S. HRG. 109–950

OIL DEPENDENCE AND ECONOMIC RISK

HEARING

BEFORE THE

COMMITTEE ON FOREIGN RELATIONS
UNITED STATES SENATE

ONE HUNDRED NINTH CONGRESS

SECOND SESSION

JUNE 7, 2006

Printed for the use of the Committee on Foreign Relations

Available via the World Wide Web: http://www.gpoaccess.gov/congress/index.html

U.S. GOVERNMENT PRINTING OFFICE
33–736 PDF WASHINGTON : 2007

For sale by the Superintendent of Documents, U.S. Government Printing Office
Internet: bookstore.gpo.gov Phone: toll free (866) 512–1800; DC area (202) 512–1800
Fax: (202) 512–2250 Mail: Stop SSOP, Washington, DC 20402–0001

COMMITTEE ON FOREIGN RELATIONS

RICHARD G. LUGAR, Indiana, *Chairman*

CHUCK HAGEL, Nebraska
LINCOLN CHAFEE, Rhode Island
GEORGE ALLEN, Virginia
NORM COLEMAN, Minnesota
GEORGE V. VOINOVICH, Ohio
LAMAR ALEXANDER, Tennessee
JOHN E. SUNUNU, New Hampshire
LISA MURKOWSKI, Alaska
MEL MARTINEZ, Florida

JOSEPH R. BIDEN, JR., Delaware
PAUL S. SARBANES, Maryland
CHRISTOPHER J. DODD, Connecticut
JOHN F. KERRY, Massachusetts
RUSSELL D. FEINGOLD, Wisconsin
BARBARA BOXER, California
BILL NELSON, Florida
BARACK OBAMA, Illinois

KENNETH A. MYERS, Jr., *Staff Director*
ANTONY J. BLINKEN, *Democratic Staff Director*

CONTENTS

OIL DEPENDENCE AND ECONOMIC RISK

WEDNESDAY, JUNE 7, 2006

U.S. SENATE,
COMMITTEE ON FOREIGN RELATIONS,
Washington, DC.

The committee met, pursuant to notice, at 9:00 a.m., in room SH–216, Hart Senate Office Building, Hon. Richard G. Lugar (chairman of the committee) presiding.

Present: Senators Lugar, Chafee, Coleman, Voinovich, Alexander, Sununu, Murkowski, Martinez, Biden, Nelson.

OPENING STATEMENT OF HON. RICHARD G. LUGAR, U.S. SENATOR FROM INDIANA

The CHAIRMAN. This hearing of the Senate Foreign Relations Committee is called to order. Let me mention at the outset that the Chair is aware of the vigorous schedules that Senators have, and I want to simply indicate that, for the record, we are likely to have a rollcall vote at about 10 a.m., and at that point the Chair will declare a recess of about 10 minutes in which the Senators may vote, so we'll have that interruption.

Likewise, there will be a joint session of the Congress to hear the distinguished President of Latvia, and some Members may be joining that situation. The hearing, however, will continue here throughout that period of time because this is a serious endeavor and we are very grateful to have our distinguished witness with us this morning. So I, as the Chair, will try to accommodate the Members, but at the outset we know that we have these scheduling situations.

Today the committee meets to continue our examination of the geopolitical consequences of energy imbalances and United States dependence on energy imports. In previous hearings, we have focused on quantifying the costs of U.S. energy dependence and examining options for improving our energy security. We also have explored in detail how energy is shaping our relationships with other nations, including India, China, and the Persian Gulf states. Later this month, we will have hearings that look at energy in the context of our relationships with Latin America and with Russia.

Today, with the help of our esteemed witness, former Federal Reserve Chairman Alan Greenspan, we will have a unique opportunity to examine economic effects of United States energy dependence. We are delighted that Chairman Greenspan has joined us today. He has given extraordinary service to our country over many years, and no one speaks with greater authority on the United States economy. His presence here, for his first Congressional testi-

mony since leaving the Federal Reserve, is a testament to the economic importance he ascribes to solving our energy dilemma.

The Foreign Relations Committee has devoted intense scrutiny to energy issues because we believe that America's national security and our economic well-being depend on reducing our dependence on foreign oil and establishing more predictable, transparent, and cooperative relationships with both producer and consumer nations. To this end, I have introduced the Energy Diplomacy and Security Act which would strengthen United States diplomatic capabilities related to energy and encourage greater international cooperation on energy security.

As Secretary Rice stated before this committee, our diplomatic activities around the world are being—and she used the term—"warped" by petro-politics. Important foreign policy goals—from accelerating progress in the developing world and expanding trade, to preventing weapons proliferation and promoting democratic reform—are being undermined by international energy imbalances that have weakened our foreign policy leverage, while strengthening the hand of oil-rich authoritarian governments. In a speech in March at the Brookings Institution, I attempted to outline these dynamics in greater detail, and I ask those remarks be entered in the record.

[EDITOR'S NOTE.—The aforementinoed speech appears at the end of this hearing in the Additional Material Submitted for the Record section.]

As recently as 4 years ago, spare production capacity exceeded world oil consumption by about 10 percent. As world demand for oil has rapidly increased in the last few years, spare capacity has declined to less than 2 percent. Any major disruption of oil creates scarcity that will drive prices up. Our vulnerability was made clear to Americans after the devastation of Hurricanes Katrina and Rita. But even as supplies rebounded from those disasters, we experienced a continued upward trend in oil prices. Events such as the civil unrest in Nigeria, uncertainty over Iran's nuclear program, and worries over Venezuelan supply have kept the price of oil above $70 a barrel.

Our capacity to deal with these energy vulnerabilities in a foreign policy context is shaped in part by the ability of our own economy to adjust to changing energy markets. Eventually, because of scarcity, terrorist threats, market shocks, and foreign manipulation, the high price of oil will lead to enormous investment in, and political support for, alternatives. The problem is that by the time sufficient motivation comes to the markets, it may be too late to prevent the severe economic and security consequences of our oil dependence.

Today, we will have the benefit of Chairman Greenspan's insights into the risks of oil dependency to our economic prosperity. We are all interested in a clearer picture of how current energy prices are affecting our economy, how our economy may react to certain types of supply disruptions, and what steps we should take as a Nation to reduce the economic risks of our energy vulnerability.

We welcome again Chairman Greenspan to the Foreign Relations Committee, and thank him for lending his expertise to our ongoing

inquiry. At the time that the distinguished ranking member comes I'll recognize him, of course, for his opening comment and statements, but for the moment we want to make the best use of our time and we'd like to proceed directly to our distinguished witness. We're delighted to have you and we would ask you to proceed.

STATEMENT OF HON. ALAN C. GREENSPAN, PRESIDENT, GREENSPAN ASSOCIATES LLC, WASHINGTON, DC

Dr. GREENSPAN. Well, thank you very much Mr. Chairman, Senators. This morning I shall try to detail how the balance of world oil supply and demand has become so precarious that even small acts of sabotage or local insurrection have a significant impact on prices. American business, to date, has largely succeeded in finding productivity improvements that have contained energy costs. American households, however, are struggling with rising gasoline prices.

Even before the devastating hurricanes of last summer, world oil markets had been subject to a degree of strain not experienced for a generation. 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. Today, world oil production stands at about 85 million barrels a day, and little excess capacity remains. Just how much excess capacity and of what quality oil, is a matter of debate. But no matter what the precise answer, the buffer between supply and demand is much too small to absorb shutdowns of even a small part of the world's production. Moreover, growing threats of violence to oilfields, pipelines, storage facilities, and refineries, especially in the Middle East, have increased the private demand to hold oil inventories worldwide. Oil users judge they need to be prepared for the possibility that at some point a raid will succeed, with a devastating impact on supply.

For most of the history of oil, its producers and consumers determined its price. Only those who could physically store large quantities of oil had the ability to trade. But important advances in finance have opened the market to a much larger number of participants. There has been a major upsurge in over-the-counter trading of oil futures and other commodity derivatives. Thus, when in the last couple of years it became apparent that the world's oil industry was not investing enough to expand crude-oil production capacity quickly enough to meet the rising demand, increasing numbers of hedge funds and other institutional investors began bidding for oil. They accumulated it in substantial net long positions in crude oil futures, largely in the over-the-counter market. These net long futures contracts, in effect, constituted a bet that oil prices would rise. The sellers of those contracts to investors, when all of the offsetting claims are considered, are of necessity, the present owners of the billions of barrels of private inventories of oil held throughout the world—namely, the producers and consumers.

Even though inventories of oil have risen significantly in recent years, persistent upward price movements have made it apparent that the rise in investors' ownership claims to the world's oil inventories has likely exceeded the inventory increase. This implies a re-

duction in the unencumbered inventory holdings of producers and consumers. In other words, some part of the oil in the world's storage tanks and pipelines is spoken for by investors. The extent of the surge in participation by financial institutions in claims on real barrels of oil is reflected in the near tripling of the notional value of commodity derivatives (excluding precious metals) during the four quarters of 2005 reported by U.S. commercial banks. Most of those contracts are for oil. The accumulation of net long positions in oil on the New York Mercantile Exchange by noncommercial traders, which is to say by investors, has exhibited a similar pattern.

The new participants, investors, and speculators in the world's 2 trillion-a-year oil market are hastening the adjustment process that has become so urgent with the virtual elimination of the world supply buffer. With the demand from the investment community, oil prices have moved up sooner than they would have otherwise. In addition, there has been a large increase in oil inventories. In response to higher prices, producers have increased production dramatically and some consumption has been scaled back. Even though crude oil productive capacity is still inadequate, it too has risen significantly over the past 2 years in response to price.

Hypothetically, if we still had the 10 million barrels a day of spare capacity that existed two decades ago, neither surges in demand nor temporary shutdowns of output from violence, hurricanes, or unscheduled maintenance would be having much, if any, impact on price. Returning to such a level of spare capacity appears wholly out of reach for the foreseeable future, however. This is not because there is any shortage of oil in the ground. The problem is that aside from Saudi-Aramco, few, if any, national oil companies which own most of the world's proved oil reserves are investing enough of their surging cash flow to convert the reserves into crude oil productive capacity. Only Saudi-Aramco appears sufficiently concerned, at least publicly, that high oil prices will reduce the long-term demand for oil, which could significantly diminish the value of Saudi Arabia's—or indeed, any country's—oil reserves.

Although outlays on productive capacity are rising, the significant proportion of oil revenues held as 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 a rate of reinvestment by these economies adequate to meet rising world oil demand. Some members of the Organization of Petroleum Exporting Countries (OPEC) have recently announced expansion plans. But how firm such plans are, is difficult to judge. They and other nations have rebuffed offers by international oil companies to help tap their reserves. Opportunities to expand oil production elsewhere are limited to a few regions, notably the former Soviet Union.

Besides feared shortfalls in crude oil capacity, the adequacy of world refining capacity has become worrisome as well. Over the past decade, crude oil production has risen faster than refining capacity. A continuation of this trend would soon make lack of refin-

ing capacity the binding constraint on growth in oil use. This may already be happening in certain grades of oil, 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 a special 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 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, which are easier to refine, and the heavier crudes such as Maya, which are not.

To be sure, refining capacity does continue to expand, albeit too gradually, and oil exploration and development is continuing, even in 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, additions to proved reserves in the developed world have not kept pace with production; so those reserves are being depleted.

The history of world petroleum is one of a rapidly growing industry in which producers have sought to provide consumers with stable prices to foster the growth of demand. In the first decade of the 20th century, pricing power was firmly in the hands of Americans. 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 would raise limits on output to suppress price spikes and cut output to prevent sharp price declines.

Indeed, as late as the 1950s, crude oil production in the United States (more than 40 percent of which was in Texas) still accounted for more than half of the world total. In 1951, excess Texas crude was poured into the market to contain the impact on oil prices of the nationalization of Iranian oil. Excess American oil was again released to the market to counter the price pressures induced by the Suez crisis of 1956 and the Arab-Israeli War of 1967.

American oil's historical role ended in 1971, when rising world demand finally exceeded the excess crude oil capacity of the United States. At that point, the marginal pricing of oil abruptly shifted—at first to a few large Middle East producers and later to market forces broader than they, or anyone, can contain.

To capitalize on their newly acquired pricing power in the early 1970s, many producing nations, especially in the Middle East, nationalized their oil companies. The full magnitude of the pricing power of the nationalized companies became evident 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, far 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. That translates to $76 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 which were hallmarks of the decades following World War II. Since the more than tenfold increase in crude oil prices between 1972 and 1981, world oil consumption per dollar of real GDP equivalent of global gross domestic product (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 4.5 percent, well in excess of growth of our real GDP. However, between 1973 and 2006, U.S. oil consumption grew, on average, at only a half a 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 less oil-intensive industries. The remainder of the decline is due to improved energy conservation: greater home insulation, better gasoline mileage, more efficient machinery, and streamlined production processes. These ongoing trends seem to have intensified of late with the sharp, recent increases in oil prices.

To date, it is difficult to find serious erosion in world economic activity as a consequence of sharply higher oil prices. Indeed, we have just experienced one of the strongest global economic expansions since the end of World War II. The United States, especially, has been able to absorb the huge implicit tax of rising oil prices so far. However, recent data indicate we may finally be experiencing some impact.

Clearly, if the current almost nonexistent supply buffer were significantly increased through a step-up in supply or a stepdown in consumption, oil prices would fall, perhaps sharply. This would likely occur even if there were no decrease in the threat to oil facilities from attacks or hurricanes. A large enough buffer could absorb such contingencies with modest impact on price.

But for good reason, holders of claims to the existing private inventories of oil apparently do not foresee a likelihood of change sufficient to alter the current outlook. This does not mean that oil prices will necessarily move higher, however. All of the concerns about future contingencies are already discounted in today's spot price. It will require a change in the outlook one way or the other to move crude oil prices. History tells us that will happen—often.

The U.S. economy has been able to absorb the huge impact of rising oil prices with little consequence to date because it has become far more flexible over the past three decades owing to deregulation and globalization. Growing protectionism would undermine that flexibility and make our Nation increasingly vulnerable to the vagaries of the oil market.

Current oil prices over time should lower to some extent our worrisome dependence on petroleum. Still higher oil prices will inevitably lead to more vehicle transportation to hybrids, and despite the inconvenience, plug-in hybrids. Corn ethanol, though valuable,

can play only a limited role, because its ability to displace gasoline is modest at best. But cellulosic ethanol, should it fulfill its promise, would help to wean us of our petroleum dependence, as could clean coal and nuclear power. With those developments, oil in the years ahead will remain an important element of our energy future, but it need no longer be the dominant player.

Thank you very much, Mr. Chairman, I look forward to your questions.

[The prepared statement of Dr. Greenspan follows:]

PREPARED STATEMENT OF HON. ALAN C. GREENSPAN, PRESIDENT, GREENSPAN ASSOCIATES LLC, WASHINGTON, DC

Mr. Chairman, Senator Biden, and members of the committee. This morning I shall try to detail how the balance of world oil supply and demand has become so precarious that even small acts of sabotage or local insurrection have a significant impact on oil prices. American business, to date, has largely succeeded in finding productivity improvements that have contained energy costs. American households, however, are struggling with rising gasoline prices.

Even before the devastating hurricanes of last summer, world oil markets had been subject to a degree of strain not experienced for a generation. 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. Today world oil production stands at about 85 million barrels a day, and little excess capacity remains. Just how much excess capacity, and of what quality oil, is a matter of debate. But no matter what the precise answer, the buffer between supply and demand is much too small to absorb shutdowns of even a small part of the world's production. Moreover, growing threats of violence to oilfields, pipelines, storage facilities, and refineries, especially in the Middle East, have increased the private demand to hold oil inventories worldwide. Oil users judge they need to be prepared for the possibility that at some point a raid will succeed with a devastating impact on supply.

For most of the history of oil, its producers and consumers determined its price. Only those who could physically store large quantities of oil had the ability to trade. But important advances in finance have opened the market to a much larger number of participants. There has been a major upsurge in over-the-counter trading of oil futures and other commodity derivatives. Thus, when in the last couple of years it became apparent that the world's oil industry was not investing enough to expand crude oil production capacity quickly enough to meet rising demand, increasing numbers of hedge funds and other institutional investors began bidding for oil. They accumulated it in substantial net long positions in crude oil futures, largely in the over-the-counter market. These net long futures contracts, in effect, constituted a bet that oil prices would rise. The sellers of those contracts to investors, when all of the offsetting claims are considered, are of necessity the present owners of the billions of barrels of private inventories of oil held throughout the world—namely, the producers and consumers.

Even though inventories of oil have risen significantly in recent years, persistent upward price movements have made it apparent that the rise in investors' ownership claims to the world's oil inventories has likely exceeded the inventory increase. This implies a reduction in the unencumbered inventory holdings of producers and consumers. In other words, some part of the oil in the world's storage tanks and pipelines is spoken for by investors. The extent of the surge in participation by financial institutions in claims on real barrels of oil is reflected in the near tripling of the notional value of commodity derivatives (excluding precious metals) during the four quarters of 2005 reported by U.S. commercial banks. Most of those contracts are for oil. The accumulation of net long positions in oil on the New York Mercantile Exchange by noncommercial traders, which is to say by investors, has exhibited a similar pattern.

The new participants, investors and speculators, to the world's $2 trillion-a-year oil market are hastening the adjustment process that has become so urgent with the virtual elimination of the world supply buffer. With the demand from the investment community, oil prices have moved up sooner than they would have otherwise. In addition, there has been a large increase in oil inventories. In response to higher prices, producers have increased production dramatically and some consumption has been scaled back. Even though crude oil productive capacity is still inadequate, it too has risen significantly over the past 2 years in response to price.

Hypothetically, if we still had the 10 million barrels a day of spare capacity that existed two decades ago, neither surges in demand nor temporary shutdowns of output from violence, hurricanes, or unscheduled maintenance would be having much, if any, impact on price. Returning to such a level of spare capacity appears wholly out of reach for the foreseeable future, however. This is not because there is any shortage of oil in the ground. The problem is that aside from Saudi-Aramco, few, if any, national oil companies which own most of the world's proved oil reserves are investing enough of their surging cash flow to convert the reserves into crude oil productive capacity. Only Saudi-Aramco appears sufficiently concerned, at least publicly, that high oil prices will reduce the long-term demand for oil, which could significantly diminish the value of Saudi Arabia's—or indeed, any country's—oil reserves.

Although outlays on productive capacity are rising, the significant proportion of oil revenues held as 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 a rate of reinvestment by these economies adequate to meet rising world oil demand. Some members of the Organization of Petroleum Exporting Countries (OPEC) have recently announced expansion plans. But how firm such plans are is difficult to judge. They and other nations have rebuffed offers by international oil companies to help tap their reserves. Opportunities to expand oil production elsewhere are limited to a few regions, notably the former Soviet Union.

Besides feared shortfalls in crude oil capacity, the adequacy of world refining capacity has become worrisome as well. Over the past decade, crude oil production has risen faster than refining capacity. 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 of oil, 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 a special 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 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, which are easier to refine, and the heavier crudes such as Maya, which are not.

To be sure, refining capacity does continue to expand, albeit too gradually, and oil exploration and development is continuing, even in 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, additions to proved reserves in the developed world have not kept pace with production; so those reserves are being depleted.

The history of world petroleum is one of a rapidly growing industry in which producers have sought to provide consumers with stable prices to foster the growth of demand. In the first decade of the 20th century, pricing power was firmly in the hands of Americans. 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 would raise limits on output to suppress price spikes and cut output to prevent sharp price declines.

Indeed, as late as the 1950s, crude oil production in the United States (more than 40 percent of which was in Texas) still accounted for more than half of the world total. In 1951, excess Texas crude was poured into the market to contain the impact on oil prices of the nationalization of Iranian oil. Excess American oil was again released to the market to counter the price pressures induced by the Suez crisis of 1956 and the Arab-Israeli War of 1967.

American oil's historical role ended in 1971, when rising world demand finally exceeded the excess crude oil capacity of the United States. At that point, the marginal pricing of oil abruptly shifted—at first to a few large Middle East producers and later to market forces broader than they, or anyone, can contain.

To capitalize on their newly acquired pricing power in the early 1970s, many producing nations, especially in the Middle East, nationalized their oil companies. The full magnitude of the pricing power of the nationalized companies became evident 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, far 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. That translates to $76 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 which were hallmarks of the decades 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 product (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 4½ percent, well in excess of growth of our real GDP.

However, between 1973 and 2006, U.S. oil consumption grew, on average, at only ½ 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 less oil-intensive industries. The remainder of the decline is due to improved energy conservation: greater home insulation, better gasoline mileage, more efficient machinery, and streamlined production processes. These ongoing trends seem to have intensified of late with the sharp, recent increases in oil prices.

To date, it is difficult to find serious erosion in world economic activity as a consequence of sharply higher oil prices. Indeed, we have just experienced one of the strongest global economic expansions since the end of World War II. The United States, especially, has been able to absorb the huge implicit tax of rising oil prices so far. However, recent data indicate we may finally be experiencing some impact.

Clearly, if the current almost nonexistent supply buffer were significantly increased through a step-up in supply or a stepdown in consumption, oil prices would fall, perhaps sharply. This would likely occur even if there were no decrease in the threat to oil facilities from attacks or hurricanes. A large enough buffer could absorb such contingencies with modest impact on price.

But for good reason, holders of claims to the existing private inventories of oil apparently do not foresee a likelihood of change sufficient to alter the current outlook. This does not mean that oil prices will necessarily move higher, however. All of the concerns about future contingencies are already discounted in today's spot price. It will require a change in the outlook one way or the other to move crude oil prices. History tells us that will happen—often.

The U.S. economy has been able to absorb the huge impact of rising oil prices with little consequence to date because it has become far more flexible over the past three decades owing to deregulation and globalization. Growing protectionism would undermine that flexibility and make our Nation increasingly vulnerable to the vagaries of the oil market.

Current oil prices over time should lower to some extent our worrisome dependence on petroleum. Still higher oil prices will inevitably move vehicle transportation to hybrids, and despite the inconvenience, plug-in hybrids. Corn ethanol, though valuable, can play only a limited role, because its ability to displace gasoline is modest at best. But cellulosic ethanol, should it fulfill its promise, would help to wean us of our petroleum dependence, as could clean coal and nuclear power. With those developments, oil in the years ahead will remain an important element of our energy future, but it need no longer be the dominant player.

The CHAIRMAN. Thank you very much, Chairman. I'd like to recognize now the distinguished ranking member of our committee, Senator Biden, for his opening statement.

OPENING STATEMENT OF HON. JOSEPH R. BIDEN, JR., U.S. SENATOR FROM DELAWARE

Senator BIDEN. Dr. Greenspan, thank you very much for being here. Today's headlines obviously make it clear just how important this hearing is. On the one hand, we have concern about inflation, led by the petroleum-based energy costs that has increased 61 percent at an annual rate in the first quarter of this year. And on the other hand, we have our financial markets roiled by the worry that

the Federal Reserve's prescription—continuing a course of 15 straight rate increases—could put the brakes on an economy that is already slowing down some.

We could not have clearer evidence, in my view, of our country's vulnerability to oil prices. I am pleased to be working with my colleague, the chairman of the committee, on a series of hearings relating to the cost of our dependence on imported oil, and joining with him and others in a search for alternatives.

But today, it's a privilege to hear you. You've guided this Nation's monetary policy for almost two decades, and through a wide variety of domestic and international challenges, and through profound changes in our economy. In my view, no one in the world who spoke on economic affairs was more listened to than you were, Mr. Chairman. Not always understood, but listened to. It's a little daunting to have you before this committee, someone of your stature. You yourself once said, "If I turn out to be particularly clear, you probably misunderstood what I said." So your pronouncements, although they seem clear to me today, then as the Chairman has said, they can still move markets. And we appreciate your candor and your clarity and some guidance for us in the challenges we face.

The last time you appeared before this committee, Mr. Chairman, you were facing—we were facing—the Pesos crisis, the first wave of international financial crises in the late 1990s. The topic of today's hearing presents threats of a similar magnitude to our economy, in our view, and to our security. Today we're concerned about fundamentals, about the fuels that make our economy run, about the threats to our economic security, because we do not control—as you've pointed out very starkly, by going through the historical analysis—we do not control access to those fuels like we did in the 1950s and 1960s. And we're looking for ways that we can move to a more secure source in the near future.

And it seems to me our failure to set a national energy policy and reduce our consumption of oil has handcuffed our foreign policy and weakened us economically. Global oil consumption—especially with the extremely rapid modernization of countries like China and India—is growing faster than the discovery and development of new supplies. And supply has never been so tight, as you point out, relative to demand. We now live in a world that consumes 85 million barrels every day. That's an enormous amount, and meanwhile the world's spare production capacity has shrunk to 2 percent of demand. And that means the slightest thing—a terrorist attack in Saudi Arabia, talk tough on Iran, violence in Nicaragua, even a bad storm in the Gulf—can cause oil markets to panic, for reasons you've stated in terms of it being controlled by private investors as well.

Here in the Foreign Relations Committee, we deal every day in foreign policy implications of our dependence on imported fossil fuels. Most obviously, there are complex relationships with what Michael Mandelbaum calls, and others have called, the "Axis of Oil"—the oil-rich regimes around the world.

This dependence has a pernicious effect, in my view, on our foreign policy. It literally helps us fuel terrorism—the very terrorism we're fighting—because some of the dollars we spend on crude

wind up in the pockets of the radicals that we are worried about. It limits our options and limits our leverage in dealing with national security threats, because oil-rich countries can stand up to us and oil-dependent countries are afraid to stand with us.

And it undercuts our hopes, in my view, of advancing democracy and freedom because repressive regimes, swimming in a sea of high-priced oil, can resist pressures to reform as we see right now in Iran.

To cite just one example, Iran's most recent threats to disrupt oil exports—as a direct response to our attempts to deal with their nuclear ambitions—was immediately translated into an increase in oil prices, a jump to $73 a barrel. Not just economic forces, but political conflicts, drive the markets.

I will not repeat what the Chairman has often mentioned about the ability of nation's to essentially indicate, or impact the security of other countries by threatening to and/or curtailing access to oil. It has a powerful, powerful impact.

So we're here today to get a chance to talk to you about the economic impact of oil and gas prices. And during your long tenure, Mr. Chairman, oil and gas prices spiked dangerously several times.

So you've repeatedly warned us about the potential impact of those fundamental energy prices on inflation as they worked their way through the economy, as well as the potential to slow economic activity as consumers and producers move limited dollars from other sectors to cover energy costs.

In your last Monetary Report to Congress last year, Dr. Greenspan, you placed significant stress on the potential problems that could arise from a jump in energy prices.

You reported then that the impact that could have on consumer spending—the hit to the average American pocketbook—would depend on how much incomes were growing. On that front, the news is not encouraging. Yesterday's, I guess it was yesterday's, June 2nd Wall Street Journal piece on data suggests a rise in energy prices are hurting low income shoppers.

On that front, as I said, it depends on how incomes are growing. The last reports from the job market show yet another disappointingly small increase in the number of Americans finding work. And the persistence of a very troubling notion of stagnation in wages. Something, it seems to me, is not going right. Thus far, in the economic recovery when the job picture is as weak at it appears to be, I wish you—I'm going to ask you to speak to that, if you will. Wages are still flat, up just a penny an hour. That's 40 cents for a 40-hour work week. And the cost of living, including the cost of gasoline, and everything made and transported with petroleum continues to grow faster than incomes.

The cost of gasoline went up 2 cents a gallon last week. That's over 40 cents more for every 20 gallons of gas pumped. That means that the higher price of gasoline really hurt low-income and middle-income families. Gas is pretty much a fixed cost for the average American family who can't switch cars or move closer to work. For them, it's is not an abstract discussion.

As I said, I referenced the Wall Street Journal article saying "Rising Energy Prices Pinch Low-Income Shoppers." Slow growth,

flat wages—American households are part of the context we need to understand when we talk about the impact of oil prices.

In the bigger picture, our dependence on foreign oil feeds a cycle of dependence on foreign lenders to finance our dependence on foreign oil. Our trade deficit, which you've often spoke to, through March of this year, is $192 billion—that's 6 percent of our economy. Thirty percent of that deficit—$65 billion—was the cost of our petroleum imports. That number could grow, I'm told, to as high as $100 billion this year.

To finance that trade deficit, we are borrowing from other countries, and supply of our debt will eventually outrun our demand, the way things are going. As we are already seeing, that means a weaker dollar, making imported oil—and the thousands of consumer goods from cars to computers—even more expensive.

Until we do something about our dependence on imported oil, we will not be in control, in our view, of our economic security. Will we, are we going to be able to restore our energy security by reducing our consumption of oil? Will we, can we, how do we make the most progress in the shortest amount of time? If we focus on fuels that we put in our cars and trucks, 70 percent of the oil we consume is used in transportation. Can we immediately begin to reduce oil consumption by switching to fuels that we can grow at home and making better, and more efficient use of our energy that we consume?

You pointed out that ethanol is not the answer, but it seems to me ethanol may be a way to begin to jump-start this process, as a logical element of the process of moving to cellulosic fuels and other fuels. I agree with you that we have to move faster in clean coal technology and nuclear energy.

But it seems to me we have to make sure, first of all, that we're driving good cars by increasing fuel efficiency. By requiring that every car sold in the United States is a flex-fuel vehicle that can run on alternative fuels like E85—85 percent ethanol.

Second, it seems to me, we need to make sure that we're using good fuels by requiring all major oil companies to add alternative fuel pumps to at least half of the gas stations they own.

And finally, it seems to me, we need to put in place the market and the infrastructure for alternative fuels so that as new, more advanced fuel technologies like cellulosic and ethanol become more widely available, with the available cars and the pumps that we, hopefully, have already begun to have put in place.

So, we've asked you here today to help us understand better the shape we're in today, and to draw on your experience, which is extensive, to understand how we manage this move into the future. So Doctor, your statement was enlightening. I'm looking forward to being able to ask you questions, and Mr. Chairman, I thank you for the courtesy of allowing me to make my statement at this point. Thank you again, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator Biden. Let me just say that the Chair will try to make a pragmatic choice. We have a number of members here, and as I indicated earlier on we'll have a rollcall vote at 10:00, and of course, some members will be attending the joint session, which all members have been asked to attend.

So with the concurrence of the ranking member, I'm going to suggest we have, perhaps, besides the two of us at the moment, maybe a 5 minute round so as many Senators can be heard during that period, and I plan to return after the vote and continue on, and the ranking member will too, so we can ask our questions more extensively then.

So, we'll try a 5-minute round and begin with Senator Chafee.

Senator CHAFEE. Thank you, Mr. Chairman, very much. And I've got my question here. In your prepared statement you said that much oil revenues have been diverted to meet the perceived high priority needs of rapidly growing populations, and maybe you could talk about what's happening in China and India. Those of us that have been to China see all the bicyclists, and I'm sure the Chinese are going to gradually change from bicycles to petroleum-based vehicles. One point three billion people, in India also, a billion people. How's that, what effect is that going to have on this issue?

Dr. GREENSPAN. Well, Senator, as you're aware, the motor vehicle culture in China is gaining very rapidly. All you have to do is remember that it wasn't that long ago when there were traffic jams in Beijing with bicycles. And now it's just car to car, bumper to bumper, and they're producing cars at a very rapid pace and indeed coupled with their imports they're adding—the actual sales level is quite high.

The problem in China is, even before this surge, is that their oil efficiency is half ours. Namely, the ratio of oil consumption to GDP is twice that of the United States, and there's a great deal of inefficiency, and obviously since their basic desire is essentially to move as fast as they can in the manufacturing area, the issue of fuel efficiency is not their highest priority even though they are aware of it, and obviously increasingly are aware of environmental problems that affect them.

There's no question that fuel efficiency will increase in China as the economy gets more sophisticated. But because it starts at such a highly inefficient level, and because its growth rate is far faster than the world average, it's a major demander of oil and indeed it's the second largest consumer in the world and probably—talking about the contribution to the increase in the demand—it is by far the dominant force, and is very likely to be until they run into really serious congestion with respect to car saturation. But at the moment, the demand for gasoline is going up quite significantly.

Senator CHAFEE. And India is similar? China and India have their own reserves, so as they come onto the market, transportation is 65 percent of our consumption—as these two colossus come onto the market, supply and demand has to be a factor.

Dr. GREENSPAN. India has got, of course, a good deal less in the way of consumption levels than China. And although it's growing, it's not growing as fast as China, and the level of economic activity there is much less than in China. So, I would say India is possibly a concern, but China is by far the most important issue. The great irony, however, is that the two most rapidly growing consumers in crude oil in absolute terms recently is China and the United States, not India.

Senator CHAFEE. Thank you, Mr. Chairman. I'd just note that I think in the grand scheme of things, as these two countries dip

their straw into the world's reserves, their appetite is going to be enormous and that's just going to be a factor on the price.

Dr. GREENSPAN. I think you're addressing a very important aspect of our future.

The CHAIRMAN. Thank you, Senator Chafee, Senator Coleman.

Senator COLEMAN. Thank you, Mr. Chairman, it's a great pleasure to have you here today, Chairman Greenspan.

I had a chance about a week or so ago to review a presentation by the CEO of Alliance Bernstein, talking about the possibilities of lessening dependency, things like hybrids, in a couple of years Toyota may be out with a lithium battery that could sustain and have a tremendous impact on reducing the need for fuel for transportation, and then as you note—not just corn ethanol, but cellulosic ethanol—and the possibility of even going to 60 billion barrels of ethanol in some time in the not-too-distant future.

And you end your presentation here, with those developments, oil in the years ahead will remain an important element of our energy future, but it would no longer be the dominant player. With the possibility of cellulosic out there, with the possibility, very short-term of hybrids—does that mean that we should be engaging on some kind of Manhattan Project to accelerate, quickly, the opportunity of cellulosic—it's kind of at our fingertips but we're not there yet? And what would that mean, and how do we accelerate getting there?

Dr. GREENSPAN. Well, the reason I raise the issue that corn ethanol is limited is merely the fact that you get 2.7 gallons of ethanol out of a bushel of corn. If you just do the arithmetic we produce 11 billion bushels of corn a year. If you convert that into actual gasoline equivalent, considering the fact that the BTU per gallon of corn ethanol is about two-thirds that of gasoline, it's an important addition, and indeed it's of very significant importance, especially today.

But over the longer run, it's going to have to be cellulosic where the real ethanol imprints are going to come from, because there you don't have the types of restraints—the more corn we put into ethanol the less we feed to hogs and that's a very important trade-off. It's not the case with cellulosic ethanol and the advantage is there, if we can essentially start to make that productive and get anywhere near the increases in yields of acreage of switchgrass. For example, we've gotten in the grains over the last 15, 20, 30 years. The growth in agricultural productivity has been awesome—if we could associate that with switchgrass, we're going to have an awful lot of gallons of cellulosic ethanol, and I think that's important as where the edge is.

Senator, the major problem that I think we have is that, as I pointed out in my prepared remarks, the United States controlled the world oil industry until, for the first 100 years of the industry. We set the price, we decided, essentially, when there was a surplus or a deficit and corrected it, and the growth in the oil markets moved very significantly in pace.

Starting in the 1970s, as I pointed out, we lost price control. We will never get it back unless we can find a way to refill the vacant reservoirs of east Texas which were filled with crude oil—we've used it all. In other words, our power over oil was the reserves we

had in the ground in the United States. Despite Alaska, despite California, despite the Gulf of Mexico which has been a very major addition, we're out of it. We're out of the market, essentially, as a very critical player with respect to price.

That means that if we are very significantly tied to petroleum for our way of life, which indeed we are—in other words, Senator Biden points out that people drive cars in a way which represents what they think of themselves as people—what their lifestyle is. It's hard to imagine disengaging an American from his car. We all squawk when the gasoline price goes up but there is no evidence that we reduce the mileages we drive. We eventually will buy cars which are more fuel efficient, use less gasoline, but it's not because we drive less. And therefore, I think the basic focus is to find ways to recognize that we are not going to be a world power in oil ever again. And the dramatic and very facile reduction in our oil use, I should say that the rising prices have been a very effective tool in compressing demand. Our demand has very much flattened out and we are gradually disengaging ourselves from petroleum. If it happens sufficiently, smoothly, then that's the best of all possible contingencies. What we have to make a judgment on is what happens if it doesn't go smoothly and what types of policies that we can address, and I think you point out the critical ones—how do we get consumption down basically on our highways—which incidentally use one out of every seven barrels consumed in the world every day.

Senator COLEMAN. Thanks, Chairman.

The CHAIRMAN. Thank you very much. Senator Voinovich.

Senator VOINOVICH. Thank you, Mr. Chairman. It's nice to see you again, Chairman Greenspan.

The last couple of years I've been very concerned about our dependence on foreign sources of energy. In fact I've called for a second Declaration of Independence, that is, to become less reliant on foreign energy sources because of our national security interests, and also our economic concerns. Several weeks ago I was in Brussels at a Thurman Marshall Fund meeting and I was quite taken back with the concern the Europeans have in terms of their energy vulnerability—Iran and also the practices and policies of the Russian Federation. They're very worried about how that's all going to work out.

Your testimony this morning seems to give the impression that maybe things aren't as bad as some of us think they are. I really feel that this country needs to have a reaction like we had to Sputnik going up, in terms of becoming more energy independent.

We had testimony here several months ago from a Dr. Luft and he said, "Oil prices are not going down at any time, the rise in oil prices will yield large financial surpluses to the Middle Eastern oil producers. This petro-dollar windfall will strengthen the Jihadists while undermining the strategic relationship the region's oil producers have with the United States. Real concern about impact on security." We had other testimony, I'll quote from Hillard Harrington who heads the Energy Modeling Forum at Stanford, he said "Many large scale models of the U.S. economy estimate that the level of real GDP could decline by 2 percent for a doubling of oil prices." Since the economy is growing more rapidly than 2 per-

cent per year, that impact would not mean recession, basically going along with what you've said.

Other researchers, however, think that these estimates underestimate the impacts, because they do not focus explicitly on sudden and scary oil price shocks. These other researchers think that our historical experience suggests that the level of real GDP would decline more than 5 percent for doubling of the oil price, and he goes on to say, "My personal view is that the higher estimate may be closer to what actually would happen if we had a major disruption, and that would mean a recession."

So I'd be really interested in terms of our vulnerability, in terms of our security, and also the issue of what impact an interruption would have on our GDP and our economy.

Dr. GREENSPAN. Well, Senator, I think those same models will indicate that the impact on the GDP is a function of how rapidly the prices change. In other words, at this moment, we are observing a fairly significant increase in oil prices, in fact energy prices generally. And until very recently, it is very difficult to find any serious impact on actual levels of real activity. There's been no significant cutback in consumption. In fact, seasonally adjusted, our weekly 20 million barrels a day consumption in recent weeks has actually been edging up, not down. It's certainly the case throughout this year. We're a little bit slow and it's a small aberration, but there is no sharp correction and the reason is basically that we have developed a degree of flexibility in this economy which starts off in the 1970s with the bipartisan deregulation that we were all involved with, and which has carried forward to this day, especially in the financial area, and in the transportation areas, which has given us an ability to absorb shocks, of which energy is one, and come back readily.

American corporations have been hit by a very large increase in energy costs. Yet, profit margins of nonfinancial, nonenergy corporations continue to grow. The reason in part is that there has been a large increase in cost, but the productivity that has been put in place in the last several years with respect to energy-saving equipment has apparently been enough to keep the actual unit cost of energy moving at a relatively modest rate. In other words, a goodly part of the price increase has been offset by improved productivity and coupled with other productivity gains, profit margins continue to grow, which means that we have not had the real serious impact.

If you look at motor gasoline consumption—seasonally adjusted—gasoline which essentially is used in passenger cars and light trucks—it has not gone down. In fact, if anything it's tilted up slightly. The only serious area of reduction in energy use is apparently in diesel, where those big Class VII, Class VIII tractor trailers consume huge amounts—in fact, 20 percent of total motor fuel on highways is consumed by heavy trucks. Those have cut back significantly. And for a number of reasons. Obviously, there has been efficiently in the way that goods are carried because of that.

But there is, as yet, no really serious issue here with respect to the impact on the United States. If, however, we get a sharp increase in prices very quickly, because our capital stock, our facilities, still really are built, and were originally constructed with $20

oil in mind, and therefore there's not a great deal of efficiency built into our capital stock, so if we get a big shock it can create a significant contraction in our economy. It's very difficult to tell how much, because an awful large part of it is psychological. But if the flexibility is there, the flexibility that enabled us to get hit by 9/11, declined very sharply but for a very short period of time, and because of the flexibility of the system that we have built, we were able to absorb it. I'm not terribly concerned about that problem.

So, as far as national security policies are concerned, I think it's important to one, make certain that we maintain a flexible economy and two, to find ways to one, recognize that we're not going to be a price setter in oil in any conceivable future—to find ways to wean ourselves off gasoline is a critical issue of energy. That applies very importantly on highway fuel, cellulosic, and ultimately applies gas-to-oil technologies, which if we ever get to natural gas hydrates which is a huge potential long-term source of methane—we can find ways to get ourselves away from the actual petroleum industry, but it will essentially require very considerable effort, and I think the most practical places are in cellulosic ethanol, and in hybrids. Because right now you get a hybrid car—you plug it in overnight, eight or nine hours—and you can get 100 miles a gallon on it. The technology is going to improve, but that is a very major saver of gasoline. And if you combine the new ethanols with that, it's a decline in convenience of the motor vehicle to drive it, but it is not as though we have a choice of good and bad. We've got a choice of not-so-good, and worse. We have to make a choice of one or the other.

The CHAIRMAN. Thank you very much, Mr. Voinovich. Senator Alexander.

Senator ALEXANDER. Thank you, Mr. Chairman. Dr. Greenspan, thank you for being here. Thank you for your analysis and as I hear you, you're saying we were oil independent until the early 1970s. The United States—quite a bit we make speeches about this goal—oil independence from foreign oil and we had it until the early 1970s. You're telling us we're not ever going to have it again, if I hear you right.

Dr. GREENSPAN. I wish I could find the means to think my way through to such an eventuality. I've tried. I failed.

Senator ALEXANDER. But it helps that—so I assume by implication you're suggesting that our best government policy is probably not to join China in chasing around the world, tying up every oil reserve that we can. That is a long-term solution. That's probably not our most promising course. I think I also hear you saying that because of this enormous flexibility of our economy, and I heard you say it about 9/11, which was a revelation to me, that despite the dislocations of 9/11, the economy absorbed those. And I think you're also saying to us that even with these relatively high prices for gasoline, our flexible economy is so strong that it seems to absorb those.

The question I'm getting to is, what in the market is going to drive this transformation that logic would impel us toward? Based on your analysis, we should be finding something else to put in our cars and trucks other than petroleum-based fuel. And it's almost that simple, because you say we're not going to stop driving, and

so we're going to continue to drive more, we're not going to compete with China for oil, so I guess my question is—if you're in our shoes, and we're looking for government policies, it seems to me our economy is so strong and flexible that there may be nothing in the market that will force us to make the changes that we need to make to find the alternate fuel.

For example, you mentioned hybrids. Well, Mr. Goan, the President of Nissan, is renting Toyota's technology and not building many hybrids because he says when you build something that costs you $6,000 to put in the car, and customers are only willing to pay $2,000, you've got a problem. So what in the marketplace is going to drive this transformation for alternate fuel?

Dr. GREENSPAN. I would think, Senator, that you have to start with the presumption that if you do nothing, what is likely to happen. And then ask yourself, would that outcome be acceptable, and how would you alter it? And I would put forth the projection of what would happen if you do nothing. If you do nothing, what we will find is that the pressures on price are very likely to continue. I don't necessarily think they need to go much higher, because we've already had—as I pointed out in my prepared remarks—the whole financial industry moving in advance of events, and they may have already created a price which already projects a goodly part of this future.

But let's just say the prices are where they are—what is going to happen is that we're going to start to get major changes in fuel efficiency cars purchased by American consumers. Especially hybrids, and if the price goes higher which it very well may be, despite the fact that Americans say they do not like plugged-in hybrids—that's not what happens when the choices ultimately are there—people accept what is made available. We don't have the capability of, when I was a kid, 19 cents a gallon gasoline, huge gas guzzlers, vast sources of oil, never worry about energy—we don't have those choices, we have to make a judgment. As it stands now, it makes no sense to go out and basically try to find oil. The oil that really is available that is sufficiently cheap to essentially exploit is held by the nationalized oil companies.

My judgment is that if you look at the trends that have developed since the early 1970s, we have been weaning ourselves off oil very considerably. We are now half as intensive as we were, and we will continue to be considerably less intensive.

The critical area is clearly on highways, and there is where we have to figure one, how do you drive certain numbers of miles which American consumers want. And you can do that either by getting substitutes for motor fuels other than petroleum. It looks to me now like cellulosic ethanol is the largest potential—there is coal-diesel and a variety of others, other forms of bio-diesel which you can get—but it's either that or you change the nature of the motor. And here I think it's going to be both.

If that is indeed the case, and we get, as Senator Chafee pointed out, continued increases in Chinese demand, in world demand, likely prices may very well move higher, and what will happen is that we will—the markets will force us, or more exactly, prices of gasoline will rise to a level where everyone will be very unhappy—they

will not stop driving. They will pay the price, but they will buy much fewer gasoline-consuming vehicles in one form or another.

That's where the future is, and indeed you can make the case that obviously petroleum will continue to be available in some significant quantities. And if there is a very substantial decline in consumption of oil in the United States, the price will come down worldwide. That will create a significant gap, because remember, we consume a quarter of the world's oil right now.

If we are able to bring down our consumption by a number of means, that's where the world is likely to end up and I'm not sure that is all that bad, and from a national security point of view, we won't be literally disassociated from petroleum, but the problems that it's easy to be concerned about, namely all this huge amount of cash going to countries who are not friends of ours, it's a very serious issue. And the quickest way that you can shut that off is to open up a gap in spare capacity, and you can do that by increasing capacity which is very difficult, or lower consumption. That will lower the price significantly and if we're asking for a national security implication, because such a significant part of the price is probably the result of this new surge in demand for oil by the financial system, the financial system will turn around and prices will come down quite considerably, and that more than anything else I know, will shut off a goodly part of the very large cash flow which is going to those who do not have our best interests at heart.

The CHAIRMAN. Thank you very much, Senator Alexander. Now, let me mention that Senator Biden and I will go to the floor temporarily. I will pass the Chairmanship over to Senator Sununu for his questions and he will exhaust that time on Senator Murkowski or Senator Martinez, then hopefully we'll be back so we will not lose——

Senator Sununu [presiding]. Hopefully you'll be back so I don't have to serve as Chairman for too long. I think all of my colleagues will appreciate that.

Dr. Greenspan, I served on the Budget Committee in the House. I'm on the Foreign Relations Committee here, and the Banking Committee, so I've seen you testify a fair number of times, and I want you to know I appreciate the novelty of your two word declarative "I failed." It's not something that we've heard very often, and for good reason, but it's refreshing. It's always refreshing to hear someone be clear about what they know and what they don't know, what they can envision and what they have a hard time foreseeing.

I want to begin by checking your math. You made a point about the fact that corn-based ethanol is almost certainly unable to have any significant role in supplanting petroleum. You mentioned 11 billion bushels, 2.7 gallons a bushel, roughly a two-thirds conversion factor, that translates in 18 billion gallons which sounds like a lot if we use every bushel of corn in America to produce a petroleum substitute. That's gallons, yes. Compared to national consumption—I did the quick math—on the order of 180 or 200 billion gallons, so we're talking about 10 percent of the total petroleum usage in the country if we starved every hog in the country.

I think that's important to emphasize here, while I understand the value of the ethanol program to farmers and to those that par-

ticipate in it. But if we use every bushel of corn, we're still only talking about 10 percent of what we consume in petroleum.

It seems to me that to the extent that we're concerned about this problem, I don't see a great national security threat by a family of four deciding to buy a mini-van that gets 22 miles to the gallon instead of 28 miles to the gallon. I think as you point out, it's the choice they make and Americans enjoy driving cars—most of the oil, the vast majority, is used for transportation, and most of that is a consumer decision, a lifestyle decision.

But what is important to avoid economic dislocations is the maintenance of the flexibility you talked about—the resilience in the economy. So, I think that the important question from my perspective is how do we maintain that flexibility, and are there things that we could do or might do that would hurt that flexibility. I am always worried about the unintended consequence. I would like you to comment on things that you believe might undermine that flexibility in general, and specifically about policies such as production tax credits, government R&D subsidies on fossil fuel technology, CAFE standards. Are those things that should be pursued, or should we have concerns about how they would affect this underlying resilience?

Dr. GREENSPAN. Senator, the major threat to flexibility that we now perceive is twofold. The one that concerns me most is the very modest yet not large move toward protectionism in this country.

Protectionism, to the extent that you block the free flow of goods, services, and finance—almost by definition undermines flexibility and the adjustment process. And to the extent that we engage in that, that we prevent the ability of everything to move when something else moves, which is what flexibility does, and what creates the type of resilience we saw in 9/11, and indeed in the stock market crash of 1987 and the crash of 2000—the economy barely went down in those particular areas, largely because of the considerable flexibility in the international area, but also in the financial area.

The one great change that has occurred in the United States, and indeed the rest of the world, is the dramatic increase in international technology—which coupled with an extraordinary expansion in new types of financial products which laid off credit risk from highly vulnerable, highly leveraged financial institutions which made loans to those who were far more capable of absorbing risks. I'm speaking mainly of credit derivatives, but there are a whole series of other financial instruments that are relevant. That has given us a flexibility that if we try to overregulate that particular area it will reduce the flexibility, reduce our ability to make the types of adjustments that we've been able to make, and will create a problem that in the event of an oil shock or crisis, our ability to absorb it and reduce the impact on employment and output would be limited.

Senator SUNUNU. I think that the impact of protectionism on our economy's flexibility is something that most Members of Congress can internalize pretty well. We understand the impact of setting up those kinds of tariffs and borders. But this is one that I'd like you to elaborate on a little bit. You're saying that the existence of a credit derivatives market contributes to that economic flexibility. You also mention in your testimony, though, the participation of

the financial markets in the energy futures markets and commodities markets and is that also something that you see as increasing our—the resiliency and the flexibility of our economy? Has that been a positive step? Some people would view that as speculation, and speculation is always bad, but you view it as a positive step?

Dr. GREENSPAN. I do indeed, Senator. And the reason I do, as I point out in my prepared remarks is the great advantage of speculation in the sense that it was originally supposed to be understood, is that when there are perceived imbalances in the future, speculation or investing or endeavoring to look for abnormal rates of return in the financial field tends to advance the adjustment process so that when the corrections actually occur, they are far less abrupt.

And what we are seeing today because of the existence of hedge funds and others taking on fairly large positions in the oil-derivatives markets, and then effectively increasing the demand for real barrels of oil, is to move the price up and therefore to hasten the adjustment process which indeed is occurring—that is, we are literally seeing significant acceleration in energy productivity within the corporate sector. We are seeing a flattening out, not a decline, but a flattening out of gasoline demand, and indeed a decline in overall motor fuel consumption on highways because of price. And that would not have happened were it not for the financial system being involved, because prices would have been lower through a considerable amount—part of 2004 through most of 2005, and if that were the case, the levels of demand would be higher, the pressures on the economy far greater, and we would have increased the risk of a shock.

So, what the financial system has done is preventive medicine if I may put it that way.

Senator SUNUNU. Thank you. Senator Murkowski.

Senator MURKOWSKI. Thank you, Chairman Greenspan. It's a pleasure to have you here this morning and to hear your testimony.

I want to go back to a statement you had made to Senator Coleman. You indicated that the power over oil that we once had was what we had here in the ground in the United States and that gave us that ability to be somewhat energy independent, or oil independent—if you will—and we lost that after the early 1970s.

I want to hear a few comments from you this morning about the direction of natural gas, an area where I think we look to in this country as that next great area of possible dependence. Right now we're in a situation where our imports of LNG are at a pretty minimal level. I understand it's about 3 percent right now, but the increase—LNG imports have increased by 180 percent in the past several years, still accounting for only about 3 percent of our U.S. imports.

The concern that I have had is that we go in the same direction with natural gas as we are with oil—being dependent on foreign sources for an extremely important resource for us here in this country—and a recognition that we can do something about it, because we have that ability to grow that resource here.

You've mentioned that, and this was in a hearing that we had before the Energy Committee a couple of years ago—that in order for us to meet our demand here in this country, we must rely on

imported LNG. We're trying to move a project down from Alaska to get Alaska's natural gas to the rest of the United States. That project is not moving as quickly as we would like. We recognize that the country is counting on Alaska's gas to come down. We're trying to make sure that, in fact, that happens.

I am very concerned that we take the approach with a resource like natural gas and say, "Well, we simply can't produce enough of it here in this country. We must look to foreign nations for that resource," and we must put ourselves again in that position of being vulnerable, of providing cash to those countries—that as you point out—might be our friend today, but who knows where they're going to be next year.

My question to you is where are we with the demand/supply picture with natural gas—how do we keep ourselves from getting in the same position with natural gas as we are with oil in terms of our reliance?

Dr. GREENSPAN. Senator, you raise a very important question and indeed with the loss of production in the Gulf of Mexico as a result of Katrina and Rita last summer, we're not back to productive capability domestically that we had been.

For a generation, we had looked to Canada for piped gas for about a sixth of our needs, and we were growing reasonably well and price was low—I remember when it was $2 per MBTUs. The problem is that the only outlook we really have got is liquefied natural gas. And there are several problems as to why we have not picked up as quickly as I think we need to in that particular area.

First, of course, is that a goodly part of the liquefied natural gas market is on long-term contract around the world. And, for example, there's a very big contract, the biggest probably that I ever remember from the operations in Indonesia to Japan, which was a major source of their liquefied natural gas in the long-term contracts, and it worked exceptionally well.

We have not been able to do that—we get a lot of our LNG from Trinidad and the Caribbean, but the size of what we are going to need and can very readily use right now has got to come from Qatar or from the Middle East or from other sources—there's a big dispute as I'm sure you're aware now with respect to Russian gas going LNG to the United States. But our problem is that we've got to one, hopefully get longer-term contracts with the actual producers of the gas which will then ship it to us, and then we've got to be certain that we've got the terminals. Until fairly recently, the "not in my back yard" notion made it very difficult to bring LNG terminals into the United States for fear that there would be these tankers that would explode and a variety of other problems.

Most importantly, we do not yet have a spot market in liquefied natural gas, and the reason we don't is, for example, the trade in crude oil represents such a—imports of crude oil worldwide represent effectively 60 percent of world consumption. The trade from one country to another is very large. The figure is only a fourth in natural gas, and a goodly part of that is piped gas, including the piped gas from Russia down into Europe. So, we don't have the degree of sophistication as of yet in international trade in LNG, but we are going to need to make this a viable source in the United States, essentially equivalent to how we handle crude oil.

It's going to take a while, but if we can do that, we will then have the capability of converting gas into liquids with the new technologies that are coming on and this could be another source of replacement of petroleum, and may, indeed, be an actually significant possibility. So, the LNG issue has got a lot of facets to it, all of which are very important for the United States, for our national security and for the maintenance of, essentially, a car fleet on the roads not fueled by natural gas, but eventually fueled by the liquids we can derive from natural gas, provided we've got adequate capabilities to purchase it and import it.

Because we do have the inklings—you remember, energy is not rising in real terms anywhere near energy consumption in the United States—anywhere near what our incomes are. So we have the capability of buying, we have the purchasing power that produces other goods and services which gives us the ability to buy a great deal of energy of the type that we would need, and that largely—in the natural gas field, is to accelerate the capabilities of getting contracts, long-term contracts, and deliverable supplies of LNG, and eventually the North Slope gas which would not be a small addition—as you point out—to the lower 48 States' consumption.

Senator MURKOWSKI. Mr. Chairman, I have to excuse myself and go vote. I appreciate you mentioning the North Slope gas, and I absolutely appreciate you mentioning the great potential with natural gas hydrates. I believe when we look to that as a long-term future, there's great potential there. It needs to be nurtured, but I do get concerned that we focus on imported LNG and we are in a situation with natural gas as we are currently with oil in terms of our dependency and our energy security and the vulnerability that we face.

I'm trying to figure out a way to get our stuff down to the lower 48 to help in, I think, a significant way. I appreciate your comments.

Thank you, Mr. Chairman.

The CHAIRMAN. Thank you very much, Senator Murkowski. At this point we'll have a second round of questioning and we'll have a 10-minute limit on questions in each round.

Chairman Greenspan, in your testimony you mentioned the desirability of price increases in oil being gradual. In fact, you discuss that it's remarkable that the impact on the economy, even given fairly sharp increases, has not been greater. I would just ask—the reason in this context—one of the real problems of remaining too calm about all this, is that a great deal on the ground doesn't happen. We talked a little bit about the problems of corn ethanol and this is not a solution, and we decided to go on to cellulosic. But even in this interim period, the corn ethanol situation suffers from the fact that, despite a lot of plants being started, not much ethanol is being produced. And furthermore, even if it was being produced, the number of outlets in terms of filling stations and gas stations is de minimus at this point. The number of flex-fuel cars in the country, likewise, despite promises by automobile companies to produce half a million more, in the case of both Ford and General Motors this year—so that even that particular solution really needs urgency, and is clouded by the MTBE factor in which ethanol

has been diverted off to California and New England, so the price of ethanol at the pump at one of these M85 stations, using market economics, is almost identical with the petroleum. Therefore the Mom and Pop people who have started these places, because the oil companies have resisted doing so, sometimes don't sell very much ethanol. It's hard to keep them in the game.

On the cellulosic front, there are real problems in the Department of Energy, as I see it, just getting the regulations for the loan guarantees for our companies such as Iogen who wants to come into Idaho. I cite them because they are the only large candidate for production of cellulosic ethanol very soon, and they may not start until the end of this year or next year.

Now, in the midst of this, what happens if, for example, an incident such as the Russians cutting off natural gas to the Ukraine, albeit for only 48 hours, but nonetheless, the shock waves through Europe were substantial from this—or other suggestions by countries. Picking up on that measure that they could simply stop production for a while. That it may be in their strategic interests not to worry about markets or pricing, but the availability.

Leaving aside, as you point out, their lack of interest in going into their reserves, exploiting those, or trying to find capital around the world to do that—what I'm just wanting to examine for a moment is what are the possibilities or even the probabilities of shock therapy coming from national decisions that change the pricing situation abruptly, but with United States no more prepared, still fumbling about as we try to get these alternatives under way?

Dr. GREENSPAN. Well, Senator, as you point out, in certain respects, Europe is in far worse shape than we are. Europe's solution to the Russian gas problem, in my judgment, is to have very substantial liquefied natural gas terminals on standby. With contracts, contingent contracts out there to import natural gas liquids. It won't pay Europe to do that, but what it will do is put a cap on the price. In other words, it will significantly restrain the issue of what is, largely equates to a monopolistic position that Russian has with respect to European gas. And if that standby facility is there, it will be costly to maintain. It will be costly to get it contingent contracts. It will also depend on an issue that I was discussing with Senator Murkowski, namely the advent and the emergence of a viable spot market in liquefied natural gas.

But it strikes me that we ought to be in similar—try to create similar sorts of devices. But having said that, it's not terribly difficult to imagine—you remember the aborted insurgency raid on the major Saudi Arabian facility not too far from us, the gas processing facility. Had they succeeded in shutting that down, there would be an incredible impact on the world. We do have strategic petroleum reserves both here and in Europe which we would use and presumably it would obviously be the type of problem which is exactly what the reserve is for.

The CHAIRMAN. What sort of procedures could we adopt—just to pick up your point—the Europeans have this rather expensive contingency factor, but take the Saudi example. If they had succeeded, this is a real problem for the world, quite apart from us, but I'm not certain, aside from our strategic oil reserves, what we've got that really is a stopper in these cases.

Dr. GREENSPAN. We don't have much. If, however, we do not undercut the flexibility of our economy, we will take the shock. There's no way of avoiding the shock. Strategic petroleum reserve of 700 million barrels is not a small amount and when really—it very much depends on the extent of damage and how fast the systems can come back.

But I can very readily envision a shock in which even if we can bring in strategic control in reserve, the market price will still go straight up. And as I pointed out with respect to the discussion with Senator Alexander on the issue of the impact on the American economy—rising prices per se need not have an effect on American economic growth if the rise is gradual and the adjustment process is able to take place.

But a shock has got to be absorbed in one form or another, and at this particular stage, we don't have any backup other than the strategic petroleum reserve and our flexibility. We've got to find more ways to deal with this problem.

The CHAIRMAN. In going a little further with this—if the shock occurred in our economy, and on various other days you've testified on these sorts of subject—we have already a fairly large Federal deficit. We have an even larger deficit in terms of our trade imbalance. We are dependent upon others to loan us money by our bonds essentially. It's sort of a grand bargain to keep the world economy afloat this way, so there is still some purchasing power elsewhere.

But please explain what that kind of shock in our economy might mean, not only to us and our ability to cope with all of this, but to the world economy.

Dr. GREENSPAN. Mr. Chairman, it's difficult to give you a definitive answer because there are lots of different ways in which that can unfold. We don't know to what extent the foreigners hold U.S. dollars, basically because under our constitution we protect foreigners' property rights as firmly as we protect our own. And if you're looking for a safe haven for resources, and you don't trust your own currency, your own economy, or any of a number of reasons, you do know that a deposit in the United States is safe. And a large part of the accumulation of U.S. Treasury securities are that. I won't mention who, but I had a very interesting conversation with a monetary authority person abroad who has very large holdings of U.S. dollars and he asked me at one point when there was some question about possible problems, whether the United States securities were safe? And I said, "Of course they are." And he said, "That's very important to us because that's the reason we keep our money with you." Now I don't know the extent to which—how much are the aggregate holdings, or the result of that and how much are just economic investments in real rates of returns and productivity.

But that is a critical issue. It is basically that we are safe and I feel fine about that the Constitution is not going to be affected by a problem in the oil fields of the Middle East, but as an economic issue I would be concerned. I don't know any way to differentiate those particular issues. But I think you can reasonably well conclude that whatever the consequences are of a major shutdown of a Middle East facility, most specifically related to the processing of crude oil, the more the damage is to the world industrial struc-

ture. And the greater our flexibility, the greater our ability to absorb that. But there is no scenario which I am aware in which we get off scott-free. It's going to be a real serious problem, and I think the purpose of your deliberations in this committee is largely to make judgments as to what can this Government do to—not eliminate a potential shock—there is no way you can do that. But how do we set in place sets of policies which diminish its impact.

The CHAIRMAN. Well, you've accurately stated our quest and there are obviously foreign policy and security implications in this, in addition to those issues covered by our Energy Committee or the Banking Committee or Armed Services Committee—each one of us has a role but we've tried really in these hearings to get a comprehensive view of our national security and the foreign policy aspects, and your testimony is helpful.

Senator Biden.

Senator BIDEN. Mr. Chairman, it's such a pleasure to have you. I mean it sincerely. You are so, the breadth of your knowledge is impressive and very much needed by this committee, and the clarity with which you talk about it, is extremely, extremely helpful.

I'd like to focus on, in the short time we have, two pieces. One, by the way, not that it matters, but I couldn't agree with you more about the question if this is a Constitutional investment or an economic investment, and I have a feeling a significant part of it is—and I'm praying that this relates to the certainty of the investment as opposed to the economic return, which is a big, big piece as well. But as you said, no one's going to know until it ever gets tested, and pray God we don't get it tested that clearly.

And in terms of flexibility—that's really what we're about here in this committee. The Senator and I had opportunities, both during the hearings and working our staffs together and us talking—we're really not naive enough to think that we're going to talk about and be able to be "energy independent" which is a phrase which is thrown around, but flexibility matters a great deal. Not only the broad flexibility of our economy, but flexibility as we build in flexibility to be able to deal with oil shocks, and it's a process—we're talking about a process to put in training.

And I'd like to get to a point which is when we struggle—not just the two of us, but others—including my colleague from Florida and my colleague from Ohio. We're all basically on the same page here. As we struggle with the notion of providing flexibility by having alternative fuels—and as you point out, the vast majority, you know, one in seven barrels of oil in the world is consumed on American highways—so obviously that's the biggest, biggest ticket item you could impact on. And 90-some percent of all of the refined oil is going into the engine or the tank of an automobile.

Right now there's the economic incentive for alternative fuels to have a shelf-life. There's actually a lot of discussion on the street—which you've forgotten more about than I'm ever going to learn—about investments in alternative energy sources. There is a burgeoning industry that is—goes well beyond corn ethanol out there—and one of the worries I have—worries is the wrong phrase—one of the concerns I have is in the past when we controlled oil, figuratively speaking, in the sense you used it in the phrase, up until the early 1970s, and now the cartel controls it.

There has been this sort of self-interest realization on the part of oil that, if it gets too expensive, you're going to find yourself in the position where it's not beneficial for the industry in the long-run and those who hold the reserves—it clearly, notwithstanding the lip service, I should maybe not say it, clearly notwithstanding discussion on the part of major American oil companies about their interest in finding alternative sources of fuel—it is not really overwhelmingly in their interest that we would, in fact, make a major shift in consumption of oil.

So here's my concern, and I'd like you to speak to it two ways. One, is it legitimate, the concern I'm about to express; and two, if it is—what do we do about it? I am concerned that as the decision to get the tens of, the billions of dollars, tens of billions of dollars over the next decade of investment needed to, in fact, produce or generate an alternative energy source, the kind of investment needed to make it—to give us the flexibility, where it takes up 20, 25, 30, 40 percent of our consumption, at least in automobiles, over the next decade or more—that it rests upon the price being competitive with oil. And I don't say this as, I'm not making a populist argument here. But it would seem to me to be in the naked self-interest of the major energy producers—oil fossil fuel producers now—that if that became a genuinely competitive, alternative source of energy that allowed us not independence, but genuine flexibility, that it would be very much in the interest of the industry to drop the price. It doesn't take much for them to swallow losses for some time in order to have the effect of driving out of business what are essentially, great potential—cellulosic, for example—great potential, but in its infancy. Is that a concern that is not well-placed? Are the economic incentives for major oil, whether it's Saudi Arabia and OPEC, or specific energy companies—is that concern of mine misplaced? Are we still going to get the kind of investment which—we're talking the need of billions of dollars of capital to move into these alternative sources of energy to make them competitive, so we're producing billions of gallons—equivalent gallons of oil by alternative sources.

Is it a misplaced concern?

Dr. GREENSPAN. Your concern that people in the oil industry concerned about competition coming in, would produce cellulosic ethanol at a subsidized price to drive out the competition? Or a——

Senator BIDEN. Just in terms of simple flexibility. We had two very impressive panels that came before us about 3 or 4 weeks ago. And they pointed out that in order for us to get to the point where there is really an alternative to fossil fuel for transportation, that you really have to acquire a scale sufficiently large in the existing oil industry now. You have to have, not just the kinds of plants that are bringing economic growth to Southern Indiana, producing four million barrels a year, roughly, equivalent—you have to get on the scale of the major oil refineries, in terms of production. And that is not necessarily in the immediate self-interest with oil at the price it is now and likely to remain, of those very companies.

So where do you get the tens of billions of dollars of investment? And they gave it a—I realize it's more illustrative than—but they, one of the very well-respected figures we had before us, speaking about alternative energy, he gave a chart, it was kind of a wish

list. He said, look, the projected "if" in switchgrass, we produce, we have the increased yield per acre, increased productivity we've had in corn just in the last 30 years. That if you devoted the prairies of—I think he picked South Dakota—to, that exist now to a higher yield but in an economically competitive switchgrass process by which you refine the switchgrass for, as you point out, that's the better bang for the buck in terms of a percentage of it that is usable and is closer to a BTU equivalent of oil, et cetera. He said, and he put up a chart, he said "South Dakota would be the second largest producer of energy." And he was making a point that wasn't literal, but illustrative of the kind of thing that can happen if we put, for example, 60 million acres—as opposed to 110 million acres—60 million acres in ethanol-based fuels over the next 15 years.

And he made a statement—he said that as Australia tried to move to an ethanol-based system—as it began to take root, the price of oil was dropped significantly, making it uncompetitive without subsidies, and it really tanked. Whereas in Brazil, they—for reasons I realize that's a controlled economy, I'm not suggesting we emulate it or model it—but the bottom line is, Brazil really is at a place now where they have a distinct flexibility—an alternative. They do not have to listen to Chavez and his ranting and ravings about what he's going to do to them, cutting off access oil.

And so the question is, is there any reasonably historically, or purely from an economic incentive standpoint, and I'm about to go over my time. I apologize, Mr. Chairman, but is there any concern about if we were to mandate in a process, flex-fuel automobiles, mandate ethanol-ready gas stations and so there's enough of an infrastructure so that if you build a car there's a place to fill it up—if we were to mandate more rational mileage for American automobiles. And we both come from UAW states, it's not something we're looking forward to going on and just looking for fights—but if we did all of those things, would you have to put, essentially, a floor on the, you know, of $30 or $35 or the equivalent of a barrel of oil in order to make sure that you've got investors who are willing to invest in the long-run and not worried if all of a sudden, oil drops to $26 a barrel and their investments tank?

Dr. GREENSPAN. I think that's quite unlikely, and let me give you the reasons why I think so. It's a legitimate question, because I would say if you had raised that question 20 years ago, it's a real question. And the reason it would be a real question is that at that particular point, it was quite apparent that you could get, let's say, a 5- or 6-year lead on significant amounts of crude oil out of potential unexplored reserves other than OPEC. That is no longer available. And, in fact, if you take a look at the far distant futures contracts now, for example, go out to December 2012—crude oil is $66 a barrel. Twenty, no 10 years ago, even 5 years ago, 6 years ago, that figure was $20 a barrel. The reason that has happened is that the full structure of the international oil industry is getting tighter and tighter and tighter. It started off in 1870 and we have consumed an unbelievable amount of oil. And whatever there was, there is less, and it's beginning to show up in various different places. It's beginning to show up in inability on the part of those drilling in less hospitable places to get oil, and it's very costly.

So what I think is going to happen here is we are already beginning to see private equity funds beginning to invest in ethanol. Just as the Chairman mentioned, this particular facility that is being put up and may be available, he said, by the end of the year—that will tell you what the potential cost runs are and what a good deal of the economics are. And if it appears to be credible, you'll begin to get an awful lot of financial assets coming in—not an insignificant part of what the oil industry, the hedge fund industry who are now investing in oil—I think they'd start to go into those particular types of projects.

Especially if the numbers make sense, which I think they do, for reasons exactly why you point out. If that is indeed the case, there will be potential concerns of the type you raise, Senator. I cannot say with certainty that it will not all of a sudden be some pocket of weakness in oil prices which brings it all the way down.

The real problem, strangely enough, is what happens to the price of oil if we succeed? Because, if indeed we get a real major displacement of gasoline use on U.S. highways, the world price will come down. My guess is, and I must tell you I can't argue that it's very much greater than a guess—it will not drop back to $20 a barrel. It will drop, but it will drop back to levels which will not undercut the economic viability of the cellulosic ethanol, and indeed it may very well be that the marginal cost and rates of return of cellulosic ethanol may very well be determining the crude oil price.

Senator BIDEN. Well, I pray for that day.

Dr. GREENSPAN. Well, we may inadvertently, all of a sudden, South Dakota may become the new energy czar.

Senator BIDEN. It seems to me your view is one that's shared by most of us up here, that we're really reaching an oil peak here, and it seems to me that it's the end of cheap oil. I would love to envision the world being more secure. Enough that in fact we move back to that "Bay of Cheap Oil," but in terms of the reserves available, in terms of what I look at there—and I don't pretend—I think I know, I feel I know a lot more about foreign policy than I do about the oil industry. But the fact is, I don't see the near term, no matter how well we succeed, that there's so much stability in the oil-producing countries around the world in the next generation that we aren't going to find ourselves subject to—in bad need of flexibility.

My time is up, I can't tell you how much I appreciate your being here, Mr. Chairman. Your views are welcome and greatly respected, and I thank you for taking the time.

Dr. GREENSPAN. Thank you very much.

The CHAIRMAN. Thank you, Senator Biden. Senator Voinovich.

Senator VOINOVICH. Thank you, Mr. Chairman. I do share Senator Biden's appreciation of your being here today.

Recently, I met with, a kind of reception with the chairmen of the three major U.S. auto companies, and they indicated that they definitely were going to go forward with more ethanol-fueled vehicles. In fact, one of them said that 25 percent were going to be ethanol, E85. I have met with representatives from the oil industry and talked to them about the infrastructure needed to make this available, E85, and their response was that, number one, they weren't really interested in putting those pumps in. And the reason

for it was that the cost of ethanol was high and that in some instances, higher than gasoline. And last but not least, that when people find that they're going to have to tank up more often with ethanol than with gasoline, they're going to be less inclined to use ethanol.

The concern that I have is that there seems to be a collision, maybe going to occur between the auto makers who, by the way, get credit for their E85 even though you may not use E85, and the auto companies saying, you know, we're not that interested in it.

We are thinking about—building on the last energy bill—of increasing the tax credit for building these pumps from 35 to 50 percent. In other words, we're going to say, "We're going to make it more worth your while to put these pumps in." And I'd be interested in what you think of that.

Second of all, from your testimony, I got the impression that you really felt that the future was in cellulosic renewables, and that's puzzling to a degree, because if you look out in the marketplace, we're seeing tremendous investments in ethanol refineries. In my State when I was Governor, I tried to get them to build a refinery. I couldn't do it to save my soul, and we've got three that are underway and looks like we're going to have more. There's supposedly 38 of them being built in the country, and the issue is for us, in terms of investment, should we be putting—or in terms of incentives—be putting more money into that, or should we spend a lot more of our dollars in moving in the area of cellulosic which I understand the technology still isn't there yet for cellulosic, and by the way, these ethanol plants aren't going to be able to handle cellulosics. They will have to add something or build new ones. And of course the other one is the hybrid that you made mention of, and that is the electric battery plus gasoline. I met with somebody recently and they were talking about diesel-electric for big trucks.

So I'd be interested in your comments about some of these statements I've made and where do you think we're going and if you were in our shoes, where would you be putting your money?

Dr. GREENSPAN. I think it's a very tough question and I'll tell you why. First of all, it's ultimately going to be the markets and technology which will determine what is what. The real problems with ethanol are one, that whenever you're dealing with a huge, say 9 million barrel a day gasoline market, and the inability to intertwine the two types of oils in the pipelines, because as you know you cannot put ethanol through oil pipelines because of the chemical——

Senator VOINOVICH. That's the other thing they mentioned, they've got to truck it in to do it.

Dr. GREENSPAN. Exactly. It's got to be. Ethanol has got to be until we find some solution to that, a generally local issue. In other words, what you've got to do is have your local refinery essentially working off local crops and delivered by trucks and you can't get huge volumes of that very easily right away. And I don't know enough about the actual details of what the costs are and the like, and the ability to shift from corn to cellulosic, but I do know that because corn is inherently limited in size, it has been a very useful additive to date, and is clearly that's all we've got. So, cellulosic is very nice, but it's hypothetical at this particular point.

But, if ethanol is to be a really significant issue here, it's going to have to be cellulosic. And so I would think that what we'd want to do is to get up as quickly as possibly on technologies of cellulosic and find it——

Senator VOINOVICH. So you would be, if you're—we're going to try to pass another, it's the second version of an energy bill——

Dr. GREENSPAN. Yeah, I would move as quickly as I could to find out whether cellulosic is really a practical alternative. Because if it turns out that the plants actually work, are cost-effective and have potential, reasonably good capacity, with very few problems which invariably occur in these sorts of technology which we don't anticipate in advance. If you can find out if this stuff works rather quickly, I would try—because of the inability to add/mix corn and cellulosic ethanols as far as the production facilities are concerned—to find out whether you've got something here. Because if you do, then I think you move ahead as quickly as you can in developing cellulosic, because that's the only thing that's going to create the volumes adequate to really be a major competitive thrust against gasoline.

Then I'd also be trying to move as quickly as we can on liquefied natural gas, and the gas to liquids conversion capabilities, which are also beginning to work here——

Senator VOINOVICH. Can I interrupt you just a minute. That gets into another issue and I'm sorry I missed the testimony—your response to Lisa Murkowski's questions. But you know and I know that the high cost of natural gas has clobbered a part of our economy, the chemical industry, and they haven't been able to adapt as some others have.

Dr. GREENSPAN. They've moved out of the country.

Senator VOINOVICH. We're a net, right, we used to be a net exporter, now we're an importer. I had a company in the other day. They were in 3 years ago. They had 22,000 people in the United States, now they've got 14,000 and they basically said, "If you don't do something about these natural gas costs, we're going to lose more jobs." And in our home heating, I mean, we've increased lie heat dramatically to help people with their heating costs. We got a break this last winter because it wasn't as bad as what people expected, but we're now seeing the cost of natural gas go down quite a bit because I guess they've got a great deal of supply out there and——

Dr. GREENSPAN. It's basically a weather phenomenon.

Senator VOINOVICH. But you think it's a phenomenon, you think that the natural gas costs will ratchet up again?

Dr. GREENSPAN. Well, we're now at about a little over $6 for a million BTUs. We had been, of course——

Senator VOINOVICH. $16, $14, $15, yeah.

Dr. GREENSPAN. Really sharply, the problem is storage capabilities with gas are not obviously as efficient as with liquids, and when you have any commodity without inventory, like electric power or, even to a lesser extent natural gas, demand and supply variations create huge immediate changes in price, rather than work their way through the inventory system, which is what happens in oil.

And so the gas issue here largely is going to rest—not on the current balances which we now have which is, you know, we import a large chunk of our gas from Canada. We produce a big chunk of it in the United States, although the production has come down because of the hurricanes—and it's liquefied natural gas where the answer lies.

Senator VOINOVICH. Yeah, but can I ask you something? The question is, we talk about LGN—what I've been getting from talking to people, are they, is the infrastructure being put in the United States in order to bring in LGNs and I understand that some of the people overseas that provide LGN are wondering whether or not we're going to have the places where it can be brought in and stored.

Dr. GREENSPAN. Yeah, we—our problem at the moment is actually less the terminals which we have a fairly large number that are planned, authorized, or under construction. It's getting the LNG to begin with. In other words, what we need to do is—because a lot of this stuff is on long-term contract, we have yet to get very substantial long-term commitments as the Japanese have with the Indonesian liquefied natural gas operations. And it's only when we start to get those longer-term contracts or the LNG market becomes sufficiently large and sophisticated that there is a spot market, which there isn't to speak of now, and that's what our problem is. We need to get a more sophisticated market. But there is a lot of stranded gas out in the world which is available and if you can get a world market in LNG it could be rivaling a good deal of the oil market in certain respects.

Senator VOINOVICH. I'm out of my time, but the real question is, is Mr. Jones in Cleveland, Ohio, whose natural gas costs have gone up astronomically, and he's saying to me, "Senator, what are you doing about bringing down my natural gas costs?" and the question is what are the prospects, you know, in the next year or 2 years to see a situation where I can say to him, "You know, I think that maybe you're going to see a 25 percent reduction in your natural gas costs."

Dr. GREENSPAN. Well, I think what you can say, Senator, is the fact that if we get this "stuttering" process of expanding liquefied natural gas on track, which we should be able to do, I hope, within a couple of years, then the price begins to reflect the marginal cost of bringing gas from a lot of different places in the world to the United States which had been—I don't know where it is now, but as of the last time I looked at the cost structure—is down in the area of $4 per million BTUs. Now, I don't know whether or not that automatically is what the price will become, but at some point it's going to be LNG imports which is going to set the price for all of the gas in the United States. It can't do it yet. It's only 3 percent of the total.

The CHAIRMAN. Thank you very much, Senator Voinovich.

Senator Nelson.

Senator NELSON. Thank you, Mr. Chairman. Mr. Chairman, it's good to see you.

Dr. GREENSPAN. Good to see you, Senator.

Senator NELSON. Given the fact that we in the United States have about 3 percent of the world's oil reserves, yet we consume

25 percent of the world's oil production, certainly your testimony is well-received, and I think will go a long way in trying to jolt some people out of this oil dependence.

But I'd like you to comment on an additional fact, just for the record, that 79 percent of the world's oil reserves are controlled by governments, suggesting that substantial amounts of proven global reserves could be subject to political decisions, not market forces.

Dr. GREENSPAN. Well, I'm fearful that they're doing it now. And the real problem that I think we have is that vast amounts of reserves in the ground which could be extracted for just a few dollars a barrel. It used to be in a sense, it's gone up a lot, but it's still relatively negligible. The problem is that the incentives for the nationalized oil companies to do that are not very great. The sole exception, at least to those whom I've spoken with who really are concerned about the high price, are the leaders of Saudi-Aramco, who recognize that a 250 billion reserve plus situation is very precarious if all of a sudden the United States, the big user, starts to switch to non-oil, non-petroleum means of energy, because what that will do in the long-run is lower the market value of their reserves, and they recognize that, and they're trying, essentially, to expand capacity to hold the prices down.

But the vast proportion of those national oil companies rebuff the international oil companies—the ones with the technology and capability of going in—and if a deal could be made, some royalty or something like that, we could increase the crude oil capacity of the world very significantly with the effect of bringing prices down quite markedly. But there is very strong political resistance to do that, and even outside of OPEC. I mean, Mexico, its constitution prevents foreigners from having any commitment in the national patrimony which is their crude oil, despite the fact that PEMEX executives, Mexican national oil company, are petitioning their government to allow them to ask foreigners to come in so that certain particular fields deep in the Gulf of Mexico and deep down under the sands are there, but they don't have the technology to get there. And so far, nothing has happened. And that's true everywhere.

And that's what our problem largely is. It's not as though the oil is not there, it's just that the capability of converting it into productive capacity to meet the growing demands from China, India, everywhere else in the world are a very big question, a very big problem.

Senator NELSON. Well given that, we each year go through a drill up here where we try to increase CAFE standards, and we always get beat trying just to increase miles per gallon on SUVs, phased in over a number of years. Is this not the time, in addition to what you've testified about alternative fuels like ethanol, nuclear and so forth, is this not also the time for us to have the likes of a Manhattan Project where we go out and develop an engine for the future that will be totally independent of oil?

Dr. GREENSPAN. I think the example of the Manhattan Project—that project was far more narrow than people realize. There was a specific technology that, as you know, there had been an early discovery that the uranium atom was unstable and that eventually led to the Chicago operation——

Senator NELSON. Then let me substitute for Manhattan, an "Apollo" project.

Dr. GREENSPAN. Okay. That is actually a more relevant thing, because we're starting with much less knowledge. I would hope we don't have to do that, and the reason is that at the moment, I think the markets are working in the direction of a solution. If we create an "Apollo Project" it may fail, it may not fail, but one thing it surely will do is that it will eliminate all of the market incentives, because there would be no way for a private equity fund that wanted, for example, to invest in the cellulosic project to compete with unlimited funds of an Apollo Project.

So, I would hope not, but not because I think it may not succeed. It might. But I'm almost certain that it would divert what is already working at this stage—to be sure slowly—and it's very frustrating, but it is working. And I'd like to see the market forces continue, because they are working. We've seen the gradual disengagement of the United States from petroleum—it's been going on for 35 years. We've now reduced our dependence by half and we're still moving it down. And at some point we're going to get to a level where it's not going to be a national security question any more. And I would hate to divert that process.

Senator NELSON. Reduced our dependence by half, and yet our consumption of foreign oil goes up as a percentage of our total consumption.

Dr. GREENSPAN. That is correct, and indeed it will continue to do so. And this is the reason why if we can get a major shift in how we drive our motor vehicles—whether or not it's hybrid or plug-in hybrids, or whether or not it's cellulosic-based ethanol—or whether we find we can work from liquefied natural gas of which there is a vast amount out there, converting that into liquids. There are an awful lot of alternate sources, and they're not mutually exclusive. So, we're on our way, gradually, to weaning ourselves off petroleum. It is slow, and I regret to say in many cases, it's like watching grass grow, but it is working. And I think we have to be careful to nurture that process.

Senator NELSON. Final question, Mr. Chairman. Is your opinion the same with regard to the development of an Apollo-type project for a new engine if you set a date certain in the future so that the market forces knew that within that 30-year period that you would not have the competition of this new engine?

Dr. GREENSPAN. Senator, I don't think that this Congress or the next one can commit the United States to such a view. The pressures, as you know far better than I, when that particular deadline begins to grip, it would have very profound implications. A lot of constituents would become very strained as a consequence. I'm not sure how successful you would be to put that in place. I would hate to see it tried, because I don't think in the past when we've tried such things it ever really worked out very well.

Senator NELSON. Is that to say that you are suggesting to us that over the course of the next 20 or 30 years that what we should do is reduce our energy consumption of foreign oil so that we're completely free of foreign oil over the course of the next two or three decades?

Dr. GREENSPAN. I would say we reduce our consumption of petroleum. Because whether foreign or domestic, it doesn't affect the price. But what is necessarily the case, as far as the United States is concerned, if national security is the issue, is weaning ourselves off of those very serious sources of supply which create problems for us. The issue is to get off petroleum, not whether or not it's imported or not. And I think that where our ethics ought to be are in those promising areas where large possible changes are conceivable. And that's the reason why I would like to see us move as quickly as we could to find out whether the various forms of cellulosic ethanol are in fact feasible. Everyone thinks they are, everyone has figured out the acreages we need of switchgrass and the extent of types of significant crop yield changes that are required and the technology of converting these carbohydrates into oil is well known. Indeed, we used to use ethanol in American motor vehicles before the first World War, so it's not an unknown technology, but we don't know if we can make it work at the levels, the volumes, the huge volumes that are going to be required to make a very major—very major effect in motor gasoline consumption in the United States.

Senator NELSON. Well, if it doesn't work, I'm going to be advocating for an Apollo Project.

Dr. GREENSPAN. I hope it works, sir.

The CHAIRMAN. Thank you very much, Senator Nelson. I have just one more question and this concerns an area we haven't touched upon today. Some in the coal industry believe that there are possibilities for believing there's a portion of the petroleum demand in the United States which is the use of coal. This then leads to other questions—quickly environmental considerations which many in our country believe that although there are large reserves of coal available they have environmental problems.

Now this leads to a debate—we've been reading in the press—between various companies in the coal industry. Some are saying that it may simply be a prudential measure that at some stage the United States will require carbon sequestration and therefore if you're building a new power plant you ought to build one that takes that into consideration. Whereas others take a more traditional view. That is that all of this carbon sequestration is very expensive. Even the procedures are not altogether well established, they would claim. And then we have sort of the issue of the scientific evidence for climate change, global warming, which sometimes leaves the science into the almost theological as people dispute this in the country. So it swirls around the coal business in a big way.

On the other hand, the discussion of coal can't be omitted from the conversation because from the United States' standpoint, we do have a lot of coal. As locally based in many places in our country and there are many persons who are prepared to build power plants under certain circumstances that sequester the carbon and might serve us for a long time.

Have you given any thought to the place of coal in this? And the debate that I've just described abruptly here?

Dr. GREENSPAN. Well, Mr. Chairman, it's fairly obvious that if the worst of all possible circumstances arose, we do have the tech-

nology to create, to build only plug-in motor vehicles, and to use only coal, whether it's cleaned, or otherwise, to generate electric power. We can keep our vehicle fleet on the road. Now I grant you that there will be a lot of required, re-plug ins every hundred miles or thereabouts, but we could do it. That's the extreme fallback position.

Less than that is obviously we are moving toward the sequestrated carbon and other clean technologies, but I don't think we've focused enough on nuclear. The technology of nuclear has changed dramatically since Three Mile Island. The French have been running three-fourths of their electric power system for decades on nuclear and it's worked quite fine. I think that our knee-jerk reaction against the issue of nuclear is in the full context of our environmental requirements, and indeed the health requirements involved in getting a very large coal economy, have got to be matched against nuclear. Nuclear's got problems, there are difficulties clearly with waste and a number of other issues, but we are developing technologies which can address it on an interim basis, meaning 100 years or something like that. Without putting nuclear into the mix here, I think we're making a mistake.

But the one thing we can say with a reasonable degree of accuracy is that the energy abundance on which this Nation was built is over. We no longer have the choice of one abundant energy source versus another. We're now having to make choices as I put in before, between the non-good, and the still less non-good. We will not have the uninhibited lifestyle available to us that very low-cost and available energy enabled us to live up through the 1950s and the 1960s and indeed even today. Because what is happening is year by year we're getting closer to the point where we're starting to really run out of oil, even in the national oil companies. And at some point we're going to reach a peak of production, and it's going to start down. That doesn't mean that oil is going to go away. You can have a decline go on for a long period of time and still produce a good deal of oil, but oil is a finite resource. We have to remember that we tend to switch to a new major fuel before the other major fuel is dissipated. We moved to coal before we denuded the forests of wood, and we moved to petroleum before we ran out of coal. And I would surely presume we're going to move to the next set of energy technologies before we run out of oil.

The CHAIRMAN. Senator Voinovich, do you have additional——

Senator VOINOVICH. I do, Mr. Chairman.

I'd just like to get back to that natural gas question again. From what I heard you say, it's probably going to be 3 or 4 years before Mrs. Jones in Cleveland, Ohio, is going to see her cost of heating go down?

Dr. GREENSPAN. I don't know what the time frame is. If you had asked me 2 years ago, I would have said we probably would be there by now—we haven't been. It's been a much more difficult, just plain institutional structure—it's got nothing to do with technology or anything like that. It's just that we haven't managed it in a way to lock in foreign sources of gas, find the appropriate tanker fleets, get the contracts written so certain numbers of deliveries are made to each LNG terminal per month, and have the gas-

ification of the liquids structured in such a manner that it goes into the pipelines as we need them——

Senator VOINOVICH. So, basically what you're saying is that the future in terms of getting our costs down are the liquefied natural gas, and we've got to move on that as quickly as we can.

Dr. GREENSPAN. Yes, I can not envisage any way to get natural gas prices down in the United States other than through a significant increase in the imports of liquefied natural gas.

Senator VOINOVICH. Well, you might be interested to know that the last energy bill did provide some significant incentives in clean coal technology to—we have an abundance of coal, 250 years of coal in this country to utilize that more than we're now doing it, and the other thing—I don't know whether you're aware of it, but I have a Nuclear Regulatory Commission under my subcommittee in another committee. We have 19 applications. They are coming into the NRC, and so because of the incentives that we put into the energy bill, they're moving in that direction. So I think that's something that we should be——

Dr. GREENSPAN. Are we getting to, yet, a standardized nuclear plant which everyone can basically deal with without waiting for the years and years of people fussing over——

Senator VOINOVICH. Well, the technology's out there, and in addition to that, we've made it easier for them. They can now commit to their application with the technology and siting, and most of these are going to site them in areas that are already sited, so you don't have to deal with the "not in my back yard" syndrome that they run into, and the technology's pretty well accepted. A lot of it is European technology. Some of it has been used in South Africa—so I think that we're, we've got it, and I think the reason why we're seeing the applications is because we do have the technology that we can move forward with.

The other question I have is dealing with—getting back to oil—after sitting in on hearings I start to sweat bullets about how vulnerable we are to some foreign power deciding to—I mean, I thought what if Saudi Arabia becomes unstable? Somebody like Osama bin Laden gets elected and with their mindset, we're just going to cut it off and it doesn't make any difference whether we get the money or not, we're going to do what we're supposed to do. You have Chavez talking about it down in, you know, let's get at the United States—so I think we should be moving away from the Persian Gulf in terms of that area because it's not that stable, and God only knows where this whole terrorism thing's going to finally play out. We don't know. We're very uncertain about this.

But if you take that into consideration, the next question is, we spend—according to testimony before this committee—about $50 billion a year to protect our oil in the Persian Gulf. And if we gradually move away from that source, who's going to pick up the costs of protecting it? I mean, I don't think some of our European allies get it that we've been doing them a big favor for a long time of protecting that source of oil supply.

So, the question is, if we move away from that—first of all, do you think that's a good idea? Second of all, if we do—maybe this is beyond, you know, it may be a foreign policy question—what im-

plication does that have in terms of our relationship with these countries in the Persian Gulf?

Dr. GREENSPAN. First of all, Senator, I think that the issue is not from whom we purchase our crude oil. It's what the price is. Because we have an international market. And merely saying that we won't buy from one supplier or the other is really not terribly important, because the trade is so large and the interchange of crudes is so substantial that there's one price in the world for each particular grade adjusted for transportation and the like. And so whether we buy from Saudi Arabia, or from Venezuela, or from Canada doesn't matter. The question basically is what is the overall oil infrastructure supply and therefore, given the world demand, what is its price. And I think our interests and indeed I think I've always envisaged the reason why we have such large investments in the Middle East to protect oil is essentially that we are the major user. We consume 25 percent of the world production, but it doesn't matter where we get the oil. But what we do know is that if the Middle East gets shut down or places in the Middle East from which we get no oil shut down, the cost to us will go up the same. And so, our interest is in maintaining the supply, and indeed not only the Middle East, but actually the tanker shipments across the various oceans.

So our interest has got to be, until we can reduce our consumption, to hope and protect if we can, the existing system until it eventually begins to peak—and it will go down of its own—I don't know whether or not it starts down in the 2040s as I gather the Energy Information Agency of the Department of Energy has been projecting, or whether some new technologies come in and reservoirs are capable of getting 80 percent recoveries—well above what it is now. Obviously, it increases the availability very substantially—it's hard to know where all of this is coming out, but what we do know is our interest is, so long as we are very critically determined on petroleum, to make sure that its aggregate supply is maintained. Not that it's maintained in any particular geographic arrangement.

Senator VOINOVICH. Mr. Chairman, can I ask one more question? It gets back to your legislation. Tom Friedman recently suggested that we refocus our policy on developing an access of energy to compete with. He quotes it "Access of Evil" that would mean that India, China, and the United States get together and start talking with each other about this whole energy business. To talk about the supply and how we need the supply and what are some of the things that maybe we can do respectively to try to reduce the demand.

Dr. GREENSPAN. I'm not sure what it is that that confab will conclude and what we can do to enforce the particular conclusion. If there is a, for example, a joint discussion to find ways in which we can all conserve on energy, and interchange ideas and abilities, there may be something to that. But it's not clear to me that the three of us combined somehow can be a cartel which will dictate to OPEC—doesn't sound credible to me. Because I don't think any of us has the capability of restraining our use of petroleum without impacting on our economies very significantly and it's only when we find alternate means and alternate solutions that we have that

capability. So, Tom Friedman has got a lot of good ideas. I'm not sure this is one of his better ones.

Senator VOINOVICH. Thank you, Mr. Chairman, and thank you, Mr. Chairman.

The CHAIRMAN. Thank you, Senator Voinovich, and we all thank you again, Chairman Greenspan for your testimony today. It's been comprehensive and very, very helpful.

I want to present for the record—a request by Senator Biden—the written testimony of John Podesta, President of the Center for American Progress, to be made a part of the record. Without objection, that insertion will occur.

[EDITOR'S NOTE.—The previously referred to information appears in the Additional Material Submitted for the Record section at the end of this hearing.]

Thank you again, we look forward to continuing our visits with you.

Dr. GREENSPAN. Thank you very much, Mr. Chairman.

The CHAIRMAN. The hearing is adjourned.

[Whereupon, at 11:37 a.m. the hearing was adjourned.]

ADDITIONAL MATERIAL SUBMITTED FOR THE RECORD

PREPARED STATEMENT OF JOHN PODESTA, PRESIDENT OF THE CENTER FOR AMERICAN PROGRESS

Chairman Lugar, Senator Biden, and members of the Senate Foreign Relations Committee, thank you for the invitation to submit testimony today on the critically important topic of our Nation's oil dependence and the risk it poses to our economy. The Center for American Progress has placed a high priority on developing policy solutions to a variety of energy-related issues, including the pressing challenge of our Nation's growing dependence on oil and the closely related threat of global warming.

The United States is saddled with rising prices for gasoline and crude oil, escalating uncertainty in energy markets, and increasing oil importation stretching into the foreseeable future. These stubborn facts will not change without an aggressive policy response that promotes both radically increased energy efficiency in our vehicle fleet and a rapid shift to greater use of alternative renewable fuels. At the Center for American Progress, it is our belief that such a bold program to advance both new technology for conservation and greater use of biofuels to replace polluting fossil fuel will have a tremendous positive impact on jobs and economic growth, as well as securing improved national, economic, and environmental security. This moment holds both great risk and great opportunity.

Let me quickly review the underlying fundamentals.

SUPPLY IS STRUGGLING TO KEEP UP WITH DEMAND

Today the cost of a gallon of gasoline remains well above $3 per gallon in many parts of the country, and the cost of a barrel of oil continues to hover above $70. Just a few years ago, these prices would have been unthinkable, and they are having a significant and regressive impact on working families and on our greater economy. The causes of these persistent high prices are clear. Global demand is outpacing supply and refining capacity, creating a tight market that leaves us and our allies increasingly vulnerable to disruptions in energy supplies from unstable and sometimes hostile countries (which adds a further premium to prices). Consumers have insufficient choices in fuel type, fuel efficiency, or even other transportation options, all adding to the economic strain on families.

The United States is responsible for 25 percent of global oil demand, largely for our vehicle fleet, yet we possess less than 3 percent of proven oil reserves. Clearly domestic supplies cannot solve this problem. Oil is a global commodity, and global demand will define our options as long as we rely on oil as the lifeblood of our economy. These patterns show few signs of declining. Today global oil demand has already surpassed 80 million barrels per day, and the Energy Information Administration (ETA) projects it to reach 103 million barrels per day in 2015 and nearly

120 million barrels per day in 2025. Projected increases in world oil demand would require an increase of more than 42 million barrels per day relative to 2002 crude oil production capacity, the equivalent of four Saudi Arabias, but global oil reserves are already being depleted three times faster than new reserves are being discovered, according to a 2004 Department of Energy (DOE) analysis.

Domestically, our demand shows even more alarming trends. As the largest consumer of oil on the planet, we are most vulnerable to fluctuations in this market. Yet America's dependence on imported oil has grown steadily since 1972, when domestic output reached its peak of 11.6 million barrels per day. Domestic production is now 9 million barrels per day and declining. Yet total oil consumption is nearly 21 million barrels per day, and, absent change, projected to reach 29 million barrels per day by 2025. Today, 66 percent of oil consumed in the United States comes from foreign sources, up from 58 percent in 2000, with about 20 percent of those imports coming from the volatile Persian Gulf region. In spite of these alarming statistics, the efficiency of our vehicles is moving in the wrong direction. In 1987, the average fuel economy of U.S. auto and light truck fleet was 26 mpg; in 2004, that number had fallen to 25 mpg.

RELIANCE ON OIL HAS REAL COSTS TO THE U.S. ECONOMY

In 2005, the United States spent over $300,000 a minute on foreign oil. Oil is the largest component of the U.S. trade deficit, which has reached an unprecedented cumulative level of $2.835 trillion during this administration. In 2005, our trade deficit reached $723.6 billion, a 17 percent jump over the previous year and twice the trade deficit of 2001. Oil imports accounted for nearly 25 percent of the entire deficit, with rising crude oil costs adding an estimated $70 billion to the Nation's trade imbalance in 2005 and as much as $100 billion predicted in 2006. Volatility in the oil market creates further costs, estimated by the DOE at $7 trillion during the past 30 years. Together, these impacts mean that our reliance on oil is a substantial drain on our overall economy.

Rising energy costs are also highly regressive. Working families—who spend the largest share of their income on transportation and energy—are hit the hardest. A recent Center for American Progress analysis found that between March 2001 and May 2006, rapidly rising gasoline prices and flat minimum wages have resulted in a nearly 105 percent increase in the cost for minimum wage earners of getting to work each week. On average, it now takes 11.2 hours of work—until Tuesday morning—for these low wage earners to pay to get to work, up from an average of 5.5 hours in March 2001. Amid these rising gasoline and oil prices, 23.2 million families with incomes of less than $24,102 paid almost 8 percent of their annual income for gasoline in 2004, according to the most recent data from the Bureau of Labor Statistics. And that's before the recent jump in gas prices.

Yet while consumers are taking a hit at the pump, oil companies have made record profits. In 2005, Exxon earned the highest profit ever recorded by a corporation: $36 billion. Large profits were reaped throughout the industry, with companies like Valero Energy—the Nation's largest oil refiner—posting record quarterly earnings of $849 million. In light of the record-breaking profits and substantial social costs from energy prices, there is a need for increased Federal oversight on issues of market power and consolidation, market manipulation, and price gouging.

A further cost to America's businesses and consumers has been the failure to put the full weight of public policy behind the transition to energy efficient and renewable energy technologies. U.S. auto manufacturers, who are hemorrhaging jobs, are losing market share to foreign competitors in the race to produce more fuel-efficient vehicles and could benefit from strong manufacturing conversion incentives to get more efficient and alternative-fuel cars on the road. The slow progress in bringing biofuels to scale delays the benefits to U.S. farmers and refinery and construction workers that will come from an emerging renewable fuels industry and upgraded infrastructure.

RELIANCE ON OIL POSES SERIOUS NATIONAL SECURITY AND DIPLOMATIC CHALLENGES AS WELL

Since 2001, America's dependency on foreign oil has steadily increased, even as the cost of oil has more than doubled. This dependence compromises our foreign policy objectives by compelling the United States to support or tolerate authoritarian regimes that pose a threat to its national security. An increasing share of the world's oil imports will come from these undemocratic countries, not from friendly, stable ones like Canada or Norway.

These political risks both threaten our security and impose direct costs by driving an ever larger risk premium into the price of each barrel of oil. Osama bin Laden

has identified the global energy infrastructure as an important target for his followers, and in February 2006, suicide bombers attacked a key oil processing facility in Saudi Arabia. The attackers failed to penetrate the heavily guarded facility's security perimeter, but nevertheless oil prices jumped 3.4 percent. Likewise, Iran has to do no more than threaten to cut supply for oil prices around the world to spike, as it demonstrated once again this week.

The defense of the global oil infrastructure is another cost born in large part by the United States. Around the world, the U.S. military is charged with protecting pipelines, refineries, and strategic sea lanes from terrorist or insurgent attack. The Department of Defense has stepped up its arms deliveries and training to forces in Angola and Nigeria. As long as American forces remain in Iraq, a significant number of them will spend their time guarding highly vulnerable pipelines, refineries, loading facilities, trucking routes, and other petroleum installations. The U.S. Navy is patrolling the vital tanker lanes of the Persian Gulf and the Strait of Hormuz, the South China Sea, and the Strait of Malacca. While these costs are not solely born in the defense of oil, our dependence on oil makes them essential.

The Congress may have to vote again before the end of the year to raise the Federal debt limit, this time to $9 trillion. The combination of our unbalanced fiscal policy with a deepening trade deficit, a third of which came from imported petroleum products in 2005, is untenable. As we finance our deficits in global capital markets, we reduce our own flexibility in national security matters while increasing the leverage of our competitors. I do not want to overstate the importance of this development, but it is imprudent to think that the increase in our debt attributable to energy costs will not negatively impact our national security.

Climate change—which is caused by excess emissions of heat-trapping gases from the combustion of fossil fuels as well as other human activities—also poses a growing threat to our national and economic security. Scientists project that the earth's average temperature will increase 2 to 10°F (1.4 to 5.8°C) over the next 100 years if the world fails to curb greenhouse gas emissions (of which the United States currently accounts for 25 percent). The U.S. State Department released a report predicting that these increases in temperature would cause sea levels to rise (threatening the coastal areas where 53 percent of Americans live), more frequent and severe storms, the widespread destruction of ecosystems, and more frequent heat waves and droughts. One of the many lessons of Katrina is that the economic and social impacts of such natural disasters would be enormous.

In much of the developing world, meanwhile, reliance on oil has already been devastating. The International Energy Agency (lEA) estimates that for every $10 hike in the cost of a barrel of crude, the economy of an oil importing country in sub-Saharan Africa is impacted more than 10 times as much as the United States. As a result, important gains reaped from sensible debt forgiveness initiatives are being wiped out by rising energy costs (see Annex 1). For example, the increase in the cost of imported oil from 2002 to the projection for 2006 for Ethiopia is over 10 percent of their total debt service relief granted. This increased cost of oil is equal to 4 percent of their GDP. To put that percentage in context, Ethiopia spends the equivalent of 2.6 percent of their GDP on health care. The resulting squeeze on struggling developing world budgets can lead to serious consequences with international repercussions. Decreasing our reliance on oil and helping the developing world to do the same would reduce greenhouse gas emissions and global inequity, thereby ultimately increasing domestic economic security in our Nation and the developing world.

LEADERSHIP IN MOVING AWAY FROM OIL DEPENDENCE IS NEEDED

To find a path forward that strengthens our domestic economy and increases our security, it is essential that the Senate continue to show real leadership in advancing policy solutions that break our dependence on oil in a manner consistent with the rising threat of climate change. These policies should encourage the domestic production of more efficient vehicles and the development of a domestic renewable fuels industry and infrastructure that decreases both oil consumption and greenhouse gas emissions.

The American Fuels Act (S. 2446) written by Chairman Lugar and Senator Obama, for example, is a bipartisan measure that creates meaningful incentives for commercializing the next generation of ethanol and investing in new fueling infrastructure. The recently introduced Clean EDGE legislation (S. 2829) contains many building blocks for a rapid transition to a more secure energy future, including strong incentives for the rapid deployment of an E85 ethanol infrastructure for distribution and fueling stations, increased investment in commercialization of cellulosic ethanol, strong incentives and mandates for the deployment of flexible fuel

vehicles and hybrid electric cars within the fleet, as well as manufacturing conversion incentives for domestic production of high performance cars.

In addition, innovative policies that will ensure reductions in oil consumption, like the binding oil savings targets included in the Vehicle and Fuel Choices for American Security Act (S. 2025), or an increase in fuel economy standards, should be part of a meaningful policy program to break the grip of imported oil on the domestic economy. Senator Tom Daschle, a Distinguished Fellow at the Center for American Progress, and Vinod Khosla, who testified before this committee just last month, have recently proposed a Carbon Alternative Fuel Equivalent standard that expands on the traditional CAFE calculations to incorporate both fuel economy and the use of alternative fuels in a single metric that captures the benefits of reduced carbon emissions.

Over time, ending our oil dependence will mean a stronger economy, more jobs, healthier communities, greater innovation, and a more efficient and productive workforce. These benefits should not be delayed. The economy of Brazil offers a compelling picture of what an alternative fuel future holds for the United States. Since the mid-1970s, Brazil has saved $100 billion dollars by substituting domestically produced ethanol for imported oil. Ethanol now accounts for 20 percent of Brazil's transportation fuel market, and production of flexible fuel vehicles able to run on gasoline or ethanol has grown from less than 1 percent of the Brazilian new car market in 2001 to more than 70 percent today. The country of Sweden has proposed to do even more, setting a national goal to end their reliance on oil altogether over 15 years by 2020.

The United States has had its own success with the recently enacted Renewable Fuel Standard (RFS). The RFS mandates that 7.5 billion gallons of ethanol be used in the U.S. fuel supply by 2012, but a rapidly growing ethanol industry is on track to meet that requirement well before the deadline. We need to nurture this success into an even larger market for renewable fuels from sources that minimize environmental impacts and greenhouse gas emissions. All opportunities to expand the market for clean renewable fuels should be pursued. For example, the Environmental Protection Agency's rulemaking on mobile source emissions presents a unique one. By replacing with ethanol the 25 percent of our gasoline supply that is made up of aromatic compounds, we have the opportunity to improve air quality and protect public health while increasing our national and economic security.

Clearly, there is much to be done, but as seen in the previous examples, much is possible. It is time for concerted effort to move rapidly toward increased energy independence by uniting the country behind a bold national goal as we did with the Manhattan Project or the Apollo space program. The American people are looking to you for leadership.

Thank you for the opportunity to submit this testimony.

ANNEX 1: THE IMPACT OF HIGHER OIL PRICES ON SELECT HIPC COUNTRIES [1]

Country	GDP (US$ in 2005)	Debt service relief granted (US$)	Annual oil consumption (bbl in 2003) [2]	Estimated cost of oil to country in 2002 (US$) [3]	Projected cost of oil to country in 2006 (US$) [4]	Increase in annual cost to country 2002–2006 [5]	Cost of oil in 2006 as percent GDP	Increase in cost as percent debt relief	Increase in cost as percent GDP	Public expenditure on health as percent GDP (2002)	Total poverty reduction expenditures as percent GDP (est. 2006) [6]
Mauritania	1.4 billion	1.1 billion	9 million	184 million	520 million	336 million	38.3	30.5	24.8	2.9	5.5
Sao Tome and Principe	69 million	200 million	0.2 million	5 million	14 million	9 million	20.4	4.5	13.2	9.7	31.1
Guinea-Bissau	280 million	790 million	0.9 million	19 million	53 million	34 million	18.9	4.3	12.2	3.0	5.3
Sierra Leone	1.1 billion	950 million	2 million	50 million	141 million	91 million	12.5	9.6	8.1	1.7	4.9
Gambia	429 million	90 million	0.7 million	15 million	43 million	28 million	10.1	31.1	6.5	3.3	5.0
Burundi	730 million	1.5 billion	1 million	23 million	65 million	42 million	8.9	2.8	5.7	0.6	2.9
Senegal	8.0 billion	850 million	11 million	238 million	671 million	434 million	8.4	51.0	5.4	2.3	8.6
Rwanda	1.8 billion	1.4 billion	2 million	46 million	130 million	84 million	7.1	6.0	4.6	3.1	10.6
Ethiopia	8.8 billion	3.3 billion	10 million	207 million	585 million	378 million	6.6	11.4	4.3	2.6	17.0
Malawi	2.0 billion	1 billion	2 million	42 million	118 million	76 million	5.9	7.6	3.8	4.0	15.4
Guinea	3.6 billion	800 million	3 million	64 million	182 million	118 million	5.1	14.7	3.3	0.9	3.3
Mozambique	5.7 billion	4.3 billion	4 million	84 million	238 million	154 million	4.2	3.6	2.7	4.1	17.6
Tanzania	12.1 billion	3 billion	8 million	169 million	476 million	308 million	3.9	10.3	2.5	2.7	12.1
Niger	3.4 billion	1.2 billion	2 million	41 million	117 million	76 million	3.4	6.3	2.2	2.0	6.5
Burkina Faso	5.4 billion	930 million	3 million	61 million	173 million	112 million	3.2	12.0	2.1	2.0	5.9
Uganda	8.0 billion	2 billion	4 million	77 million	217 million	140 million	2.7	7.0	1.8	2.1	10.7
Mali	5.4 billion	900 million	2 million	33 million	92 million	59 million	1.7	6.6	1.1	2.3	7.7

[1] This survey includes only countries in Africa that have reached either their completion or decision points under the Heavily Indebted Poor Country Initiative (HIPC) and are 100 percent reliant on oil imports. These are 17 of the total 29 HIPC countries.

[2] Calculations made assume 2003 consumption levels are representative of levels in 2002 and 2006.

[3] Cost of oil to country in 2002 is calculated using CIA World Factbook figures for estimated 2003 country consumption levels and an average of 2002 weekly crude oil prices provided by the Energy Information Administration of the Department of Energy, or $20.99/bbl. Inflation since 2002 is assumed to be negligible.

[4] The estimated 2006 world oil price, $59.31/bbl is the average of 2006 weekly world prices as of June 1, 2006, as provided by the Energy Information Administration of the Department of Energy.

[5] Increase in cost of oil from 2002 to 2006 denotes a 183 percent increase.

[6] What is considered "Poverty Reduction Expenditure" varies according to country, but primarily includes public spending on education and health. It may also include rural infrastructure, water works, roads, HIV, social safety nets, and agricultural research.

Sources: CIA World Factbook; U.S. Department of State, Bureau of African Affairs; The World Bank, Energy Sector Management Assistance Program and International Development Association; International Monetary Fund; Department of Energy, Energy Information Administration; United Nations Development Program.

○

VerDate 11-MAY-2000 14:39 Aug 03, 2007 Jkt 000000 PO 00000 Frm 00048 Fmt 6633 Sfmt 6611 H:\DOCS\OIL.TXT mich PsN: mich