

For release on delivery
10:30 a.m. local time
October 18, 2005
(9:30 p.m. EDT October 17, 2005)

Remarks by

Alan Greenspan

Chairman

Board of Governors of the Federal Reserve System

before the

Japan Business Federation, the Japan Chamber of Commerce and Industry,

and the Japan Association of Corporate Executives

Tokyo, Japan

October 18, 2005

Even before the devastating hurricanes of August and September 2005, world oil markets had been subject to a degree of strain not experienced for a generation. Increased demand and lagging additions to productive capacity had eliminated a significant amount of the slack in world oil markets that had been essential in containing crude oil and product prices between 1985 and 2000. In such tight markets, the shutdown of oil platforms and refineries last month by Hurricanes Katrina and Rita was an accident waiting to happen. In their aftermath, prices of crude oil worldwide moved sharply higher, and with refineries stressed by a shortage of capacity, margins for refined products in the United States roughly doubled. Prices of natural gas soared as well.

Oil prices had been persistently edging higher since 2002 as increases in global oil consumption progressively absorbed the buffer of several million barrels a day in excess capacity that stood between production and demand. Any pickup in consumption or shortfall in production for a commodity as price inelastic in the short run as oil was bound to be immediately reflected in a spike in prices. Such a price spike effectively represented a tax that drained purchasing power from oil consumers. Although the global economic expansion appears to have been on a reasonably firm path through the summer months, the recent surge in energy prices will undoubtedly be a drag from now on. In the United States, Japan, and elsewhere, the effect on growth would have been greater had oil not declined in importance as an input to world economic activity since the 1970s.

How did we arrive at a state in which the balance of world energy supply and demand could be so fragile that weather, not to mention individual acts of sabotage or local insurrection, could have a significant impact on economic growth? Even so large a weather event as August and September's hurricanes, had they occurred in earlier decades of ample oil capacity, would

have had hardly noticeable effects on crude prices if producers placed their excess supplies on the market or on product prices if idle refinery capacity were activated.

The history of the world petroleum industry is one of a rapidly growing industry seeking the stable prices that have been seen by producers as essential to the expansion of the market. In the early twentieth century, pricing power was firmly in the hands of Americans, predominately John D. Rockefeller and Standard Oil. Reportedly appalled by the volatility of crude oil prices that stunted the growth of oil markets in the early years of the petroleum industry, Rockefeller had endeavored with some success to stabilize those prices by gaining control by the turn of the century of nine-tenths of U.S. refining capacity. But even after the breakup of the Standard Oil monopoly in 1911, pricing power remained with the United States--first with the U.S. oil companies and later with the Texas Railroad Commission, which raised limits on output to suppress price spikes and cut output to prevent sharp price declines.

Indeed, as late as 1952, crude oil production in the United States (44 percent of which was in Texas) still accounted for more than half of the world total. Excess Texas crude oil capacity was notably brought to bear to contain the impact on oil prices of the nationalization of Iranian oil a half-century ago. Again, excess American oil was released to the market to counter the price pressures induced by the Suez crisis of 1956 and the Arab-Israeli War of 1967.

Of course, concentrated control in the hands of a few producers over any resource can pose potential problems. In the event, that historical role ended in 1971, when excess crude oil capacity in the United States was finally absorbed by rising world demand. At that point, the marginal pricing of oil, which for so long had been under the control of international oil companies, predominantly American, abruptly shifted to a few large Middle East producers and

to greater market forces than those that they and the other members of the Organization of Petroleum Exporting Countries (OPEC) could contain.

To capitalize on their newly acquired pricing power, many producing nations, especially in the Middle East, nationalized their oil companies. But the full magnitude of the pricing power of the nationalized oil companies became evident only in the aftermath of the oil embargo of 1973. During that period, posted crude oil prices at Ras Tanura, Saudi Arabia, rose to more than \$11 per barrel, a level significantly above the \$1.80 per barrel that had been unchanged from 1961 to 1970. The further surge in oil prices that accompanied the Iranian Revolution in 1979 eventually drove up prices to \$39 per barrel by February 1981 (\$75 per barrel in today's prices).

The higher prices of the 1970s abruptly ended the extraordinary growth of U.S. and world consumption of oil and the increased intensity of its use that was so evident in the decades immediately following World War II. Since the more than tenfold increase in crude oil prices between 1972 and 1981, world oil consumption per real dollar equivalent of global gross domestic produce (GDP) has declined by approximately one-third.

In the United States, between 1945 and 1973, consumption of petroleum products rose at a startling average annual rate of 4-1/2 percent, well in excess of growth of our real GDP. However, between 1973 and 2004, oil consumption grew in the United States, on average, at only 1/2 percent per year, far short of the rise in real GDP. In consequence, the ratio of U.S. oil consumption to GDP fell by half.

Much of the decline in the ratio of oil use to real GDP in the United States has resulted from growth in the proportion of GDP composed of services, high-tech goods, and other presumably less oil-intensive industries. Additionally, part of the decline in this ratio is due to

improved energy conservation for a given set of economic activities, including greater home insulation, better gasoline mileage, more efficient machinery, and streamlined production processes. These trends have been ongoing but have likely intensified of late with the sharp, recent increases in oil prices.

In Japan, which until recently was the world's second largest oil consumer, the growth of demand was also strong before the developments of the 1970s. Subsequently, shocked by the increase in prices and without indigenous production to cushion the effects on incomes, Japan sharply curtailed the growth of its oil use, reducing the ratio of oil consumption to GDP by about half as well.

Although the production quotas of OPEC have been a significant factor in price determination for a third of a century, the story since 1973 has been as much about the power of markets as it has been about power over markets. The incentives to alter oil consumption provided by market prices eventually resolved even the most seemingly insurmountable difficulties posed by inadequate supply outside the OPEC cartel.

Many observers feared that the gap projected between supply and demand in the immediate post-1973 period would be so large that rationing would be the only practical solution. But the resolution did not occur that way. In the United States, to be sure, mandated fuel-efficiency standards for cars and light trucks induced the slower growth of gasoline demand. Some observers argue, however, that, even without government-enforced standards, market forces would have led to increased fuel efficiency. Indeed, the number of small, fuel-efficient Japanese cars that were imported into U.S. markets rose throughout the 1970s as the price of oil moved higher.

Moreover, at that time, prices were expected to go still higher. For example, the U.S. Department of Energy in 1979 had projections showing real oil prices reaching nearly \$60 per barrel by 1995--the equivalent of more than \$120 in today's prices. The failure of oil prices to rise as projected in the late 1970s is a testament to the power of markets and the technologies they foster.

Today, the average price of crude oil, despite its recent surge, is still in real terms below the price peak of February 1981. Moreover, since oil use, as I noted, is only two-thirds as important an input into world GDP as it was three decades ago, the effect of the current surge in oil prices, though noticeable, is likely to prove significantly less consequential to economic growth and inflation than the surge in the 1970s.

The petroleum industry's early years of hit-or-miss exploration and development of oil and gas has given way to a more systematic, high-tech approach. The dramatic changes in technology in recent years have made existing oil and natural gas reserves stretch further while keeping energy costs lower than they otherwise would have been. Seismic imaging and advanced drilling techniques are facilitating the discovery of promising new reservoirs and are enabling the continued development of mature fields. Accordingly, one might expect that the cost of developing new fields and, hence, the long-term price of new oil and gas would have declined. And, indeed, these costs have declined, though less than they might otherwise have done. Much of the innovation in oil development outside OPEC, for example, has been directed at overcoming an increasingly inhospitable and costly exploratory environment, the consequence of more than a century of draining the more immediately accessible sources of crude oil.

Still, consistent with declining long-term marginal costs of extraction, distant futures prices for crude oil moved lower, on net, during the 1990s. The most-distant futures prices fell from a bit more than \$20 per barrel before the first Gulf War to less than \$18 a barrel on average in 1999.

Such long-term price stability has eroded noticeably over the past five years. Between 1991 and 2000, although spot prices ranged between \$11 and \$35 per barrel, distant futures exhibited little variation. Since then, distant futures prices have risen sharply. In early August, prices for delivery in 2011 of light sweet crude breached \$60 per barrel, in line with recent increases in spot prices. This surge arguably reflects the growing presumption that increases in crude oil capacity outside OPEC will no longer be adequate to serve rising world demand going forward, especially from emerging Asia. Additionally, the longer-term crude price has presumably been driven up by renewed fears of supply disruptions in the Middle East and elsewhere.

But the opportunities for profitable exploration and development in the industrial economies are dwindling, and the international oil companies are currently largely prohibited, restricted, or face considerable political risk in investing in OPEC and other developing countries. In such a highly profitable market environment for oil producers, one would have expected a far greater surge of oil investments. Indeed, some producers have significantly ratcheted up their investment plans.

But because of the geographic concentration of proved reserves, much of the investment in crude oil productive capacity required to meet demand, without prices rising unduly, will need to be undertaken by national oil companies in OPEC and other developing economies. Although

investment is rising, the significant proportion of oil revenues invested in financial assets suggests that many governments perceive that the benefits of investing in additional capacity to meet rising world oil demand are limited. Moreover, much oil revenue has been diverted to meet the perceived high-priority needs of rapidly growing populations. Unless those policies, political institutions, and attitudes change, it is difficult to envision adequate reinvestment into the oil facilities of these economies.

Besides feared shortfalls in crude oil capacity, the status of world refining capacity has become worrisome as well. Crude oil production has been rising faster than refining capacity over the past decade. A continuation of this trend would soon make lack of refining capacity the binding constraint on growth in oil use. This may already be happening in certain grades, given the growing mismatch between the heavier and more sour content of world crude oil production and the rising world demand for lighter, sweeter petroleum products.

There is thus an especial need to add adequate coking and desulphurization capacity to convert the average gravity and sulphur content of much of the world's crude oil to the lighter and sweeter needs of product markets, which are increasingly dominated by transportation fuels that must meet ever more stringent environmental requirements. Yet the expansion and the modernization of world refineries are lagging. For example, no new refinery has been built in the United States since 1976. The consequence of lagging modernization is reflected in a significant widening of the price spread between the higher priced light sweet crudes such as Brent and the heavier crudes such as Maya.

To be sure, refining capacity continues to expand, albeit gradually, and exploration and development activities are ongoing, even in developed industrial countries. Conversion of the

vast Athabasca oil sands reserves in Alberta to productive capacity, while slow, has made this unconventional source of oil highly competitive at current market prices. However, despite improved technology and high prices, proved reserves in the developed countries are being depleted because additions to these reserves have not kept pace with production.

* * *

The production, demand, and price outlook for oil beyond the current market turbulence will doubtless continue to reflect longer-term concerns. Much will depend on the response of demand to price over the longer run. If history is any guide, should higher prices persist, energy use over time will continue to decline relative to GDP. In the wake of sharply higher prices, the oil intensity of the U.S. economy, as I pointed out earlier, has been reduced by about half since the early 1970s. Much of that displacement was achieved by 1985. Progress in reducing oil intensity has continued since then, but at a lessened pace. For example, after the initial surge in the fuel efficiencies of our light motor vehicles during the 1980s, reflecting the earlier run-up in oil prices, improvements have since slowed to a trickle.

The more-modest rate of decline in the energy intensity of the U.S. economy after 1985 should not be surprising, given the generally lower level of real oil prices that have prevailed since then. With real energy prices again on the rise, more-rapid decreases in the intensity of energy use in the years ahead seem virtually inevitable. Long-term demand elasticities over the past three decades have proved noticeably higher than those evident in the short term. Indeed, gasoline consumption has declined markedly in the United States in recent weeks, presumably partly as a consequence of higher prices.

* * *

Altering the magnitude and manner of energy consumption will significantly affect the path of the global economy over the long term. For years, long-term prospects for oil and natural gas prices appeared benign. When choosing capital projects, businesses in the past could mostly look through short-run fluctuations in oil and natural gas prices, with an anticipation that moderate prices would prevail over the longer haul. The recent shift in expectations, however, has been substantial enough and persistent enough to direct business-investment decisions in favor of energy-cost reduction. Over the past decade, energy consumed, measured in British thermal units, per real dollar of gross nonfinancial, non-energy corporate product in the United States has declined substantially, and this trend may be expected to accelerate in coming years. In Japan, as well, energy use has declined as a fraction of GDP, but these savings were largely achieved in previous decades, and energy intensity has been flat more recently.

We can expect similar increases in oil efficiency in the rapidly growing economies of East Asia as they respond to the same set of market incentives. But at present, China consumes roughly twice as much oil per dollar of GDP as the United States, and if, as projected, its share of world GDP continues to increase, the average improvements in world oil-intensity will be less pronounced than the improvements in individual countries, viewed separately, would suggest.

* * *

We cannot judge with certainty how technological possibilities will play out in the future, but we can say with some assurance that developments in energy markets will remain central in determining the longer-run health of our nations' economies. The experience of the past fifty years--and indeed much longer than that--affirms that market forces play a key role in conserving scarce energy resources, directing those resources to their most highly valued uses. However,

the availability of adequate productive capacity will also be driven by nonmarket influences and by other policy considerations.

To be sure, energy issues present policymakers with difficult tradeoffs to consider. The concentration of oil reserves in politically volatile areas of the world is an ongoing concern. But that concern and others, one hopes, will be addressed in a manner that, to the greatest extent possible, does not distort or stifle the meaningful functioning of our markets. Barring political impediments to the operation of markets, the same price signals that are so critical for balancing energy supply and demand in the short run also signal profit opportunities for long-term supply expansion. Moreover, they stimulate the research and development that will unlock new approaches to energy production and use that we can now only barely envision.

Improving technology and ongoing shifts in the structure of economic activity are reducing the energy intensity of industrial countries, and presumably recent oil price increases will accelerate the pace of displacement of energy-intensive production facilities. If history is any guide, oil will eventually be overtaken by less-costly alternatives well before conventional oil reserves run out. Indeed, oil displaced coal despite still vast untapped reserves of coal, and coal displaced wood without denuding our forest lands.

New technologies to more fully exploit existing conventional oil reserves will emerge in the years ahead. Moreover, innovation is already altering the power source of motor vehicles, and much research is directed at reducing gasoline requirements. We will begin the transition to the next major sources of energy, perhaps before midcentury, as production from conventional oil reservoirs, according to central-tendency scenarios of the U.S. Department of Energy, is projected to peak. In fact, the development and application of new sources of energy, especially

nonconventional sources of oil, is already in train. Nonetheless, the transition will take time. We, and the rest of the world, doubtless will have to live with the geopolitical and other uncertainties of the oil markets for some time to come.