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Remarks by
Alan Greenspan
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The dramatic rise in six-year forward futures prices for crude oil and natural gas over the past few years has received relatively little attention for an economic event that can significantly affect the long-term path of the U.S. economy. Six years is a period long enough to seek, discover, drill, and lift oil and gas, and hence futures prices at that horizon can be viewed as effective long-term supply prices.

These elevated long-term prices, if sustained, could alter the magnitude of and manner in which the United States consumes energy. Until recently, long-term expectations of oil and gas prices appeared benign. When choosing capital projects, businesses could mostly look through short-run fluctuations in prices to moderate prices over the longer haul. The recent shift in expectations, however, has been substantial enough and persistent enough to influence business investment decisions, especially for facilities that require large quantities of natural gas. Although the effect of these developments on energy-related investments is significant, it doubtless will fall far short of the large changes in our capital stock that followed the 1970s surge in crude oil prices.

The energy intensity of the United States economy has been reduced by almost half since the early 1970s. Much of the energy displacement occurred by 1985, within a few years of the peak in the real price of oil. Progress in reducing energy intensity has continued since then, but at a lessened pace. This more-modest pace should not be surprising, given the generally lower level of real oil and natural gas prices that prevailed between 1985 and 2000 and that carried over into electric power prices.

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The production side of the oil and gas markets also has changed dramatically over the

past decade. Technological changes taking place are likely to make existing energy reserves stretch further and to keep long-term energy costs lower than they otherwise would have been. Seismic techniques and satellite imaging, which are facilitating the discovery of promising new reservoirs of crude oil and natural gas worldwide, have nearly doubled the success rate of new-field wildcat wells in the United States during the past decade. New techniques allow far deeper drilling of promising fields, especially offshore. The newer innovations in recovery are reported to have increased significantly the average proportion of oil and, to a lesser extent, gas reserves eventually brought to the surface.

One might expect that, as a consequence of what has been a dramatic shift from the hit-or-miss wildcat oil and gas exploration and development of the past to more-advanced technologies, the cost of developing new fields and, hence, the long-term supply price of new oil and gas would have declined. And, indeed, these costs have declined, but by less than might otherwise have been the case. 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, distant futures prices for crude oil moved lower, on net, during the 1990s as a result of declining long-term marginal costs of extraction. The most-distant futures prices fell from a bit more than \$20 per barrel just before the first Gulf War to \$16 to \$18 a barrel in 1999. Distant futures for natural gas, which were less than \$2 per million Btu at the time of the first Gulf War drifted up to \$2.50 per million Btu by 1999, although those prices remained below the prices of oil on an equivalent Btu basis.

Such long-term price tranquility has faded noticeably over the past four years.

Between 1990 and 2000, although spot prices ranged between \$11 and \$35 per barrel, distant futures exhibited little variation. Currently prices for delivery in 2010 of light sweet crude, roughly equal to West Texas intermediate, have risen to more than \$27 per barrel. A similar pattern is evident in natural gas. Even the spikes in the spot price in 2000 had only a temporary effect on distant natural gas futures prices. That situation changed in 2001, however, when the distant futures prices for gas delivery at the Henry Hub began a rise from \$3.20 per million Btu to almost \$5 today.

The reasons for the sharp increases in both crude and gas distant futures prices seem reasonably straightforward, though they differ in important respects. The strength of crude oil prices presumably reflects fears of long-term supply disruptions in the Middle East that have resulted in an increase in risk premiums being added to the cost of capital. Although there are competitive spillovers from the higher price of oil, the causes of the rise in the long-term supply price of natural gas appear related primarily to supply and demand in North America.

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Today's tight natural gas markets have been a long time in coming. Little more than a half-century ago, drillers seeking valuable crude oil bemoaned the discovery of natural gas. Given the lack of adequate transportation, wells had to be capped or the gas flared. As the U.S. economy expanded after World War II, the development of a vast interstate transmission system facilitated widespread consumption of natural gas in our homes and business establishments. By 1970, natural gas consumption, on a heat-equivalent basis, had risen to three-fourths that of oil. But in the following decade consumption lagged because of

competitive inroads made by coal and nuclear power. Since 1985, natural gas has gradually increased its share in total energy use and, owing to its status as a clean-burning fuel, is projected by the Energy Information Administration of the United States to maintain that higher share over the next quarter century.

Dramatic changes in technology in recent years, while making existing natural gas reserves stretch further, have been unable, in the face of inexorably rising demand, to keep the underlying long-term price for natural gas in the United States from rising.

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Over the past few decades, short-term movements in domestic prices in the markets for crude oil have been determined largely by international market participants, especially OPEC. But that was not always the case.

In the early years of oil development, 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 in the early years of the petroleum industry, Rockefeller endeavored with some success to control those prices. After the breakup of Standard Oil 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 allowable output to suppress price spikes and cut output to prevent sharp declines. Indeed, as late as 1952 U.S. crude oil production still accounted for more than half of the world total. However, that historical role came to an end in 1971, when excess capacity in the United States was finally absorbed by rising demand.

At that point, the marginal pricing of oil, which for so long had been resident on the

gulf coast of Texas, moved to the Persian Gulf. To capitalize on their newly acquired pricing power, many producing nations in the Middle East nationalized their oil companies. But the full magnitude of their pricing power became evident only in the aftermath of the oil embargo of 1973. During that period, posted crude oil prices at Ras Tanura rose to more than \$11 per barrel, significantly above the \$1.80 per barrel that had been unchanged from 1961 to 1970.

The sharp price increases of the early 1970s brought to an abrupt end the extraordinary period of growth in U.S. oil consumption and the increased intensity of its use that was so evident in the decades immediately following World War II. Between 1945 and 1973, consumption of oil products rose at a startling 4-1/2 percent average annual rate, well in excess of growth of real gross domestic product. However, since 1973, oil consumption has grown, on average, only 1/2 percent per year, far short of the rise in real GDP

Although OPEC production quotas have been a significant factor in price determination for a third of a century, the story since 1973 has been as much one of the power of markets as of power over markets. The signals provided by market prices have eventually resolved even the most seemingly insurmountable difficulties of inadequate domestic supply in the United States. The gap projected between supply and demand in the immediate post-1973 period was feared by many to be so large that rationing would be the only practical solution.

But the resolution did not occur quite that way. To be sure, mandated fuel-efficiency standards for cars and light trucks accompanied slower growth of gasoline demand. Some observers argue, however, that, even without government-enforced standards, market forces would have produced increased fuel efficiency. Indeed, the number of small, fuel-efficient

Japanese cars that were imported into the United States markets grew significantly in the late 1970s after the Iranian Revolution drove up crude oil prices to nearly \$40 per barrel.

Moreover, at that time, prices were expected to go still higher. Projections of \$50 per barrel or more were widely prevalent. Our Department of Energy had baseline projections showing prices reaching \$60 per barrel--the equivalent of more than twice that 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, despite its recent surge, the price of crude oil in real terms is only half of what it was in December 1979.

As I indicated earlier, the rise in six-year oil and gas futures prices is almost surely going to affect the growth of oil and gas consumption in the United States and the nature of the capital stock investments currently under contemplation. However, the responses are likely to differ somewhat between plans for oil and those for gas usage.

OPEC, the source of greatest supply flexibility, has endeavored to calibrate crude oil liftings to price. They fear that significant supply excesses will drive down prices and revenues, whereas too low a level of output will elevate prices to a point that will induce long-term reductions in demand for oil and in the associated long-term revenues to be earned from oil.

Natural gas pricing, on the other hand, is inherently far more volatile than oil, doubtless reflecting, in part, less-developed, price-damping global trade. Because gas is particularly challenging to transport in its cryogenic form as a liquid, imports of liquefied natural gas (LNG) into the United States to date have been negligible, accounting for only 2

percent of U.S. gas supply in 2003. Environmental and safety concerns and cost considerations have limited the number of terminals available for importing LNG. Canada, which has recently supplied a sixth of our consumption, has little capacity to significantly expand its exports, in part because of the role that Canadian gas plays in supporting growing oil production from tar sands.

Given notable cost reductions for both liquefaction and transportation of LNG, significant global trade is developing. And high natural gas prices projected by distant futures prices have made imported gas a more attractive option for us. According to the tabulations of BP, worldwide imports of natural gas in 2002 were only 23 percent of world consumption, compared with 57 percent for oil. Clearly, the gas trade has a long way to go.

The gap in the behaviors of the markets for oil and for natural gas is readily observable. The prices of crude oil and products are subject to much price arbitrage, which has the effect of encouraging the transportation of supplies from areas of relative surplus to those of relative shortage and of thereby containing local price spikes. This effect was most vividly demonstrated in 2003, when Venezuelan oil production was essentially shut down. American refiners with unlimited access to world supplies were able to replace lost oil with diversions from Europe, Asia, and the Middle East.

If North American natural gas markets are to function with the flexibility exhibited by oil, more extensive access to the vast world reserves of gas is required. Markets need to be able to adjust effectively to unexpected shortfalls in domestic supply in the same way that they do in oil. Access to world natural gas supplies will require a major expansion of LNG terminal import capacity and the development of the newer offshore re-gasification

technologies. Without the flexibility such facilities impart, imbalances in supply and demand must inevitably engender price volatility.

As the technology of LNG liquefaction and shipping has improved and as safety considerations have lessened, a major expansion of U.S. import capability appears to be under way. These movements bode well for widespread natural gas availability in North America in the next decade and beyond. The near term, however, is apt to continue to be challenging.