

EVALUATION OF FEDERAL EXPENDITURES FOR WATER RESOURCE PROJECTS

Otto Eckstein, assistant professor of economics, Harvard University

Federal water-resource programs have been relatively immune from the economy drives that have affected other Federal expenditures. Expenditures for fiscal 1958 for the major project-building agencies are expected to be in excess of \$850 million, a moderate increase over 1957, and an increase of over \$150 million compared with 1956. It is true that this part of the Federal budget was subjected to budget reductions earlier than the rest, having reached peaks in 1950 and 1953. But given the general tightness in the budgetary situation, and considering particularly the drastic cuts that have been made in such vital fields as missiles development and foreign aid, every Federal expenditure must be scrutinized carefully to see if it is the best use to which the limited funds can be put, and to see if the transfer of resources from the private sector to the public sector can be justified.

This paper seeks to throw some light on these problems by examining the contribution of water-resource projects to national income and to regional income. It also deals with some of the evaluation practices now employed by the Federal agencies, and calls attention to some of the difficulties of joint private and public development.

EFFECT ON NATIONAL INCOME

Water-resource projects are investments; they absorb resources and generate output which are additions to the stream of goods and services which constitute the national income. Unlike most public expenditures, the outputs are predominantly economic and can be valued by prices, directly in the case of power and irrigation, indirectly by measures which are price equivalents in the case of flood control, navigation, and water supply. Therefore it is possible to estimate how much is added to future national income by any project and this can be compared with the cost.

The benefit-cost analyses which are submitted to the Bureau of the Budget and the Congress for each project at the time that authorization or appropriation is requested¹ can serve to show whether the additions to national income, or benefits, exceed the subtractions, or costs, that is, whether a project increases or decreases the national income. The results of the benefit-cost analysis are usually presented in terms of the benefit-cost ratio.

¹For fuller discussion of benefit-cost analysis see Federal Interagency River Basin Committee, Subcommittee on Benefits and Costs, Proposed Practices of Economic Analysis of River Basin Projects, Washington, D. C., May 1950, and O. Eckstein, Water Resource Development, The Economics of Project Evaluation, Harvard University Press (forthcoming).

TABLE I.—Benefit-cost ratios of projects for which funds were requested in 1957 budget

Benefit-cost ratio	Number of projects				
	Navigation	Flood control	Multipurpose Corps of Engineers	Bureau of Reclamation	
0 to 0.99.....					1
1.0 to 1.29.....	1	8	8		5
1.3 to 1.59.....	6	8	6		4
1.6 to 1.99.....	4	6	4		2
2.0 to 2.99.....	6	6	1		6
3.0 to 4.99.....		1			4
Over 5.0.....		2			1
	Ultimate total cost ¹				
0 to 1.0.....					3
1.0 to 1.3.....	1,000	115	837		100
1.3 to 1.6.....	480	157	801		222
1.6 to 2.0.....	180	130	405		12
2.0 to 3.0.....	198	431	158		388
3.0 to 5.0.....		24			838
Over 5.0.....		141			13

¹ In millions of dollars.

Table I is a tabulation of the benefit-cost ratios submitted by the Corps of Engineers and the Bureau of Reclamation for the projects included in the budget requests for fiscal 1957. Most of the projects are already under construction. The group as a whole will constitute the bulk of the construction program of the next several years. While all the projects (except one) have benefit-cost ratios above 1.0, the table must be interpreted in the light of the quality of the benefit-cost figures.

BENEFIT-COST ANALYSES AS INDICATORS OF CHANGE IN NATIONAL INCOME

The concepts and techniques that have been employed by the agencies to measure benefits in the past 15 years have yielded figures which considerably overstate the additions to national income. In this section we examine some of the major sources of bias. We interpret the purpose of benefit-cost analyses to be the measurement of benefits and costs "to whomsoever they may accrue" in the Nation, which is its purpose as specified in the Flood Control Act of 1936 for that field.

Indirect benefits

The biggest source of bias in benefit-cost analysis is the excessive use of indirect (or secondary) benefits. Benefits are claimed in two categories, direct and indirect, where the former correspond to market values or their equivalents, and the latter to a potpourri of other concepts designed to measure repercussion effects. In the case of irrigation, they are, primarily, profits accruing in processing and on sales of project inputs; in flood control they are designed to represent the reduction of losses of wage payments and of the other losses attributed to the interruption of economic activity due to floods; in navigation they are the benefits of the stimulation of activity along the waterway and of increased property values. In the case of irrigation projects, indirect benefits may exceed direct benefits, while in the other fields

they vary more widely, but are sometimes also of the same order of magnitude.

In times of full employment, which is the setting in terms of which the programs are justified, there is no economic rationale for claiming significant amounts of indirect benefits. The capital in processing industries would not be idle in the absence of the project; much of the loss of wages and profits caused by floods is compensated by greater activity after the flood and by offsetting gains elsewhere; similarly, the increased rents and profits along waterways are likely to be balanced by losses along transportation routes from which traffic is being diverted.²

Of course, there are some beneficial repercussion effects to which there are no offsets; that is, there are some genuine external economies. Supplemental irrigation water for an agricultural economy that is declining due to deterioration of the water supply may permit more effective utilization of processing capacity and of other sunk investments. On new irrigation projects, some of the capital of associated businesses will earn a higher return than it would earn in its alternative uses. Some of the reductions in income payments caused by floods will not be made up later, and so on. But it is most unlikely that such benefits could exceed more than 10 or 20 percent of primary benefits.

Rail rates as a measure of navigation benefits

The major source of bias in the evaluation of navigation benefits is the use of rail rates as a measure of the alternative cost of transport. From the point of view of the transport user, it is true that the rail rates are the cost that he actually would incur. But, from the point of view of the Nation, it is only the long-run, out-of-pocket, rail cost which should be counted. The difference between rail rates and out-of-pocket cost is a commodity's contribution to system overhead, and, in the event the commodity is diverted to the waterway, either the railroad suffers a loss of income, or the rates on shipments that cannot be diverted are increased. With the typical gap between out-of-pocket costs and rail rates on the order of 20-30 percent, the resultant overstatement of navigation benefits is very considerable. An arithmetic example will make this clear. Suppose a commodity is shipped at a rail rate of \$3.60 a ton, but with out-of-pocket costs equal to \$2.70. If the cost of shipping by barge is \$1.50, the navigation benefit would be figured to be \$2.10 a ton, although the benefit, from a national point of view, is only \$1.20. Thus a gap of 25 percent between rail rates and out-of-pocket costs leads to an overestimate of benefit of 43 percent.

The cost of land

On the cost side of the analysis, land and property to be inundated by a reservoir are valued at their market prices. This understates the cost in the benefit-cost framework. The reason lies in the difference in the interest rates applied on the two sides of the analysis. Benefits are discounted at interest rates of 2½ to 3 percent; the mar-

² For fuller analysis of indirect benefits, see J. Margolis, *Secondary Benefits, External Economies, and the Justification of Public Investment*, Review of Economics and Statistics, August 1957, pp. 284-291; H. B. Selby, *Indirect Benefits From Irrigation Development*, Journal of Land and Public Utilities Economics, February 1944, pp. 45-51; and O. Eckstein, *op. cit.*, chs. 5, 6, and 7.

ket value of land, however, is determined by the income stream it can produce and by the rate at which this stream is capitalized. This rate is far greater than 3 percent, ranging from 5 to 10 percent at different times. Thus, if a piece of farmland can produce a net income of \$100, it may sell for \$1,000 to \$2,000. To show the nature of the bias, let us suppose that its income is capitalized at 6 percent, making its market value, and hence its stated cost, \$1,667. If the benefit-cost analysis uses an interest rate of 3 percent, the annual cost of flooding the land will be stated as \$50, even though the loss of farm income is twice that figure. If the benefit of the project is between \$50 and \$100 a year, the benefit-cost analysis, by present standards, would justify the project, even though the change in income would be negative.

This bias understates this part of project costs by 50 percent. Where a reservoir floods good farmland, this type of cost may be as much as 30 percent of the total, and hence the effect on the cost side of the benefit-cost ratio may be an understatement of costs of up to 30 percent. To eliminate it, we can compute the annual income realized from the land to be flooded, or, in the event that market value of land is to be used, the cost must be doubled if the benefit-cost analysis is to be internally consistent and symmetrical.

Interest rates

The interest rates that have been used for the capital charges represent another important source of understatement of costs. Rates of 2½ and 3 percent have been applied, presumably because the rates on Government securities used to be at that level. The long-term rates paid by Government have risen to 4 percent or so in recent years, which suggests some increase in interest charges, following this line of reasoning. But even this adjustment does not result in proper interest rates, for, in actuality, the funds for projects in the last decade have not come from deficit financing but from taxes. Therefore, the real interest cost of projects depends upon the value of the capital in its alternative uses, uses from which it is withdrawn by taxation. Recent statistical efforts to measure this opportunity cost of Federal funds raised by taxation yield estimates between 5¼ and 6½.³ These estimates are based on studies of the likely changes in taxes that would be permitted by expenditure reduction, the incidence of such tax cuts, the rates of return that would be earned on the share of resources drawn out of investments, and the interest rates at which consumers make their voluntary saving-borrowing decisions.

These estimates of opportunity costs do not necessarily argue that Federal water projects should be planned with interest rates of that level. The time perspective of the Government may be considerably longer than that of private persons; it may value more highly the benefits accruing to unborn generations than individuals in their voluntary private choices. Also, the conservation aspect of the program argues against high interest rates. But, if low interest rates are used in the design and evaluation of projects, we must be on guard against using the low interest rate as a device to justify poor projects. To assure that capital is not wasted on investments incapable of yield-

³ J. V. Krutilla and O. Eckstein, *Multiple-Purpose River Development, Studies in Applied Economic Analysis* (Johns Hopkins Press), forthcoming, ch. 4.

ing a reasonable return, projects should not be considered justified unless benefits exceed costs by a compensating margin. Given the average capital intensity of projects, a benefit-cost ratio of 1.3 and an interest rate of 3 percent assure that the average rate of return of projects is equal to the opportunity costs of the money.

The present program

Keeping in mind these considerations, an examination of table 1 shows that a significant share of the projects in the present program is not justified economically, which is to say that the national income will be reduced by their construction. Because of the wide range of concepts and of quality in benefit-cost estimation, it is not possible to pick any one benefit-cost ratio and say that all projects that exceed it are justified and all others are not. But, given the magnitudes of the biases we have listed, and our list is far from exhaustive, there is very strong evidence that less than half of the projects can be justified. In some instances, it is not the overall quality of the project which is inadequate, but rather the excessively large scale for which the project plans provide. But, whatever the cause, our conclusion is inescapable, as far as any evidence on the economics of the projects so far presented by the agencies is concerned.

There are other projects that are eminently worth while, representing genuine opportunities for public investment, the progress of which is much delayed by the need to spread limited funds over so many undertakings. There are also enormous backlogs of projects not yet started, parts of which are of high quality. Emphasis on projects of the highest economic merit would assure that the programs make a positive contribution to national income.

What can be done to promote the selection of projects which are of greatest advantage from the national point of view? Perhaps the most important step is a reform of the benefit-cost-evaluation procedures and rigid insistence that only justified projects be built. The Subcommittee on Benefits and Costs of the Interagency Committee on Water Resources has, for almost a decade, been working to improve these procedures. But progress has been slow, primarily because there is little pressure from the Congress or the President in this direction. Before the benefit-cost figures can command public confidence, the sources of upward bias enumerated above must be removed. Also, to assure that the estimates of physical and economic magnitudes in project analyses be realistic, the review function in the executive branch should be strengthened by establishment of an independent board of review⁴ with a modest but highly competent staff of its own, or by increasing the staff and power of the Division of Resources and Civil Works of the Bureau of the Budget.

WATER RESOURCE PROJECTS AND NATIONAL ECONOMIC GROWTH

While the return on the investment in many projects is much below the rates of return earned in other sectors of the economy, the projects nevertheless represent additions to the Nation's capital stock. With the funds for the projects raised by taxation, a substantial part of the resources required for projects is drawn out of consumption uses,

⁴ This is one of the recommendations of the President's Advisory Committee on Water Resources Policy. Water Resources Policy, December 22, 1955.

the rest out of investment. Insofar as it is the former, the rate of capital accumulation is increased; insofar as it is the latter, resources are diverted from private investments yielding certain rates of return; and if the project yields a lower return, the rate of growth of the system is retarded.

In order to estimate the percent of resources for projects which are drawn out of consumption and investment, it is necessary to make some assumption about the nature of the tax cut which is being forestalled by these particular expenditures. If the next tax cut would be an increase in the exemption of the personal income tax or a splitting of the first bracket, then much the largest part of the resources could be assumed to be drawn out of consumption, thus significantly increasing the share of national income going into investment, and thereby raising the rate of growth. If an increase in the rate of growth is in itself desirable, and the growth of the Russian economy is a strong argument in support of that position, then projects yielding a reasonable rate of return can be justified on these grounds. But these considerations do not support the undertaking of submarginal projects, yielding, as they do, rates of return of 1 to 4 percent. For one thing, there are far more effective means by which the Government can step up the growth rate, such as changes in the corporation income tax or investment in technical education and scientific research; for another, at least to some extent, submarginal projects compete for the outputs of capital-goods industries, driving up the prices of capital goods and thereby discouraging a certain amount of private investment.

If it is assumed that the forestalled tax cut would be much more favorable to investment, perhaps consisting of a reduction of corporation income taxes and of upper-bracket personal income-tax rates, the case against submarginal water projects becomes even stronger. With the bulk of resources for the projects drawn out of investment rather than consumption, the loss in potential future returns on the private investments is likely to outweigh the returns on the water project. Further, the private investments generate subsequent reinvestment through accumulation of depreciation allowances and the plowing back of retained profits, while the public projects, with their extremely limited repayment requirements, ultimately simply have their capital consumed, though at a very slow rate, given the extreme durability of many water-resource projects.

Thus, it can be seen that the criterion of economic growth reinforces our previous conclusions. Projects with adequate rates of return, reflected in sufficiently high benefit-cost ratios, hasten the rate of growth of the economy, particularly if the funds for the projects are taxed out of consumption uses. Submarginal projects, on the other hand, are likely to reduce the economy's rate of growth.

EFFECT ON REGIONAL INCOME AND GROWTH

There is little doubt that the income of a region in which a project is built will be increased. The disbursement of public funds for construction and the economic opportunities created by the project affect the incomes of residents in the area favorably, and since, on most projects, much the largest part of project costs is covered out of national tax revenues, the cost borne locally will fall far short of the

benefits. If regional development is a bona fide objective of the Federal Government, the regional effects of projects may be considered to outweigh in significance the effects on national income. Statistical investigations into the magnitude of incomes generated locally by the operation of irrigation projects indicate that income in associated businesses near the project is about 1.1 to 1.7 times as large as the income earned on the project.⁵ While most of this income represents diversion from one region to another, if the development of a certain region is weighed particularly heavily in Federal policy, it can be argued that the regional effects may provide a basis for project justification.

Two broad lines of argument have been used; on the one hand, it is contended that regions that have been laggard in developing should be the recipients of Federal developmental expenditures; on the other, regions that have been growing very rapidly, in part due to past Federal investments, must be given further investments to assure continuance of the high rate of growth. If both of these lines of argument are accepted, there is the implicit view that all regions in the United States should grow at the same rate. Given the diversity of resource endowments, and given the preferences of people to live in different places, this position in favor of uniform regional growth is indefensible. In the case of laggard regions, which are, in some cases, also the regions with lowest per capita incomes, the Government should give some sort of assistance. But whether water-resource projects are the best method of aiding the people is not at all clear. In the case of the rapidly growing regions, clearly there will be a need for public services, including the services supplied by the Federal Government, such as flood control and navigation projects. Since the Government has supplied these services in the old regions, it presumably should continue to do so elsewhere as the need arises. But where the subsidized public projects are the main cause of growth, they must be judged by their capability to contribute to the national economy, and not by their regional effects, for given a sufficient subsidization of certain key factors of production, such as power or transportation or water, economic growth can be stimulated anywhere.

The magnitude of economic activity that may be triggered in this way may be very large and the resultant regional benefit considerable. But as a matter of national policy, the extent to which this is merely diversion of activity must be kept in mind. The creation of regional economies under hothouse conditions, dependent on the continued largesse of the Federal purse, may be undesirable from many points of view, not the least of which is the resultant political pressure for continuance and expansion of the subsidies.

WATER RESOURCE PROJECTS AND BUSINESS CYCLE POLICY

The preceding discussion assumed that the economy is in full employment. In times of depression, the opportunity cost on the funds and the resources used for projects is very low, of course, and insofar as there are multiplier effects, the costs may actually prove to be benefits. In the event of serious depression, water-resource projects

⁵ These studies are summarized in M. E. Marts, *Use of Indirect Benefit Analysis in Establishing Repayment Responsibility for Irrigation Projects*, Economic Geography, April 1956, pp. 132-138.

are among the relatively few areas in which the Federal Government can step up the rate at which it contributes to the effective demand for goods and services. The evaluation procedures need to be adapted drastically for this condition, stressing the low opportunity costs and the employment-generating potential of projects.

In the depression of the 1930's it was found that a considerable period elapsed between the time the decision was made to use public works as a countercyclical weapon and the time significant employment effects began to be felt,⁶ a period commonly well in excess of a year. To some extent this timelag has been shortened. The coordinator of public-works planning in the Executive Office now maintains an account of the shelf of project plans in the hands of various agencies, and while the administrative and engineering capability to simultaneously undertake a large fraction of the shelf is quite limited, the rate of expenditures could be stepped up considerably. The large number of projects under construction at any one time, while undesirable from some points of view, does make possible the rapid expansion of outlays, simply by accelerating the rate of construction. But there still remain severe obstacles, of which the most important is the necessity for Congress to vote specific appropriations. While Congress is not in session, little can be done.

Water-resource projects would only be appropriate for coping with major depressions. For the typical minor cycle, lasting 2 years or so, the technology of project building precludes countercyclical variation. The typical project takes several years to construct; to phase the expenditure flow against minor cycles, a precision in short-run forecasting would be required which is beyond the present capability of economic science.

Should there be another major depression, water-resource and other Federal public-works programs can make a contribution. Given the size of the fluctuations in total effective demand that would be involved, and given the size of the Federal budget, it is clear that public works are no more than a minor weapon in the stabilizer's arsenal. At the present time, Federal water-resource expenditures are one-fourth of 1 percent of GNP and are little more than 1 percent of the Federal budget. This is no reason to overlook the potential, and particularly for the large multidam, multipurpose program on major rivers, depressions provide the opportunity to make large investments in this kind of social overhead at little cost.⁷

THE PARTNERSHIP APPROACH

Prompted both by ideological and budgetary considerations, the Eisenhower administration has sought to transfer some of the water-resource activities to private companies and to State and local units of government. Progress has been rather slow and the reasons are not hard to find. The users of the services are reluctant to surrender

⁶ U. S. National Resources Planning Board, *The Economic Effects of the Federal Public Works Expenditures, 1933-38*, Washington, 1940.

⁷ We have assumed that any future shortage of effective demand is of a short-run nature. If, at some point in the future, possibly after Government budget outlays have declined, there should prove to be inadequate investment opportunities as a long-run phenomenon, causing unemployment and an inadequate rate of growth, water-resource projects of the sort most likely to generate complementary investments could be considered as an offset. This point of view is expressed forcefully by Professor Hansen in *Trends and Cycles in Economic Activity*, Review of Economics and Statistics, May 1957, pp. 105-115.

the subsidies that came with the Federal programs; the State and local governments are not eager to take on responsibilities without Federal evacuation of some tax areas,⁸ and perhaps most important of all, the political struggles between advocates of public and of private power is still more or less in a state of stalemate.

Greater private and local participation in water-resource development would be extremely desirable. First, it is much the surest way to eliminate projects of no economic merit, for the local people will not be willing to bear the costs unless the benefits can really be expected to accrue.⁹ Also, if we accept the present limit on the national debt and the resultant pressure against undertaking public investments as one of our institutional assumptions, partnership—or completely private development—may provide the only means by which needed projects may be financed. In my view, these are overriding reasons.

So far, however, little progress has been made in assuring the comprehensive development and integrated operation of large river systems. Recent researches by Dr. J. V. Krutilla indicate that the losses caused by failure to assure private development which is efficient from the public point of view are likely to be severe.¹⁰ Under present law, private companies cannot be compensated for the increase in energy made possible at public dams located downstream from the private installation. This is an acute problem on rivers where hydroelectric development was started in public hands but is to be continued privately, for there is no incentive for the private company to build the proper amount of storage capacity into its reservoirs, or to plan its release schedules in a manner most beneficial to the whole river system.¹¹ The resultant losses can run into millions of dollars. Also, some of the outputs of projects are nonmarketable; for example, flood control cannot be sold, and so no revenues are produced. A private company responsible to its stockholders cannot be expected to incur large expenses to provide these free gifts to the area. Theoretically, the Federal Power Commission has the power to require private companies to provide such benefits as a condition of issuing its license, but as the researches of Dr. Krutilla show, in practice, the FPC exercises this power with extreme moderation. If there is to be an increase of private development of our water resources, serious efforts need to be made to find answers to this range of problems.

REVENUE REQUIREMENTS OF PROJECTS

In principle, costs incurred for irrigation, power, and municipal water supply are considered reimbursable; that is, the beneficiaries

⁸ Nor did State officials respond with much enthusiasm to the offer of President Eisenhower to transfer both some taxes and activities to the States. *New York Times*, June 26, 1957, p. 1.

⁹ Where the local political unit is large, some of the problems that have plagued the Federal program recur. The beneficiaries of projects will endeavor to get the rest of the community to subsidize them by financing projects partly out of general revenues. It is the failure of the beneficiaries to finance the projects which unlooses the political pressures which push governments into unjustified undertakings. For a billion-dollar example at the State level, see J. C. DeHaven and J. Hishleifer, *Feather River Water for Southern California*, *Journal of Land Economics*, August 1957, pp. 198-200.

¹⁰ J. V. Krutilla and O. Eckstein, *Multiple Purpose River Development*, Johns Hopkins Press (forthcoming), especially chs. 5 and 6.

¹¹ For some possible solutions to these problems, see Krutilla and Eckstein, *op. cit.*, chs. 5, 6, and 9.

are supposed to repay the costs over the life of the project, usually assumed to be 50 years. Navigation and flood control are not reimbursable, though local interests are required to make contributions of lands and easements for local projects. In practice, with the exception of power and water supply, local revenues and contributions have been extremely small. In the case of irrigation, no interest is charged and revenues from power are used to help defray the investment. To illustrate this procedure, table II summarizes the financial analysis of the irrigation investment so far authorized for the Colorado River storage project. If interest is ignored, total payments of irrigators plus the assigned power revenues will equal the irrigation investment. In fact, the Government does pay interest, and even if we use a rate as low as 2½ percent, the irrigators pay only 6 percent of the total cost, power pays 49 percent, and the taxpayer 45 percent. This computation assumes that the power rates can actually be maintained at the high levels that are intended, a dubious assumption considering the rate of progress being made on atomic and solar power.

TABLE II.—*Summary of repayment analysis of irrigation investment of Colorado River storage project*¹

Source	Total payments, ignoring interest (in millions)	Present value of total payments ² (in millions)	Percent distribution of total payments, including interest
Payments of irrigators ³	\$36.6	\$15.2	5.4
Contribution from power revenues ⁴	246.2	139.7	49.4
Contribution of taxpayers.....	127.9	45.2
Total.....	282.8	282.8	100.0

¹ Source: U. S. Congress, House of Representatives, Report on Colorado River Storage Project, H. Rept. 1087, 84th Cong., 1st sess. Our analysis assumes that the cost allocation is correct.

² We assume an interest rate of 2½ percent.

³ Assumes equal annual payments for 50 years after a development period of 10 years.

⁴ Assumes equal payments for 50 years. Since actual power revenues will build up gradually, the contribution from power is overstated slightly.

On flood-control projects, local contributions cover 5 percent of the cost of the program, and are confined to local projects.¹² It would be difficult to make flood control completely reimbursable because of the large number of people who are protected and because communities other than the main beneficiaries of any project are unlikely to be willing to contribute, knowing that if the project is built the protection cannot be withheld from them whether they pay or not. Nevertheless, the Federal Government could insist on considerably larger contributions than it now receives, and if it encouraged the formation of flood-control districts, it could collect local contributions even in the case of reservoir projects, which are now exempt by law.

Our inland waterway system has traditionally been free of tolls. Local contributions are required for local works, but not on the waterways themselves. For the St. Lawrence seaway, strictly speaking an international project, it has been planned to impose tolls sufficient to make it self-liquidating, and it was on that basis that the authoriz-

¹² Report of the Chief of Engineers to the Subcommittee To Study Civil Works, published as vol. 3 of U. S. Army Corps of Engineers, Annual Report of the Chief of Engineers, 1951, pt. I, p. 337.

ing legislation was passed. There is now considerable agitation to eliminate the tolls.

In all of these fields, whether revenues should be collected or not is fundamentally a question of equity on which economics can shed no light. Whether the Congress chooses to redistribute income from the taxpayers to the project beneficiaries is an ethical and political issue. Nevertheless, the effect of the lack of revenue requirements on the efficiency of the water-resource program must be mentioned. Clearly here lies the main source of pressure for bad projects, and until this is diminished it is impossible to have the programs concentrated on projects of genuine economic merit. Also, with the severe fiscal needs of the Federal Government in these times, project charges should be considered a potential tax source. Surely money raised through charges on project beneficiaries would be considered an equitable tax.

CONCLUDING COMMENTS

America's water problem is receiving growing public attention. Newspapers run features on the threatening water shortage and on the possibilities of towing icebergs to southern California. There are severe shortages in many places, and the demands for water will continue to grow at a rate greater than the growth of the economy. Much research is needed to devise economical means of meeting this problem, and increased expenditures of Federal funds for this purpose can be expected to yield large benefits in the long run. Also, the growth of the economy's assets increases the potential losses from floods and generates continued need for additional control measures. Thus the significance of the problems and the need for solution can be expected to continue in the coming years.

The present water-resource program meets this challenge most imperfectly, however. In the case of at least half of all the projects that are being built, it is unlikely that their effect on national income will be positive; and even though they all represent additions to the Nation's capital stock, the return on many projects is so low that their net effect will be to reduce the rate of growth of the economy. The effect on regional incomes and growth is less ambiguous because of the large subsidies in projects; but regional effects, being in large part diversionary, are only a limited justification for national investments.

To improve the quality of the water-resource program, the following steps are suggested:

1. Improve the concepts of benefits and costs used for the economic analyses.
2. Make organizational changes in the executive branch of the Government to strengthen the process of review of project proposals.
3. Increase the level of user charges to discourage the political pressure for dubious projects.
4. Make legal and administrative changes to assure that partnership projects develop our rivers as efficient integrated systems.

Once the quality of the program is assured, we will be capable of dealing with the worsening water problems in the coming years.