoline is more likely to be recycled within the community.

One final note on the economic and job benefits of energy efficiency comes from a study conducted for the Bonneville Power Administration by a Portland, Oregon architectural-engineering firm:

The energy made available by investments in conservation is 6 times less expensive than energy delivered by investments in new thermal plants

High impact conservation programs create more jobs than would be created by building new power plants to generate an equivalent amount of energy.[10]

Another advantage of energy efficiency lies in its ability to break ground for the use of renewable energy resources—such as solar energy—now and in the future. Since energy efficiency is also a decentralized option which benefits large numbers of consumers, the policies which promote energy efficiency should also apply to solar power. Urban League President Jordan also recognizes the economic and job potential of solar energy:

Development of renewable energy sources amounts to creation of a new sector of the energy industry, an industry in which black participation has been minimal. Adaptation of new energy technologies typically requires less capital, fewer skills, and are more labor intensive. Neighborhood-based heating installations, roof-top solar devices and community-based energy technologies are suited to small scale business development and to the training and employment of poor people and minorities. So too, are programs of insulation and of modifying existing structures to make them more energy-efficient. Here again, it is clear that economic growth and sound energy policy are not mutually exclusive but mutually reinforcing.[11]

Support for Mr. Jordan's statement has been provided by Fred Dubin, president of a New York engineering firm which has conducted comprehensive energy studies for many parts of the country. Mr. Dubin analyzed the potential for replacing the energy from two nuclear plants proposed for Jamesport, Long Island by conservation and solar energy options. He concluded that the conservation-solar strategy would cost less than the $2 billion to be invested in

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[7] William G. Rosenberg, "Conservation Investments by Gas Utilities as a Gas Supply Option," Public Utilities Fortnightly, January 20, 1977, pp. 15, 18.
[8] *Rising Energy Prices and Alternative Energy Policies*, p. 18.
[9] *Ibid.*, p. 12.
[10] *Bonneville Power Administration Electric Energy Conservation Study*, Skidmore, Owings & Merril, Portland, Oregon, July 1976, pp. 10, 11.
[11] Vernon E. Jordan, Jr., p. 13.

the nuclear plants, and would create four times as many jobs.[12] More recently, the congressional Office of Technology Assessment (OTA) concluded that solar energy sources would provide more jobs than conventional (fossil and nuclear power) sources, to produce the same amount of energy. OTA found that jobs would be created to manufacture components, install systems, and maintain and adjust installed systems:

The work created in these areas will be distributed widely across the country allowing most workers to find jobs in areas close to their homes. There will be no need for laborers to live in remote or temporary construction sites. Work on solar equipment should require only simple retraining programs.[13]

Solar energy is not just an exotic technology limited to the wealthy. The Citizens Energy Project, a Washington, D.C. organization, has compiled a list of two dozen low-income groups installing solar devices for their own benefit. In each project, local resources and labor are used to make and install the systems, and the participants benefit through lower energy costs and the acquisition of new skills. The low-income projects include such efforts as a sweat equity program in a New York tenement building, where tenants supply 80 percent of their hot water needs from solar panels; a combination of weatherization and solar heaters for poor families in San Bernadino, California; and a Chicano organization in New Mexico which uses solar greenhouses and food dryers.[14]

Any equitable economic policy must be underpinned by an equitable tax policy. Here again, the interests of the energy industry are directly opposed to those of low-income and other consumers. In 1974, the Senate Committee on Government Operations released an analysis of tax data for seven major oil companies: Gulf, Exxon, Texaco, Mobil, Standard Oil of California, Standard Oil of Indiana, and Shell for the years 1968–1972. Over that five year period, five of the seven companies paid between 1.32 and 5.56 percent of their net income in United States income taxes; no company paid more than 13.05 percent.[15] Since that report, although the oil depletion allowance has been gradually reduced, oil tax breaks have remained substantial. In October 1977, Senator Kennedy released a Library of Congress study showing that because of remaining write-offs—such as "intangible" drilling costs and the investment tax credit—the maximum tax rate on oil and gas drilling operations amounts to 17.7 percent—far below the supposed 48 percent corporate tax rate. The Congressional Budget Office estimated that these tax breaks for the oil industry cost the U.S. Treasury more than $2 billion per year.[16]

More recently, attention has been focused on another loophole: a provision which allows the oil companies to deduct royalties paid to foreign nations as taxes. This has the effect of encouraging U.S. companies to develop foreign production at the expense of domestic operations. It has also given 19 of the largest oil companies $7 billion in tax breaks since 1973.[17]

The situation with the electric utility industry is just as bad. A report completed under contract to the federal government concluded that tax loopholes—the investment tax credit and accelerated depreciation allowance—had the effect of subsidizing 20 percent of each new utiliy plant under construction. If the utility industry carries out its projected construction program, federal tax dodges between 1975 and 1985 would provide about $37 billion for power plant construction—almost $4 billion per year.[18] The electric utility industry also pays very little in taxes: in 1975 electric utilities paid only 8.2 percent of their taxable income as taxes.[19] The lost tax revenues from the energy industry have

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[12] Fred S. Dubin, Statement before the Committee on Commerce, U.S. Senate, Feb. 26, 1976, p. 10.

[13] Application of Solar Technology to Today's Energy Needs, Office of Technology Assessment, June 1977, Summary, p. I–17.

[14] "CEP Releases Report on Solar Use by the Poor," Citizens' Energy Project, Washington, D.C., undated, released June 1977.

[15] *Analysis of Tax Data of Seven Major Oil Companies*, Committee on Government Operations, U.S. Senate, November 1974, pp. 1, 4.

[16] Art Pine, "Oil Firms Receive Huge Tax Breaks, New Study Shows," *Washington Post*, October 9, 1977, p. A13.

[17] "IRS Chief Testifies Today in Controversy Over Big Oil Firms' Foreign Tax Credits," Wall Street Journal, November 29, 1977, p. 7.

[18] Edward Kahn, et al, Investment Planning in the Energy Sector, Energy and Environment Division, Lawrence Berkeley Laboratory, Berkeley, California, March 1, 1976, pp. 59, 89.

[19] Richard Morgan, "Phantom Taxes In Your Electric Bill," Environmental Action Foundation, Washington, D.C., p. 4.

to be made up by increasing the bite on individual taxpayers, and have the effect of subsidizing energy production.

As if this were not enough, the congressional conference on the energy bill is presently considering proposals which would provide corporations with more breaks. Senator Russell Long, Senate Finance Committee Chairman, wants to return a sizable portion of taxes on oil consumption to the energy corporations, rather than recycle them to consumers through government programs. The conferees are also seriously considering a proposal which would grant an additional 15 percent tax credit to the construction of nuclear and coal power plants. Clearly, the demands of energy corporations for more tax loopholes run directly counter to the interests of all consumers.

Another energy issue is that of control. The Congressional Black Caucus has recognized that energy prices do not operate in an open market:

Free markets mean markets where there is open competition which benefits the consumer. Our energy markets are controlled abroad by the OPEC cartel and at home by a group of powerful producers closely linked by joint ventures, interlocking directorates, and common interests. Price and supply of all energy resources will, in the absence of clear federal policy, be determined solely by their mutual economic advantage.[20] The power of the energy corporations, who used to be called oil companies until they started to acquire other energy sources, is extensive. The top energy companies now control more than 30 percent of the nation's privately-owned coal reserves, 50 percent of the uranium reserves, and 75 percent of the natural gas reserves.[21] This gives them even more leeway in boosting unregulated prices.

Energy companies often argue that they need more revenue to finance future exploration and operation, but oil companies have been using their higher profits to purchase non-energy ventures. Mobil Oil paid over $800 million to buy into Marcor Corporation, the conglomerate that owns Montgomery Ward, the Container Corporation, and other companies.[22] Atlantic Richfield Corporation spent $536 million to acquire Anaconda Company, which in addition to holding sizable uranium reserves is the nation's third largest copper mining company.[23] Last month, Sun Oil Company spent $290 million to acquire over a third of the stock of Becton, Dickinson & Company, a major hospital supply concern.[24] Such acquisitions give energy companies greater control of the rest of the economy.

There are no guarantees that energy efficiency and solar energy might not also come under the control of giant corporations, but those energy sources have characteristics which make control difficult. Both are inherently local and decentralized: energy efficiency has numerous applications on a process-by-process basis, and solar radiation shines without discrimination on all areas of the nation. Both options are also simple enough that persons have already implemented them on a do-it-yourself basis.

Atomic energy, on the other hand, epitomizes the problems of an unsound energy policy. First, as Mr. Jordan recognizes, "Reactors are the most expensive way to meet energy needs." [25] Nuclear plants require large capital investment but are relatively poor producers of jobs. The industry's existence has depended upon billions of dollars of taxpayer subsidies such as federal research and development, government-owned uranium enrichment plants, limited accident liability, and the utility tax loopholes mentioned above. The desperate state of the industry, illustrated by a serious slowdown in new reactor orders, will spark demands for even greater subsidies and incentives. The inability of industry and government to solve the radioactive waste problem suggests that future generations may be burdened with the costs of guarding nuclear waste for thousands of years. And a recent study of federal atomic workers suggests that radiation exposure levels previously considered "safe" may cause excess cancer cases.

Because it requires large capital investments and is highly complex, atomic energy cannot provide community-controlled energy solutions nor jobs for the unskilled. As a target for sabotage and terrorism, the atomic industry will require heavy security forces, which eventually could affect the civil liberties of workers or ordinary citizens. Lastly, one cannot discuss atomic power's economics without

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[20] Congressional Black Caucus Statement on Natural Gas Deregulation and Conservation, January 23, 1978.
[21] Energy Action Committee, Washington, D.C., Press Release, Jan. 29, 1976, p. 2.
[22] Energy Action Committee, Open Letter from Paul Newman, undated.
[23] "Arco Acquires Anaconda Co. for $536 Million," Wall Street Journal, Jan. 13, 1977.
[24] "Sun Co. Acquires 34 percent of Becton Dickinson Shares," Wall Street Journal, Jan. 20, 1978, p. 5.
[25] Vernon E. Jordan, Jr., p. 10.

noting its major frailty. Even atomic energy proponents admit that one major accident, from any plant in any part of the nuclear fuel cycle, could wreak such radioactive havoc that the resulting public outcry would force the entire industry to shut down. At that point, the nation would face a radioactivity crisis, an energy crisis, and an economic crisis. Such a frail technology cannot become a major energy source, now or in the future.

In summary, there are two energy futures the nation can follow. It can depend increasingly upon energy supply options which are expensive, in need of subsidies, complicated, dangerous, destructive to workers and the environment, and which, by requiring large amounts of capital investment, lend themselves to control by large corporate entities. Or the nation can turn to energy options which are simpler, cheaper, safer, socially beneficial, decentralized, local, inherently democratic, and job-intensive. Because these two futures will benefit different interest groups, they are probably mutually exclusive. The second path, represented by energy efficiency and renewable energy sources, should be preferred because it will benefit the general citizenry, not energy corporations.

Citizens cannot afford to let the energy industries play them off against each other as "consumers," "environmentalists," "workers," and "minorities." The central issue—and the common adversary—is control and concentration of resources—whether they are information, natural, energy, or economic resources—by large corporations which abuse their political and economic power. Citizens must unite against such deeply unjust corporate power.

[Editorial From Nation's Cities, August 1977]

An Energy Plan Would Mean Work; A Fuel Plan Won't

The National Energy Plan isn't that at all. The flurry of legislation submitted to Congress by the White House adds up to a fuel plan, not an energy plan, and there is a substantial difference.

Energy, by definition, is the capacity for doing work. That's a basic concept, yet it does not appear in many current discussions of energy, nor does it rate much attention in the national energy plan now before Congress. If it did, it would drastically change the content and intent of the plan.

To be fair, it has to be said that the administration and the federal governmen aren't alone in saying "energy" when they mean "fuel." Virtually everybody has been doing it, and it probably has contributed to some general misunderstanding about what can and can't—or will and won't—be done about the energy crisis.

Consider, for example, how different the plan might be if it had been a national "capacity-for-doing-work" plan. It might have started out with an extensive look at the work that is done in this country—the moving of people and goods, the extracting and processing of raw materials, the manufacturing of goods, the growing and processing of food, the provision of services, entertainment, and communications—and it might have inventoried this vast amount of work in terms of realistic priorities. Such an inventory might give less importance, for instance, to the production of nonreturnable plastic bottles than to the production of reusable glass ones, or less importance to the production of synthetic fibers than to the production of natural ones. More important than those specific questions, however, is a basic issue: such an inventory might give to various forms of work priorities based on the relation between the particular energy requirements and the real value of the work.

This hypothetical capacity-for-doing-work plan might also look for ways that work could be done more efficiently. It might, for example, have looked at transportation as a rather involved system of road-, rail-, air-, and waterways for moving goods and people. In that case it would consider the numbers of times people and goods are moved and the distance they must travel and propose ways to reduce the distances and the number of trips. It might have looked at buildings as machines that not only use energy but in some cases generate it, rather than simply as boxes that need thicker walls or more insulation. It might have looked at the form of buildings and at the form and density of cities, which would lead to the realization that concentration of resources—physical and human—makes for more efficient use, which makes them last longer. This policy, in sum, might have started with the end uses and used them as the foundation upon which to build a comprehensive policy of energy use, energy conservation, and energy management.

The policy that could have grown from that seed—dealing with energy as the capacity for doing work—would have far-reaching implications. It would not stifle economic growth because it would have at the center of its concerns, rather than at the periphery, the long-term economic health of the country, which is, in the final analysis, dependent upon developing safe, renewable sources of energy. An energy plan would provide for intensive development now of solar and other safe, renewable energy sources, investing the amounts of oil and natural gas we have in the ground (perhaps some 50 years worth of it) to buy the time needed for that development and for the transition from oil and gas to these new forms.

This is not to say that a sound energy plan would not affect the country's economic growth. It very likely would guide it in some new directions. Emphasizing the relative usefulness of various forms of work would change employment patterns; relating work output to energy requirements (and to the specific type of energy) might well lead to a shift from a small number of large industries to a larger number of reasonably sized operations serving regional markets. Emphasizing efficiency would not mean replacing human labor with machine labor; it would instead tend to view human labor as more energy-efficient for certain jobs than machine labor. Its view of work would lead to greater employment and the availability of money for uses other than the enlargement of industrial plants.

It would also take the long view of the future. By concentrating first on the work that must be done, and on doing that efficiently (particularly in terms of energy consumption), it would hold off the fateful time at which current nonreplaceable sources of energy (fuels) are used up, or what's more likely, priced beyond use. What's more, because it would be a true energy policy, it would lead naturally to the development of, and reliance on, forms of energy that are not limited by finite supply or economic constraints. The true value of energy—the work it will do—is implicit in its definition; the price that is paid for fuels reflects only supply and demand. A comprehensive energy policy would acknowledge that difference—for today and for the future.

The bulk of the plan makes that quite clear. Very little attention is given to the end uses of energy in the plan put forward by the Carter administration. The basic strategies upon which the plan depends deal largely with "rational pricing and production policies," "reasonable certainty and stability in government policies," "substitution of abundant energy resources for those in short supply," "development of nonconventional technologies for the future," and, first on the list in the plan and labeled its "cornerstone," "conservation and fuel efficiency." That one, at least, has something to do with the use of energy, but the difference in the energy demand projected for 1985, with and without the plan, is only 4 percent, which is a pretty small cornerstone.

The starting point for the administration's plan is supply, specifically a limited (although there is little agreement on just how limited) supply of petroleum. Virtually everything in the plan stems from that premise: the proposal to use taxes and pricing policies and credits to promote a large-scale shift from oil and natural gas to coal, the proposal to tax automobiles that do not offer good gas mileage, the proposal to encourage improved building insulation. These are all proposals that have relatively little to do with end uses, but a lot to do with supply and demand; they have little to do with energy, but a lot to do with fuels.

The plan doesn't seek large-scale energy efficiency through a comprehensive look at the ways in which energy is used. It doesn't seem to recognize that energy—the capacity for doing work—can't be considered separate from its use.

Fuel, of course, can be; all it takes is a different machine to burn the fuel. That's what the administration's plan is all about: different fuels to provide the same energy to do the same work. It is really a plan to rearrange the patterns of fuel consumption in this country—and not much more. And maybe it's less: it might be simply a way to arrange the boxes on the executive branch organization chart as reorganization becomes a reality.

One thing seems reasonably certain: when all has been said and done in Congress, the country will have some form of fuel plan. And we'll still need an energy policy.

[From Not Man Apart, February 1978]

Who Cares About Unemployment

Full employment has been an official objective of the U.S., by act of Congress, ever since the 40s. Yet we seem to be little (if any) closer to that objective than we were thirty-odd years ago. Behind that statement looms a tragedy of unimaginable dimensions. Breadwinners who are unable to earn bread become the prey of self-doubt, and all too often, of self-loathing. Millions of fellow Americans suffer the anxiety and indignity of unemployment right now.

Despite the agonizing need, we seem to be retreating from our stated goal of full employment. Farm workers by the millions have been displaced by lumbering machines that absentee-owned agribusiness alone can afford to own and operate. Coal miners are idled, as the saying goes, by gargantuan shovels that make strip mining and its manifest evils physically possible. Less conspicuous, but doubtless just as harmful in the aggregate, is the whittling away of jobs a few at a time. There used to be a conductor on each municipal bus or trolley to make change for riders without the exact fare; what happened to him? What happened to the human being we used to buy tickets from, who used to give us a smile and a word of cheer? We buy tickets now from an impassive vending machine (if it isn't out of whack). The ideal assembly line, from industry's viewpoint, would be tended by a few robots and no people.

We are in the grip, it seems, of a strange societal schizophrenia. Nearly everyone pays lip service to full employment—most of us without conscious hypocrisy—but nearly everyone also concedes the right of employers to pare payrolls to a minimum. Job elimination is not an obvious route to full employment. What confronts us is not a paradox; it's an impasse.

Who will show us the way out? Big Business? Big Labor? Big Government?

Both in theory and in practice, it is the natural proclivity of business to minimize labor costs. It is the natural proclivity of business, in other words, to produce as much unemployment as it can.

Union labor does not appear likely to press any more aggressively for full employment. It isn't unheard of for unions to keep their memberships small as a way of assuring full employment at high wages to a favored few at the expense of the many. A labor leader's constituency is not the labor force but his union's dues-paying members, and "labor bosses" don't necessarily reflect the rank and file's more humane and altruistic impulses.

As for governments, they respond to pressure—which is as it should be. responding to pressure is otherwise known as "being responsive."

Once again, who will show the way out of this impasse? Well, what about us? What about the environmental movement?

It may seem quixotic to suggest that we help the unemployed try to overcome the massive inertia of Big B., Big L., and Big G., but there's logic in it. The unemployed, and the employed poor, suffer first and worst from a wide range of environmental insults. If we feel genuine concern for them, and let it be shown in our actions, they might well help us more than we can help them.

Self-interest isn't always an unworthy motive, and in any case, it isn't easily gotten rid of. We make no apology for speaking of the advantages that might accrue to environmentalists as a result of allying themselves with other for whom full employment is a cherished dream. But if you can't quite see yourself embarking on still another crusade just now, relax; you're already working for full employment if you're working for a survivable environment.

How's that?

This is how that is: goals that nearly all environmentalists are already working toward are fully compatible with full employment. A few examples will have to suffice.

POPULATION

Survival requires that population stabilization be the prelude to population reduction. When a population is stabilized or declining, its labor force is (or soon will be) stable or declining too. Obviously, securing full employment is easier with a small and stable labor force than it is with a larger and growing one. There's less likely to be "surplus labor," and business is therefore less able to use the "surplus" as a weapon with which to beat down demands for higher wages and greater fringe benefits. If labor is "in short supply," the demand for it becomes greater. Economic blackmail (as practiced for example by J.P. Stevens) tends to become self-defeating.

ENERGY

We often hear that energy production must be stepped up in order to create jobs. The fact is, energy industries rank near the bottom in terms of jobs created per dollar invested. This shouldn't come as a surprise; since the onset of the Industrial Revolution, mechanical and electrical energy has been described as "labor saving." More specifically, it saves workers the trouble of working and saves employers the trouble of paying people to work.

The soft energy path that more and more environmentalists (and others) are setting their feet on is the path to full employment. Retrofitting old houses with adequate insulation and solar energy collectors will create hundreds of thousands more jobs than creating the new energy supply needed to make the same houses comfortable if they aren't retrofitted.

DECENTRALIZATION

In the pre-automobile era, industry necessarily located small, decentralized factories within several miles of the homes of its potential workers. The motorcar changed all that; cars made it possible for industry to save money by building a few giant plants at central locations and demanding that people who wanted to work there get themselves there at their own expense. This involves billions of dollars saved by industry every year at its employees' expense. In advocating decentralization, environmentalists thereby advocate also a labor force that, while not holding the whip hand, can negotiate on equal terms with a home-town management.

Traditionally, the way to "create jobs" is to "heat up the economy"—to subsidize business on the theory that some of the money directly given to it will indirectly trickle down to people who need it. The trouble is, subsidies are too often spent on "labor saving" machinery, and heating up the economy fans the fires of inflation. What good does it do anyone if wages double while the cost of living triples?

We meant to offer tentative suggestions leading toward full employment, a goal reachable not only by creating jobs but also by reducing the number of people who want jobs and compete with each other for the jobs available. (Society should be able to find acceptable ways, for example, to delay the entry of young people into the job market and accelerate the departure of willing older people from the work force.) We only succeeded, though, if we succeeded at all, in throwing the subject open to discussion.

Another editorial, a better one, will be written on full employment if you'll share your thinking on the subject with us.

Statement of the Office of Technology Assessment, Congress of the United States

Application of Solar Technology to Today's Energy Needs

[Extract of sec. VII–2 from vol. 1]

VII.2 THE IMPACT OF SOLAR ENERGY ON AMERICAN LABOR

Onsite solar technology appears to be more labor-intensive than contemporary techniques for supplying energy, thus, in the short term, the introduction of solar energy devices might create jobs in trades now suffering from serious unemployment. In general, the new jobs will be distributed widely across the country and will not require laborers to live in remote or temporary construction sites because most workers should be able to find jobs in areas close to their homes. Work on solar equipment, for the most part, should necessitate only simple retraining programs although there may be shortages both of engineers and architects qualified to design solar equipment, and of operators trained in maintenance of some of the larger and more sophisticated solar devices which have been proposed.

Assessing the long-term implication of technological development on the work force, however, cannot be reliably undertaken with contemporary economic methods. Long-term labor impacts will depend on forecasts of future growth rates both in the economy and in U.S. energy consumption—subjects about which there is great confusion and disagreement. Although making economic projections is hampered by inprecise methodology, it is possible at this point to outline some of the critical issues which concern the effects of solar energy development on labor.

2.1. Manpower requirements

One of the most critical issues in evaluating the impact of a new energy technology on labor, and one of the most difficult to deal with reliably, is how the technology will affect overall manpower requirements in the energy industry. Tables VII–2 and VII–3 compare the manpower requirements of a conventional coal-fired generating system with the manpower required to construct and to operate each of two kinds of solar devices capable of producing equivalent amounts of energy. Only first order effects have been considered, and the estimates made about solar devices are necessarily speculative. One overall conclusion seems inescapable, however: a large fraction of the value of solar equipment is attributable to direct labor costs.

The high labor intensity of solar equipment is not surprising. Most devices can be constructed from relatively inexpensive material, and the small equipment examined here would not require extensive capital-carrying charges during construction. Although factories for mass-production of photovoltaic devices, heat engines, and other components of solar technologies will probably employ sophisticated and expensive equipment which will reduce labor in these industries in the future, a large fraction of the work involved with installation of solar equipment requires direct on site labor, will probably not be substantially reduced.

Table VII–2 lists all labor requirements for construction at the plant site, to build the 800 MWe turbine generator in a factory, to operate the generating facility at an average of 75 percent full capacity for a period of 30 years, to build a coal mine large enough to support the plant, to operate the mine, to transport the 2.5 million tons of coal per year needed to operate the plant, and to construct and maintain a transmission and distribution network. It is noteworthy that the labor for annual operations is more than 40 percent greater than the labor needed to construct the facilities, and that nearly 40 percent of the manpower requirements in operations are used to maintain the distribution facility.

Table VII–3 shows the labor requirements for a flat-plate solar water heater and for a small tracking photovoltaic device. It is apparent that if all conventional power were replaced with solar units, labor requirements would be multiplied by a factor of 2 to 5. The multiplier would be even higher if a substantial amount of conventional generating equipment was required to provide backup to the solar system. (The most economic use of solar energy requires some conventional power system backup.)

The major source of error in these estimates, apart from inaccuracies in data gathering, is the failure to consider the many secondary kinds of employment which could be created by both solar and conventional facilities. A significant fraction of this secondary labor would come in the manufacture of primary metals, glass, etc., for both solar and conventional systems. Given that the weight of solar devices would be equal to or more than conventional systems per unit output, it seems unlikely that the differences in labor requirements illustrated above would be eliminated by a more detailed analysis.

TABLE VII-2.—LABOR REQUIREMENTS FOR A CONVENTIONAL 800 MWe COAL PLANT

[In units of man-hours per megawatt-year]

	Construction	Operating and maintenance	Total
800-MWe coal plant	270	320	590
Coal strip mine using western coal	20	370	390
Coal transportation	20	150	170
Electric transmission	50	1	51
Electric distribution	140	540	680
Turbine/generator manufacturing	170	0	70
Total	670	1,380	2,050

Assumptions: 800-MWe coal plant operating at 75 percent peak capacity for 30 years; western coal strip mine with 40-mile train line and 237 train round trips per year: all data based on Bechtel data with the exception of the turbine generator manufacture (it was assumed that the turbine/generator cost of $150/kW of which 25 percent was labor and that this labor was paid at an average rate of $10/hr); calculations divide the sum of construction manpower and 30-year operating manpower requirements by the total number of megawatt-years of energy produced by the plant.

Source: "Resource Requirements, Impacts, and Potential Constraints Associated With Various Energy Futures," the draft annual report of Bechtel Corp. to ERDA, November 1976 (No. AFAE–11735–76–1).

TABLE VII-3.—LABOR REQUIREMENTS OF 2 TYPES OF DISTRIBUTED SOLAR ENERGY SYSTEMS

[In man-hours per megawatt-year]

	Construction	Operations and maintenance	Total
I. Solar hot water heaters (8m² flat plate):			
Manufacture collector	900–1, 800	0	900–1, 800
Install collector	2, 500	0	2, 500
Routine O. & M.		700–1, 400	700–1, 400
Total for hot water system [1]	3, 400–4, 300	700–1, 400	4, 100–5, 700
Total for hot water system including backup	3, 740–4, 640		4, 440–6, 040
II. Tracking silicon photovoltaic system (50 m²):			
Manufacture collector and cells	3, 000		3, 000
Install collector	1, 700–5, 500		1, 700–5, 500
Operate system		1, 200	1, 200
Total for tracking photovoltaic system	4, 700–8, 500	1, 200	5, 900–9, 700
Total for tracking photovoltaic system including backup	5, 040–8, 840		6, 240–10, 040

[1] Since electric water heaters are typically only 70 percent efficient, the man-hours per megawatt-year of solar thermal energy applied to hot water can not be compared with the man-hours per megawatt-year of electricity illustrated in the previous table. The man-hours required to produce a megawatt-year of electric hot water would be 42 percent larger than the man-hours displayed in the previous table.

Assumptions: 20-year system life; installation includes 75 ft of piping costing $0.12 MG/ft to install; flat plates installed for 1.3 MH/m² and tracking collector installed for 0.83 to 3.33 MH/m²; cells assumed to be 18 percent efficient, optical efficiency 80 percent; labor for providing backup power is assumed to be 50 percent of the construction labor shown in table VII–1 (e.g., 340 man-hours/per megawatt-year).

Source: Prepared by OTA using manufacturer's data.

2.2 Some qualitative impacts

While the analysis of the overall labor requirements of solar energy is very primitive, it is possible to be somewhat more confident about some qualitative aspects of solar energy's impact on the work force.

a. Geographic Distribution.—Employment in installation and operation of solar equipment can be expected to be distributed over a large part of the country. Initial installations of solar equipment are likely to occur in places with high isolation—the South and Southwest. Locations with relatively low levels of sunlight, such as the Northeast, however, tend to have high energy prices. Thus, while low insolation levels make solar energy in the North expensive, competing energy sources are also expensive so the net economic competitiveness of solar devices may be as high in the North as in more favorable climates. Employment in installing solar energy is, therefore, likely to be as georgraphically dispensed as the building industry. One thing about solar employment seems clear—none of the small solar devices considered in this report will require the major dislocation of a work force, or the establishment of temporary work camps as may be required for construction of a pipeline, an offshore drilling operation, or a large central generating facility in a remote location. The relatively small solar devices analyzed here will provide employment in close proximity to where workers presently live, and therefore will avoid the social disruption associated with large influxes of temporary workers.

Unlike most major manufacturing facilities, solar manufacturing at present is spread across the country in literally hundreds of small companies. The future of these businesses, however, is very uncertain. If the demand for solar equipment increases substantially, the field may be dominated by a small number of large manufacturing firms, much as the manufacturing of conventional heating and cooling equipment is dominated by a small number of firms. On the other hand, solar devices may be designed for special climates and sufficiently site-specific for manufacturing to remain geographically dispersed, much as facilities for manufacturing modular homes are today. It seems clear that because of the sophisticated technology employed, the manufatcuring components such as photovoltaic devices, and heat engines, and concentrating devices will occur in relatively small number of facilities.

b. *The stability of labor demand associated with solar equipment.*—If a major demand develops for solar energy, it is likely that employment in the area will be as stable as work in any typical building trade; the solar equipment will simply add jobs at each construction site. If a major retrofit market develops, there could also be major employment opportunities in this area; maintenance of solar equipment will also provide a stable source of jobs.

c. The skill levels required.—Most of the employment directly created by a shift to solar energy will be in installation of the equipment by the conventional building trades, and in the creation of new manufacturing industries. The skills required for installation of the equipment will be very similar to those required for conventional construction projects, although some brief training programs will undoubtedly be desirable to familiarize workers with the new equipment and its installation. Most of the work will be in framing roofs, laying footings, plumbing collectors and storage tanks, excavating trenches and pits for pipe-runs and storage tanks, installing sheet metal ducting, insulating pipes and tanks, installing electronic control units, etc. The work will be nearly identical to the installation of sophisticated air-conditioning and heating systems in conventional buildings.

Larger solar installations, such as those serving groups of buildings and large industrial operations, are likely to require supervisors, managers, draftsmen, designers, and engineers in roughly the same proportion as these skills are required in the construction of conventional power-generating facilities. In fact, since many large onsite solar facilities are likely to be supplemental to conventional boilers and generators, the solar equipment would simply add work in these areas at each installation. There may be a shortage of engineers with adequate knowledge in areas critical to onsite power in general and solar devices in particular. Designing a reliable and efficient outside device for a large installation (such as an apartment or industry) requires experience with other types of equipment not now conventionally used in utility or building energy systems and solar onsite requires even more expertise in order to manage the added complexities of collector design, thermal storage systems, and more elaborate control systems, and possibly of batteries, heat-engines, and photovoltaic devices.

Employment opportunities in manufacturing are more difficult to define, since the pattern of growth in the industry is presently unpredictable. Work opportunities will include glazing, metal extrusion, component assembly, and chemical processing (for photoelectric devices, selective surface formation, storage systems, etc.). It is difficult to anticipate whether the employment will be created in a large number of dispersed fabricating facilities, in large central plants, or in both.

The skills required to maintain the type of simple solar equipment installed on homes and small apartments will be similar to those required for conventional appliance maintenance of utility gas and electric power equipment. Most of the personnel engaged in these professions will clearly require some additional specialized training in solar technology. There is, however, a very serious shortage of persons with skills needed to operate intermediate-sized solar or conventional onsite energy equipment: owners of small total energy systems have frequently complained about the difficulty of finding and holding persons with appropriate training in operation and maintenance of engines and heat recovery units, energy control switching, and other associated equipment. Maintenance of a sophisticated collector system will present similar problems. Many of the persons now employed in the operation of total energy systems have been trained in the requisite skills by the U.S. military services: such training is apparently difficult to obtain in private industry.

Tables VII–4 and VII–5 demonstrate jobs which must now be done to support conventional electric generating equipment. The impact of solar equipment on jobs will depend on the extent to which solar devices displace fuel consumption (replacing jobs in mining with jobs in solar technologies), the extent to which the technology would cut the demand for peak generating capacity (replacing jobs in constructing and maintaining generating equipment with jobs in solar technologies), and the extent to which the need for transmission and distribution equipment would be reduced. These effects are listed in the order of their likelihood: It is most probable that solar technology would initially affect only fuel utilization, and would affect transmission and distribution requirements only in an extreme case where all or a very large fraction of local energy needs are met with solar equipment. It should not be assumed that an increase in solar utilization would necessarily replace any of the employment indicated in tables VII–4 and VII–5. The expected increase in U.S. and worldwide demand for coal, for example, is likely to be so large that employment in mining would not be affected by an expected penetration of solar energy into the market. Several observations can be made on the basis of the tables however:

Small solar installations are likely to employ more blue collar workers than professional employees. Solar installations on individual buildings typically require one supervisor for each ten workmen,[6] while the ratio for the conventional coal equipment shown in table VII–4 is closer to 1 to 3. The larger industrial and community solar systems would, however, require much more professional work.

Nearly 50 percent of the jobs associated with operating and maintaining conventional equipment is associated with coal mining and transportation. Jobs in these sectors could be replaced with jobs in repair and maintenance of onsite equipment.

About 40 percent of the work required to build a conventional electric system and 30 percent of the work required to maintain it is associated with distribution equipment, which is unlikely to be affected by solar technology.

TABLE VII–4.—SKILLS REQUIRED FOR CONSTRUCTING A COAL-FIRED ELECTRIC GENERATING PLANT AND OPERATING THE SYSTEM OVER A 30-YEAR PERIOD[1]

	Coal-fired electric generating plant		Transmission and distribution facilities	Total (percent)
I. Skills required for plant construction (as a percentage of the 3,774 man-years required to construct the plant and the transmission and distribution network):				
Nonmanual construction work	10 percent (63 percent engineers and 25 percent supervisors).		12 percent (50 percent electrical engineers, 25 percent draftsmen and designers).	22
Manual construction work	48 percent (variety of trades).		28 percent (40 percent electrical engineers, 30 percent draftsmen and designers).	76
	Coal mining and coal transport	Coal-fired generating plant	Transmission and distribution facilities	Total (percent)
II. Skills required to operate and maintain equipment for a 30-year interval (as a percentage of the 9,692 man-years required):				
Nonmanual operating work	15 percent trainmen).	8 percent (66 percent supervisors and managers).	4 percent (mostly supervisors working on distribution system).	27
Manual operating work	32 percent (mostly miners).	19 percent (variety of trades).	23 percent (mostly electricians and meter readers for distribution system).	73

[1] Details about assumptions used shown in table VIII–5.

Source: Based on data in "Manpower, Materials, and Capital Costs for Energy-Related Facilities," Bechtel Corp., April 1976.

[6] FEA *Project Independence* Task Force Labor Report.

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TABLE VII-5.—DETAILED BREAKDOWN OF SKILLS REQUIRED FOR CONVENTIONAL ELECTRIC SYSTEM

NONMANUAL MANPOWER	Western strip mine (annual operations)	Coal transport unit train (annaul operations)	Coal-fired elastic generating plant (800 MW)		Electric transmission (200 miles in length and national average)		Electric distribution				Total construction and 30 years of operation
			Annual operations	Construction	Annual operations	Construction	Annual operations	Construction	30 years of operations	Construction	
1. Engineers:											
Conductor	0	37	0	0	0	0	0	0	1,110	0	
Civil	0		1	108	.02	12	1	86	161	206	267
Electrical	.06		4	79	.08	25	3	171	214	275	489
Mechanical	.06		2	62	.02	5		29	62	198	158
Mining	.55		0						17		17
Industrial	.06		0						2		2
Safety	.09		0						3		3
Environmental	.04		0						1		1
Total, engineers	.86	37	7	249	.12	42	4	286	1,469	577	2,046
2. Designers and draftsmen	.85	0	1	100		17	0	116	56	233	289
3. Supervisors and managers	6.70	0	17	47	.23	3	9	19	988	69	1,057
4. Total, nonmanual manpower	12.00	37	25	396	.35	61	13	421	2,620	879	3,499
MANUAL POWER											
1. Pipefitters	7.00		108	477					450	477	927
2. Pipefitter/welder			12	214			3		450	214	669
3. Electrician			12	334	.40	133	38	897	1,512	1,364	2,876
4. Boilermaker			8	358					240	358	598
5. Boilermaker/welder			0	119					0	119	119
6. Iron worker			0	167		44			0	211	211
7. Carpenter			0	167						167	167
8. Equipment operators	40.00		20	119					2,400	119	2,519
9. Other	8.00		0	142	.20		31		6	142	148
10. Total, technical manpower	66.00	37	60	1,521	.72	177	72	897	7,072	2,895	9,967

d. Working conditions.—Expansion of the solar energy industry should not raise serious health or occupational hazards, but some of the possible problems are discussed below. The manufacture of some photovoltaic devices employs cadmium and arsenic compounds which could present hazards to workers assembling these units. This situation would not be unique, however, because these compounds are widely used in other industries. Some steam-fitting jobs will involve high-pressure steam lines, and some proposed thermal storage methods will require very hot oils, possibly explosive or toxic. These issues deserve serious attention before such installations become commonplace. Devices using hazardous material may only be employed in larger, more centralized solar facilities and are unlikely to be found in onsite residential systems. Replacing jobs in coal mining for those in solar equipment maintenance, however, would result in overall improved working conditions.

e. Organized labor.—Organized labor is enthusiastic about solar energy's potential for creating jobs. Like many other construction trade unions, the sheet metal workers (SMWIA) have been hard hit by unemployment: the SMWIA has a national unemployment rate of 30 percent to 35 percent, with unemployment reaching 50 percent to 60 percent in some areas of the West and Southwest.[8] Coincidentally, these are precisely the areas where solar heating and cooling is most cost effective, and will no doubt be among the first areas with widespread utilization of solar technologies.

In 1970, the plumbers and pipefitters have a nationwide unemployment rate similar to that of the sheet metal workers. A potential labor problem associated with implementation of solar technology is the question of which union will subsume the categories of newly created jobs. Until recently there have not been many solar installations so that few unions have staked out territorial perogatives. For the most part, the solar energy field is still wide open to jurisdictional competition. The situation can be expected to change as more work in the area becomes available. An arrangement has already been negotiated between the Sheet Metal Workers and the United Association of Plumbers and Pipefitters which calls for joint crews in the installation of hot air collectors using liquid storage systems. Jurisdictional disputes could be a serious problem in other areas, however, unless all issues can be settled as amicibly as this one has apparently been.

Generally, union officials feel that an upsurge of solar construction and installation would not radically alter the types of jobs available to union members, but rather the number of jobs. Firms that now produce heating, ventilating, and air conditioning equipment—many of them already into solar collector construction—would simply expand their operations. Any new firms established would be unionized in conventional ways.

While labor has occasionally resisted the introduction of new technologies into the building industry, this resistance has always been directed at technologies which reduce jobs on each building site or which transferred employment from one building trade to another. The disputes associated with the introduction of plastic plumbing, prehung doors, and metal studs, all resulted from one of these effects. Solar equipment would add work at each site without displacing work in other areas, and it is, therefore, difficult to imagine any group with a motive to resist its entry into the market.

2.3 Long-term impacts

The overall impact of generating a substantial fraction of U.S. energy from small solar devices is extremely difficult to assess since current economic theory has failed to develop satisfactory methods for conducting such analysis. None of the major price equilibrium model used to determine the future of U.S. energy supply and demand adequately treat employment issues; most make the overwhelmingly simple assumption that there will be full employment during the entire period analyzed. As a result, many of these models tend to ignore the influence of alternative energy strategies on unemployment. The difficulties of predicting economic impacts are magnified by the fact that much of the information necessary to translate a workable theory or model into useful policy information does not presently exist.

In the absence of an adequate methodology, the most critical questions involving the impact of solar technologies on the work force cannot be answered with

[8] James K. Crump, Chief International Representative, SMWIA.

certainty. An example of one difficulty can be seen in the problems associated with interpreting the implications of labor intensity. If rapid rates of growth are expected in both the U.S. economy in general and the energy production sector in particular, and if unemployment is expected to be very low as a result, any shift to a labor-intensive technology like solar energy could prevent wages from keeping pace with growth in other sections of the economy. An industry with high labor intensity requires more manpower for the same output than industries with low labor intensity. As a result, the average wage paid per worker must be lower for the labor-intensive process. If growth is not expected to be sufficient to eliminate unemployment, labor-intensive industries will be beneficial to both labor, and to society as a whole, by permitting a larger fraction of the work force to be productively employed.

Other questions which must be addressed include the following:

(1) Would the energy produced by solar equipment fill a shortfall in energy supplies resulting from a failure of alternative sources to meet energy demands, thereby allowing an expansion of labor in solar industries without reducing employment in other areas? (If solar energy filled an unsatisfied need, it would permit expansion of employment in those areas of the economy not otherwise possible.)

(2) To what extent will solar energy sources be able to reduce the need for installing additional electric generating facilities and to replace expendable fuels? If fuels are replaced, what types of fuel would these be? (If solar energy replaces only fuel and does not reduce the demand for generating equipment, solar energy would probably only replace imports and would not directly affect employment in the energy sector. If, on the other hand, it reduced the demand for new electric generating facilities, it could have some impact on the demand for construction labor in this sector. As mentioned above, if solar facilities fill a demand which would would not be possible or desirable to fill by expanding conventional capacity, it would not displace jobs anywhere in the economy.)

(3) Would the energy production by solar equipment reduce imports of oil and gas, or would it displace domestic energy supplies of coal or nuclear fuel? If imports are reduced, and funds invested instead in areas benefiting labor in the solar industries, would employment be reduced in industries now benefiting from the export market stimulated by our purchase of foreign fuels?

(4) What kinds of growth rates can be expected in energy sources which do not depend on solar energy? Will this growth rate be constrained by a shortage of capital, resources, and demand, or by a shortage of critical skills? Would solar energy compete directly for scarce resources or would it be able to tap other capital or labor supplies?

(5) What kind of work force dislocations could be expected in a shift from one energy source to another? Would new skills not now available in the building trades be demanded? What kinds of transient unemployment could be expected in this transition?

Statement of the Sierra Club

Our remarks will address only two of the elements of President Carter's economic strategy: energy and unemployment. The present lack of an environmentally sound, national, energy program is a very serious problem. We commend the President for his efforts in this area, but especially for his recommendations that the conservation of energy and the development of alternative sources are important elements in the transition to more efficient energy use. As President Carter has indicated a large part of our recent economic problems stem from too great a dependence on sources of energy, in this case gas and oil, over which we as a nation exercise essentially little control. The Sierra Club believes that more rapid development and use of appropriate, alternative sources of energy would not only reduce the pressure on our natural resources, but make good economic sense as well. We feel that the problems of unemployment and our need for clean energy sources, with prices and supply under our control, can be addressed simultaneously. One of the major areas where this can be done is through the accelerated development and greater utilization of the existing technology in the solar energy field.

The California State Energy Commission in it's 1977 Biennial Report says that there is a widespread consensus within this field that solar space and water heating are ready for commercialization in both residences and commercial establishments. If this not precisely be the case, we feel that in a very short amount of time nationwide commercialization will be feasible. Though there is continued development in solar cells which directly generate electricity, much remains to be done before they can be utilized on a scale which would have the desired effects on our economy and environment.

The installation of solar energy equipment is a labor intensive process. To illustrate; the Environmentalists for Full Employment determined recently that if $2 billion were invested in solar energy it would create more than four times as many jobs than if it were invested in the construction of a nuclear reactor (specifically: 64,000 jobs versus 15,000 jobs). This particular study also indicated that with solar energy the ratio of tradespeople to professionals is higher, 9 to 2 versus 2 to 1 for the nuclear energy situation.[1] Another study estimated that the installation of solar space heating units on only 10 percent of the new housing units built in California between now and 1985 would generate approximately 5,000 jobs a year over the next ten years, 4,000 more jobs than an equivalent nuclear alternative.[2] Solar energy has the potential of creating many jobs, but of equal importance these jobs would go to people in occupations that are more susceptible to unemployment, in addition, many of the jobs created could be filled by training of the long-term unemployed.

The Sierra Club urges the Congress and the Administration to make available greater federal funding for research on alternative energy sources, especially solar. The development and widespread use of solar energy to generate electricity could not only provide cheap energy again, and this time clean, but has the potential to generate a tremendous amount of employment and perhaps establish, within the U.S., a major new export industry. The committment is needed now so that this fledgling industry could that much sooner make a direct and positive impact on our problems of unemployment, inflation, trade deficits, etc.

Energy is not the only important area where a redirection of federal subsidies and public works money could contribute to both the environment and the economy. Additional federal funding should go toward transportation systems which, compared to freeways and highways, have less of a negative impact on the environment, are more energy efficient, and contribute to the growth and rehabilitation of the central cities instead of urban sprawl. Less emphasis on road construction and more funding of mass transit can have positive effects on total employment. A recent study demonstrated that a $5 billion transfer of funds from highway construction to mass transit would result in a 3.2% increase in the number of total transportation construction jobs.[3]

Consider the extensive intercity rail systems of Europe. Many, if not most, are powered by electricity. They are clean, fast, efficient, and heavily used. There is no reason that high quality systems, even better than those in Europe, could not be given higher priority for development here. Our experience with the Northeast Corridor Program demonstrated that high quality service does draw the passengers necessary to help sustain that kind of service. New rail systems of all types should be given more priority. The Urban Mass Transit Administration recently identified some twenty cities that it feels are potentially suitable for development of new intracity rail systems. It may not be long before fast, electrical rail systems such as these could be deriving their power from solar energy. How soon that comes about probably depends on the Administration and you, the Congress.

There are other areas within our existing rail system needing investment which could provide much additional employment of a type not requiring extensive training. AMTRAK has in the past identified about half a dozen intermediate distance passenger rail corridors where track improvements are necessary, but where funding has not been provided. More recent information reveals that over two dozen corridors are in need of more than routine repair. The recent derailments involving toxic substances makes even more immediate the question of what degree of deterioration will be allowed on passenger rail lines before track improvements are carrier out.

The rehabilitation of existing urban housing is another important area where additional federal funding should be provided. This idea is not new. It has been tried in the past. But we believe that with proper implementation it can work,

[1] *Jobs and Energy*, Environmentalists for Full Employment, Spring 1977.
[2] "A Conservation Economy: Employment," Perspectives, Sierra Club, Vol. 11, No. 5.
[3] Bruce Hannon, Energy Research Group, Center For Advanced Computation, Univ. of Illinois.

not only providing many jobs but, with proper direction, jobs for the very people whose neighborhood is effected. It has been estimated that for every $1 billion invested in urban rehabilitation, approximately 50,000 jobs would be created and roughly 25,000 units, of various types, could be refurbished.[4] Improving urban housing would predominantly effect low and moderate income families. It helps reduce urban sprawl with it's adverse effects on energy use, and increases the property tax base. A rehabilitation program should also include widespread utilization of simple conservation methods such as installation of insulation, use of storm windows, wider use of clock thermostats, etc.

There are numerous other projects involving conservation and environmental restoration that could provide substantial amounts of employment, perhaps especially effecting those hardest to employ. An article in a recent issue of The Nation describes many unfunded but very necessary projects to be found within such organizations as the Forest Service, Bureau of Land Management, HUD, and the National Park Service.[5] The various projects include wilderness restoration, campground and picnic area development where appropriate, replanting of overgrazed rangeland, control of erosion on surfaced-mined lands, replanting of clearcut forestland, the clearing of debris-clogged streams, and the establishment and maintainance of urban parks. All of the above would provide jobs, restore some of the environment, and in some cases are a direct investment in resources for future consumption.

The Sierra Club endorses the efforts of the Carter Administration and Congress in expanding training programs which are designed to attack the problems of structural unemployment. Increasing the availability of skills and the opportunities to change occupations not only is important for the happiness of the individual involved, but is obviously healthy for the nation's economy. It has specific applicability to the environmental movement in those situations where the conservation of important resources comes in conflict with relatively static production systems, often of marginal efficiency, resulting in some job displacement. Increasing the level of skills makes the labor market much more "fluid" which helps to reduce unemployment and reduce obstacles to vital conservation efforts.

The Sierra Club has actively supported the full employment goals found in the Humphrey-Hawkins legislation. We believe that environmental quality and the goals of fuel employment are inextricably intertwined; a nation that does not try to provide the dignity of a job for all it's citizens will not respect it's future generations sufficiently to preserve some of it's natural resources for them. The conservation movement's long-time goal has been to preserve some of the earth's bounty for tomorrow, a national full employment policy will help more people share in that bounty today.

[From Solar Age, September 1977]

Energy and Jobs (and the Economy)

(By Skip Laitner)

The relationship between energy and jobs (and the economy) is a confusing one. Because the number of persons employed and the size of the economy, as measured by the Gross National Product (GNP), historically has grown as non-human energy consumption has increased, business and industry leaders argue that more energy is a prerequisite for higher employment levels. But this crude correlation does not stand up to careful analysis.

Dr. Herman E. Daly, an economist with Louisiana State University has pointed out that the whole purpose of using non-human energy is to replace human labor. Thus, he writes in an essay in Toward a Steady State Economy (W. H. Freeman, San Francisco), the "observed positive correlation between non-human energy and employment are both related to some third factors which have been increasing historically, namely total output and population . . Only if total product growth [i.e., GNP] creates more jobs than are eliminated by the growth of non-human energy will employment increase."

[4] Based on statistics from the Department of Labor and the Homebuilders Association.
[5] "An Environmental Works Program," Neil B. Goldstein and Samuel H. Sage, The Nation, Feb. 11, 1978.

With this perspective, in mind, the proper question to consider is "how can we increase the productivity of goods, services and jobs without using more energy?" Conservation is the most obvious answer. Too often people believe conservation is achieved only with a reduction in productivity that sacrifices jobs. Properly viewed, however, conservation means an improvement in energy efficiency, the same unit of work is done using less energy—and, frequently, more labor. It has been shown, for example, that production of energy-efficient air conditioners would create approximately 10 percent more jobs, requiring less energy, than the use of air conditioners that are only one-half as energy efficient. Houses, therefore, can be adequately cooled using less energy but increasing labor intensity.

COMPARISON OF JOB INTENSITIES AND Kwh COSTS OF SOLAR ELECTRIC AND NUCLEAR SOURCES IN YEAR 2000 [1]

Source	Energy (10^{15} Btu's per year)	Cumulative person years of labor times 10^4 demanded to year 2000	Delivered cost (mills/kWh)
Solar thermal	1.3	1.0	25–30
Wind	4.9	3.7	13.0
Ocean thermal	7.0	.9	12.4
Photovoltaic	6.8	26.8	20–30
Total solar	20.0	32.4	(2)
Nuclear	13.0	5.2	35.6

[1] The data is extrapolated from "Project Independence Taskforce Report on Solar Energy," Federal Energy Administration, Washington, D.C., 1974. See references.
[2] Not available.

Note: The important comparison in this table is that of labor intensity, not energy capacity. The FEA data used here is intended to show only that for a given capacity of Btu output in the year 2000; a specific cumulative labor requirement is expected for the entire fuel or production cycle.

After a three-year study, the Ford Foundation's Energy Policy Project concluded in part, that substantial economies in the U.S. energy system are possible within the existing structure of the economy without sacrificing either real income or jobs. In fact, adaptation to a less energy intensive economy would result in a slight increase in employment over the existing levels of energy consumption. Real income, as measured by the nation's GNP, would be approximately twice as large as today's.

Clearly the correlation between GNP and energy consumption is a loose one. Even with conservation measures, however, major resources will need to be developed to provide our nation's energy. Many representatives of industry and government argue that only nuclear power can supplement our dwindling fossil fuel supplies. Despite the repeated promise of a cheap, safe energy source, atomic power has not lived up to early expectations; a growing body of individuals, scientists, and legislators are looking toward solar energy to sustain our economy.

This would be a fortunate choice because solar energy appears to be more job intensive than atomic power. Using data gathered by the Federal Energy Administration (FEA) in its 1974 Project Independence Report, a reasonably accurate comparison of direct employment demands can be made between nuclear energy and the six basic solar technologies—heating and cooling, biomass, solar thermal, ocean thermal, wind power and photovoltaic cells.

As demonstrated in the table below, I have calculated that solar electric technologies will provide roughly 4 times more jobs per unit of energy than will nuclear power. Moreover, delivered cost of power generated by solar energy, according to the FEA data, will be less than power from fission sources.

A wider variety of people will work physically on solar installations, as well. This will be true for two reasons: 1) the skills and training for solar projects generally are less demanding than for nuclear construction and operation—which means that more people can qualify for jobs; and 2) because solar technologies offer a greater potential for decentralized energy production (i.e., on-site generation at a shopping center or at a school), work will be available closer to home. Wages are estimated to be in the $6 to $11 per hour range, not substantially different from current levels. The transition to a decentralized solar program can greatly help the unemployed and those who have not had the training to compete for higher paying jobs.

Solar projects can open up job demand almost immediately. Unlike officials within ERDA, Westinghouse, or General Electric, leaders in the solar industry are convinced that solar technology is here today. James Ince, executive director of the Solar Energy Industry Association, a trade group for more than 100 manufacturers for solar equipment, told the Senate Select Committee for Small Business that "there is nothing wrong [with solar technology] that a few orders for the production line wouldn't solve."

One major opportunity for a large-scale demonstration program would be to require all federal buildings to implement conservation and solar technologies, based on a mandatory study of life cycle costs (i.e., where such studies demonstrate that solar energy would have money over the lifetime of a building, despite its higher initial coasts), in existing and new structures.

This legislation could have a significant impact in developing solar technologies since the federal government owns and operates over 400,000 buildings containing over 2.3 billion square feet—the equivalent of 1,250 Empire State Buildings.

Response of the General Electric Co. to Written Questions Posed by Senator Kennedy

Question 1. With the recent decrease in the number of orders for nuclear power central stations, how many turbine workers are being switched over to the manufacture of fossil-fired central stations?

Answer. The recent decrease in the number of orders for nuclear powered stations does not have significant impact on turbine workers at this time. This is because most of the turbines that are presently being manufactured are those that were ordered five to ten years ago, while those that have been ordered recently will be scheduled for production several years in the future.

Question 2. Given the lower megawatt range of fossil-fired turbines, are more workers needed to meet any given level of additional generating capacity?

Answer. Design differences within both types of turbines can cause significant variations in labor content. However, in typical cases for a given level of generation capacity, as many as 20–30 percent fewer workers would be required to manufacture fossil-fired turbine generators as compared to nuclear types.

Question 3. Do you have sufficient manufacturing facilities to handle a big transition from nuclear turbines to fossil-fired turbines?

Answer. There is more than sufficient manufacturing capacity to meet our projection of generating capacity additions within a wide range of mix of nuclear and fossil types.

Question 4. How many man-hours are required to build a 600 megawatt fossil-fired turbine? How many man-hours are required to build an 1100 megawatt nuclear turbine?

Answer. As noted above, there can be large variations in the labor content of both types, depending on specific unit designs. In typical cases, an 1100 megawatt nuclear unit might require from two to two and one-half times as many man-hours as a 600 megawatt fossil unit.

Question 5. What is the general future of turbine manufacturing through 1990?

Answer. We expect to be operating well below our capacity through 1990. Continued delays in the adoption of a national energy policy and excessive complexities of regulatory processes are major concerns both to us and to our utility customers.

Response of the Westinghouse Electric Corp. to Written Questions Posed by Senator Kennedy

Question 1. With the recent decrease in the number of orders for nuclear powered central stations, how many turbine workers are being switched over to the manufacture of fossil-fired central stations?

Answer. Reduction in the number of orders for nuclear powered central stations, together with the lower growth rate of KWH demand, has reduced the number of employes at the plants which produce turbine-generator apparatus as follows: 1974, 13,526; 1975, 12,800; 1976, 11,336; 1977, 10,623; expected 1978, 9,960.

This four-year reduction would have been greater, but concerted efforts to expand our service business has increased the manpower by about 250. There is virtually no differentiation between the labor skills required for fossil or nuclear turbine-generator units. Basically, the same facilities (i.e., machine tools) are used.

Question 2. Given the lower megawatt range of fossil-fired turbines, are more workers needed to meet any given level of additional generating capacity?

Answer. Comparison of fossil and nuclear turbine-generators:

	600 MW fossil	1100 MW nuclear
Man-hours:		
Direct (design and manufacture)	571,000	1,112,000
Indirect (marketing and administrative)	60,000	60,000
Man-years of employment	322	599

Note: The man-hours of employment are virtually the same per kilowatt for both fossil and nuclear turbine-generator units.

Question 3. Do you have sufficient manufacturing facilities to handle a big transition from nuclear turbines to fossil-fuel turbines?

Answer. On the basis of generating capability, the units are proportional in that the MW output of the nuclear unit is 83 percent greater than the fossil; whereas, the nuclear unit requires 86 percent more man-years of effort to manufacture than does the fossil-fueled turbine. Manufacturing capacity utilization is approximately as follows and we, therefore, have a significant excess capacity for either nuclear or fossil generating units.

Year:	*Capacity utilization (percent)*
1974	80
1976	80
1978	70
Early 1980's	30–40

Question 4. How many man-hours are required to build a 600 MW fossil-fired turbine? How many man-hours are required to build an 1100 MW nuclear turbine?

Answer. Refer to the reply to Question 2.

Question 5. What is the general future of turbine manufacturing through 1990?

Answer. There has been a marked decrease in turbine-generator shipments for the industry from a range in the mid-1970's of 30–44 million KW per year to a range of 15–25 million KW per year to the mid-1980's. In the late 1980's and early 1990's it is expected to increase to a range of 25–35 million KW per year, which is not as high as the mid-1970's.

Energy War Is Generating Jobs

Solar energy technicians will be vital.

by Kenneth Fiester

The effort to overcome America's desperate energy shortage—which President Carter identifies as "the moral equivalent of war"—will create millions of new jobs.

The jobs will be created because the energy war will be waged mainly with human hands rather than with the wonders of science and technology.

Many new jobs—in the long run, most of them—will be permanent. For generations industry has been substituting energy for labor and the process accelerated as cheaper, easier-to-use energy sources like natural gas and oil emerged. Now, the process must be reversed. Both in the production of goods and of energy itself, work hours will be a larger element.

These statements briefly summarize a wide range of views on the impact that new Administration energy conservation measures are expected to have on employment in the United States.

Because saving energy is inseparable from the concept of sacrifice—a concept of doing without that was brought home to most of the Nation both last winter and last summer—little heed has been paid to the benefits that will accrue from overcoming the energy shortage. Personal discomfort has tended to overshadow the recognition that what needs to be given up could be greatly outweighed by what would be received in return.

Another reason why this equation has not been generally understood is that jobs associated with energy conservation up to this point have been at the lowest rung of the ladder—short-term, minimum-wage positions for unskilled workers. The very first energy-related projects supported by the Federal Government fit that description. They were joint undertakings involving Comprehensive Employment and Training Act (CETA) programs administered by the Employment and Training Administration (ETA), the Community Services Administration, and a variety of State and local governments, nonprofit organizations, businesses and individuals to winterize (or weatherize—the terms are interchangeable) the homes of poor and elderly families. The original goals were to keep poor people from freezing, to reduce their fuel bills, and to provide work and job training for the disadvantaged unemployed (WORKLIFE, February 1976). Energy conservation was an added bonus.

The goal of the first winterization program was handling 100,000 dwellings a year at an average unit rate of a day's work for a four-person crew—the equivalent of about 2,000 full-time jobs. The Department of Labor is planning to step up the pace to a million dwellings a year, amounting to 20,000 full-time jobs distributed among many times that many individuals. The crews will comprise three unskilled or semiskilled workers, who are paid the minimum wage, and one skilled craftsworker-supervisor, who earns $5 or more an hour.

ETA's Office of Community Programs has set up a staff to examine weatherization project proposals from CETA prime sponsors involved in expansion of public service employment (PSE).

Another significant but yet unmeasurable development in the same area is the widespread movement by homeowners who are *neither* elderly *nor* poor to do their own winterizing, an activity that has increased employment and production in the insulation industry. The high cost of fuel, plus last winter's shortages, provided a powerful stimulus. Tax incentives in the new energy legislation should add another.

The State of Colorado, where concern for energy resources is of long standing, estimates that 20 million American homes need one or more of three basic energy-savers: clock thermostats, caulking and weatherstripping, and storm windows. Calculations of the full-time job equivalent required to fill those needs range from 400,000 to more than a million.

Kenneth Fiester is a freelance writer based in Washington, D.C.

Owens-Corning Fiberglas Corp. photo

Manufacture and installation of insulation are booming

Workers on weatherizing jobs done under private contract will almost certainly be paid more than the Federal minimum wage since the work is likely to involve elaborate equipment changes. Homeowners who talk with contractors about weatherization will hear a new word, "retrofit." Applied most often to furnaces and heating-air-conditioning units, it is the process of adding something or adjusting the apparatus now in place so it will work properly under new, energy-saving conditions.

Nonresidential structures such as office buildings and warehouses may be the top jobmakers on a per-unit basis. For example, energy-conservation refitting of the Hermann Building on the campus of Massachusetts Institute of Technology, relatively small at 94,000 square feet, required 800 work hours by members of the Sheet Metal Workers International Association, the union reports. These were not wage-floor hours.

However, whether general weatherizing work creates the equivalent of a million jobs or several times that number, it is undeniably not a long-term proposition. For instance, no comparable manpower increment is needed in the construction of energy-sound new homes. Business will be better for the manufacturers of insulation and thermostatic controls, but employment won't increase dramatically on that account.

To be sure, even a short-term stimulus of this size is welcome when the unemployment rate is hovering about 7 percent nationally. Even more welcome, though, are the longer term prospects.

First in line among these is solar energy, the wave of the future. Currently it is a sort of halfway-house between the catchup of weatherizing and the more fundamental changes to come in energy sources and applications. Solar energy may well have a role in these fundamental changes too, but now and for the next few years it will come into play as a means of heating and cooling homes, schools, and office buildings.

A big boost in the number of jobs in the energy field will come from the General Services Administration (GSA). The Federal agency plans to construct 27 buildings, in various sections of the country, that will be designed specifically to conserve energy. Three of the structures will be in Washington, D.C., and one in Bethesda, Md., a suburb of the Capital. The 27 structures are expected to save about $3 million on energy bills annually and all are to be in operation by 1979. The projects will create an estimated 17,900 jobs, GSA reports.

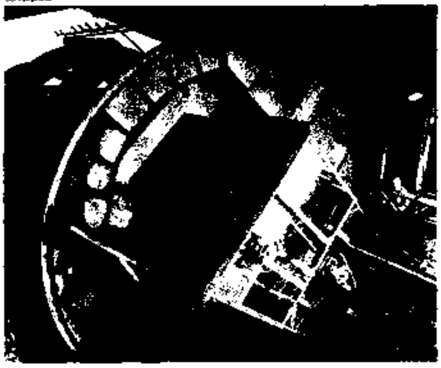
Two of the buildings will be educational facilities for the Washington Technical Institute; a third for the Lister Hill National Center for Biomedical Communications; and the fourth will be the Howard University Center, containing student union facilities. The four buildings, 4, 6, 4, and 3 stories, respectively, will encompass 671,000 gross square feet and cost a total of $35.8 million.

None of the Washington-area structures will be office buildings in the general sense, although they will contain some offices. All have many of the features of the Norris Cotton Federal Building in Manchester, N.H., which was dedicated a year ago as the first Federal building designed from the start with energy conservation as its goal.

The pioneering features of the Cotton building are worth noting since the emphasis is on energy-saving equipment that requires work hours to produce and install.

According to GSA, the $9.32 million spent on constructing the Cotton building—not counting $431,760 spent on rooftop solar heat collectors—is just about the amount that would be

Conrail photo



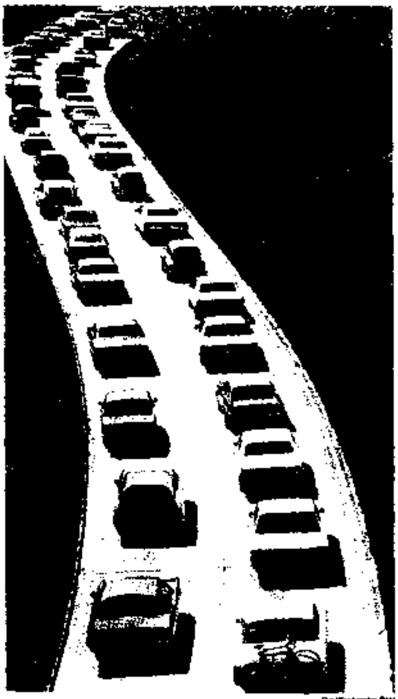
Huge rotary dumper tilts a 100-ton coal hopper car as if from a toy train. American railroads expect to double coal deliveries by 1980

spent to erect a conventional nonenergy-saving building its size—7 stories, 176,000 square feet. The Cotton's energy-saving features allow smaller, less expensive mechanical equipment for cooling, heating, and ventilation.

Within the building are about 750 sensors that measure temperature, humidity, air and water flow, solar radiation, electric power consumption, barometric pressure, and indoor illumination.

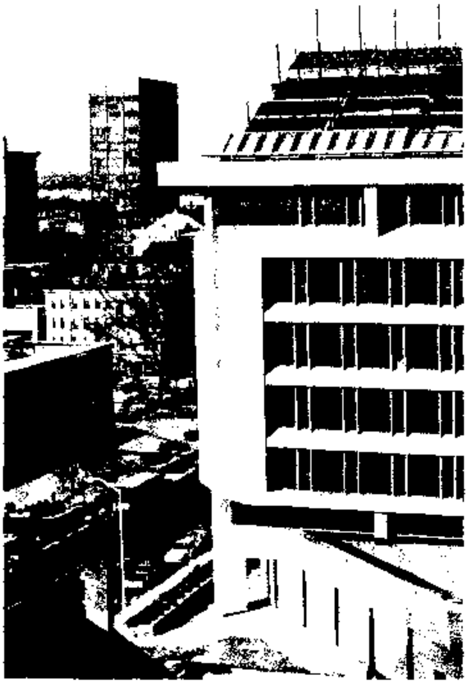
These data points are scanned every 20 seconds. Each hour all data are averaged, converted into engineering units such as degrees Celsius, watts per square meter, and so forth and stored on magnetic tape.

The tapes are then sent to National Bureau of Standards

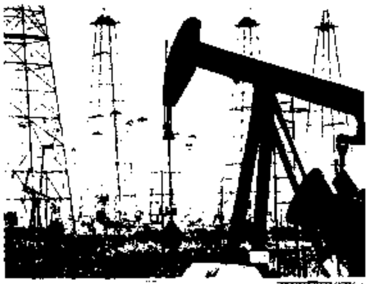


The Washington Post

Gasoline guzzling would be cut to 10 percent below present consumption



Energy saver: Norris Cotton Federal Building in Manchester, N.H., has nearly cubical solar heat collectors on the roof.



Oil friction: not enough to go around.

Christian Science Monitor

Energy

laboratories at Gaithersburg, Md., for analysis. The result, in general, is a determination of the most efficient ways of saving energy.

One of the Cotton building's unusual energy-saving aspects is its nearly cubical shape. This minimizes exterior surface areas, which normally are the greatest avenue of heat loss, especially in a northern city such as Manchester.

The functional ability of solar energy in modern times has been established for at least 25 years, although its practical application was delayed because conventional energy sources were plentiful, low in price, and cost almost nothing to install. But solar technology continued to improve so that it was ready—or almost ready—when the economic equation began to change (WORKLIFE, August 1976).

Household use of energy from the sun would be further along today if contractors who offered to install solar units

National Bureau of Standards photo

...l shape, windowless north wall, and tiltable

United Press International

In Lancaster, Ohio, Dave Barrett's trade is on the upswing

had first learned how. Scores of expensive failures, even on seemingly simple projects like a water heater or a swimming pool warmer, frightened away uncounted potential customers. Nearly all the failures stemmed from incompetence rather than misrepresentation. An active solar industry association is working hard today to hold future fumbles to a minimum.

At any rate, the sun's rays are back in the public's good graces as an energy source. President Carter's goal is 2.5 million or more homes with at least some use of solar energy. Those who follow news reports and news features, printed or broadcast, are aware that a considerable number of families didn't wait to see if they would get a tax rebate for solar conversion, but have already had rooftop units built. Specialized applications are probably in wider use; one company told a Senate committee that it had installed hot water units in 1,000 dwellings last year and was unable to keep up with demand.

A staff report prepared by the Senate Commerce Committee (now Senate Committee on Commerce, Science, and Transportation), describes how a $1.65 billion investment in energy conservation would create 100,470 public works jobs: 9,600 skilled jobs at $15,000 per year; 74,600 unskilled at $10,000; and 16,270 jobs in manufacturing. The report calculated that each $40,000 investment in materials would create one job in the related manufacturing industry. The project would focus on retrofitting schools, colleges, hospitals, and Federal buildings; weatherizing and installing solar water heaters in single family houses owned by the Department of Housing and Urban Development (HUD); and constructing bicycle paths.

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CETA SHINES in California Sun Power

by Stephen Brown

Today in California, operators of Comprehensive Employment and Training Act (CETA) programs see the sun as a source of energy to help create new jobs and increase economic and ecological stability. With the philosophical blessing of California's top government officials and grants of CETA funds, several State and local agencies are operating demonstration projects to train CETA participants for jobs in the solar energy industry.

The project managers believe CETA ties in nicely with other government incentives—such as tax and investment credits—which are generally believed to be needed to encourage commercial development of solar energy. These incentives translate into jobs: The Solar Energy Industry Association estimates there will be 74,000 new jobs in the industry in 1982 and 347,000 in 1987. As Valerie Pope, executive director of the San Bernardino Community Development Corporation, which operates several CETA solar projects in San Bernardino, explains, "We intend to get our people right in front of the line for the new opportunities."

Some of the demonstration projects emphasize instruction in the theoretical aspects of harnessing the sun to produce hot water and heat and cool homes and commercial buildings. Others emphasize training in the variety of skills required by the solar energy industry. This is the overall picture:

- The Solar Heating Technician Skills Training Program in Sonoma County, north of San Francisco, aims to graduate 16 paraprofessionals capable of designing, constructing, testing, troubleshooting, and maintaining any solar heating or cooling system. (WORKLIFE, October 1977.)

The 10-month training program, now in its second year, was originally funded by the State CETA office and currently operates under a $150,000 title I grant from the county prime sponsor. Last year, 12 students completed the course, and all found jobs in the solar energy field.

- The San Bernardino West Side Community Development Corporation (CDC) recently completed a pioneering public housing rehabilitation project that included centralized solar water and space heating systems for 10 homes. Fifty-two CETA participants gained knowledge and experience in such solar energy related skills as car-

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California

pentry, painting, electrical work, plumbing, blueprint reading, weatherization, and weatherproofing.

The homes were sold to CDC by the Veterans Administration, and after refurbishing were rented to low-income families. The new occupants began moving in February 1. The $437,500 project was funded with grants from the State CETA office, and the U.S. Department of Housing and Urban Development, and the Community Services Administration (CSA). Southern California Edison, a private utility serving the area, donated some materials.

The agency plans to develop the CDC Energy Technology Center, an industrial park housing 10 private industries that manufacture such solar-related products as pumps and insulation materials. The CDC will use a photovoltaic concentrator system to generate electricity from the sun to meet 80 percent of the industrial park's electrical energy needs.

• In Sacramento, the Solar Technician Training Project trained 18 persons in the skills and theory necessary to retrofit existing buildings with solar hot water systems. Two state agencies, the Office of the State Architect and the Office of Appropriate Technology, ran the program with funds from the State CETA office. During the on-the-job training phase of the project, students designed, constructed, and installed solar systems in several State-owned buildings. After the program ended, 11 trainees were placed in full-time jobs, and one found part-time employment

• In Gilroy, south of San Francisco, 37 former migrant farmworkers enrolled in a CETA-funded building maintenance course run by the San Jose Center for Employment Training (CET) put their newly learned skills to use in a practical solar project. They fabricated and installed solar hot water systems in 30 housing units, two laundries, and a day-care center, at a migrant housing center. Half the cost of the $42,000 projects was borne by the State Energy Commission and half came from State CETA funds. (WORKLIFE, October 1977.)

• The city of Santa Monica is using title VI funds to employ four persons in its Energy Conservation Project. The group is exploring ways in which the city can be more efficient in its use of energy. One project is to provide solar heating systems for two city swimming pools.

These demonstration projects are part of the solar energy age that has dawned in California, where the future of solar energy has been declared "a major priority" by Governor Edmund G. Brown. When the State CETA office advertised for fiscal year 1978 project proposals, its list of funding categories cited "development of solar energy" as an example of projects that "target training and job development efforts to employment opportunities in industries which could bring significant long-range economic benefits, social benefits, or technological development to the State."

Last year, the legislature passed a bill that gives a homeowner a 55 percent tax credit, to a maximum of $3,000, on the purchase and installation of a solar energy system. On commercial buildings, where solar installation costs more than $6,000, the bill provides a tax credit of 25 percent, or $3,000, whichever is greater. The State Energy Commission estimates that 170,000 homes in the State will get solar heating in the next 3 years.

Roy Irving, project director of the Sonoma County program and an instructor at the School of Environmental Studies and Planning at Sonoma State College, says, "The awareness about solar energy is growing more than people realize." He believes CETA-funded projects add to that awareness, thereby promoting growth of the solar energy industry which, in turn, creates new jobs.

As word about the Sonoma County project has spread, inquiries have flooded into the program's solar-heated Alternative Energy Center on the Sonoma State campus. Last year, the center's second annual Alternative Energy Fair drew more than 5,000 people. Says Irving: "When we started 2 years ago, there were no solar energy companies listed in the phone book. Then a year ago there were nine. This year there are 33."

Because of the newness of solar energy activities and employment, administrators of the Sonoma County and Sacramento projects have pioneered course curriculums. Their experience indicates that the critical factors are the size and scope of the project, the length of training, and the ratio of instructors to trainees.

"After last year," explains Gayla Tyson, administrator and job developer of the Sonoma County program, "we made basic changes in curriculum and course content in response to the realities of the job market. The solar technology course has a much narrower focus this year as most of the available jobs are in the area of sales, installation, and consultation. We are also de-emphasizing collector design theory since jobs dealing with collector design are usually filled by mechanical engineers. We intend to concentrate more on complex design problems and cost-benefit analysis. The ability to calculate lifetime costs and payback periods is essential to consultants and salespeople. It is also essential for consultants to know what hardware is available."

Tyson says she and Irving made "some basic changes in our expectations of the students. We try to screen out applicants with unrealistic ideas of getting rich in the solar heating field. The training program is much more rigorous this year, and we have been able to get enough self-directed people in our program to help the instructors in supervising the projects. This should be a consideration for those who are applying for CETA-funded programs."

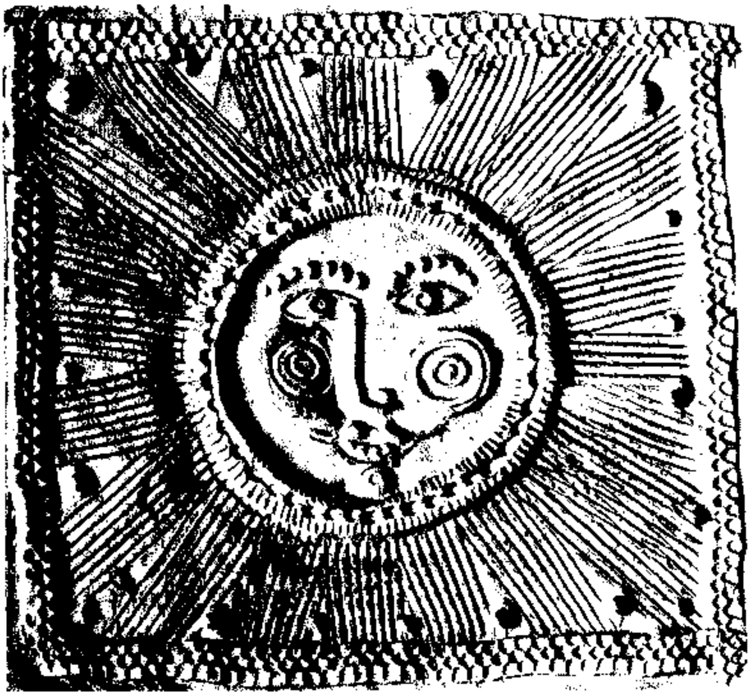
Dave Rozell, with the State Office of Appropriate Technology (OAT), says several valuable lessons were learned from the Sacramento project:

"Our allocation of 22 weeks of training to turn out a paraprofessional was naive. The training period needs to be a minimum of 10 months. We also learned the value of restricting the size and scope of our projects. More benefit can be derived from designing and building several small solar systems than one or two large systems.

"Finally, the staff necessary for such an ambitious training project should be one supervisor-instructor to every five or six trainees. This added expense is justified because the trainees gain significantly more knowledge, and their skill proficiency increases rapidly through expanded personal contact."

Future CETA-funded solar energy technician training programs may benefit from a new project just funded by the State CETA office. The first part of the project calls for the State Office of Appropriate Technology to develop a comprehensive training package for prime sponsors' use. Much of the curriculum will be based on results of the demonstration projects.

But as Ron Lipton of OAT points out, qualified solar technician trainers—persons fluent in solar energy theory, systems design, construction, and installation—are "few and far between." So, under the second part of the project, the Sonoma County program will



become State headquarters to train solar energy technician trainers. "The course will be a condensed version, probably 12 weeks, of our present project," Irving explains. "It's our hope that prime sponsors will enroll persons to learn how to conduct their own technician training programs." Irving says the first course may be offered early next fall.

Graduates of CETA projects are finding jobs. Take Liz Frakes, for example. Several months after she completed the Sonoma County program last year. Frakes landed a technician job with Enecon, an energy conservation engineering firm in San Rafael, a San Francisco suburb. She now earns $5 an hour. "Before I entered the program," Frakes recalls, "I never thought of anything as a career. I was a rebellious kid who was never going to settle down."

Besides helping trainees like Frakes find good paying jobs, the CETA projects show how solar energy may help the economically disadvantaged survive escalating energy costs. "Solar energy has been viewed as a complex technology," says Valerie Pope. "Our project was the first to relate the needs of poor people to solar energy. If we don't make this technology available to them, then when the energy crunch comes, low-income people will be freezing in the dark."

Perhaps the final word was offered in an editorial by the San Bernardino *Sun-Telegram*. Commenting on the public housing project's $437,500 cost, the paper wrote: "That seems a high price to pay for heat and hot water for 10 modest homes. However, in terms of the training provided the young men and women in marketable construction skills, savings on hot water and heat costs through the years, and the impetus the project should give further use of solar energy for residential purposes, the $437,500 was a good investment." □