Committee on Foreign Affairs

US House of Representatives

Hearing on

"Foreign Policy and National Security Implications of Oil Dependence"

March 22, 2007

Testimony by Daniel Yergin

Chairman, Cambridge Energy Research Associates

“The Fundamentals of Energy Security”

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I

It is an honor to testify before this Committee. One recognizes the timeliness of this hearing, and its importance. Energy certainly belongs in front of this Committee for many reasons.

■ The first is that the United States is deeply tied into global energy markets, as we are in the overall global economy. This is the reality. We are the largest importer of oil in the world, and 60 percent of our total oil demand is met by imports. The United States is also on track to become a major importer of liquefied natural gas (LNG), also from the global marketplace. What happens in the global energy market—whether in terms of price or disruptions—can have major political and economic reverberations around the world. It also affects the economic and political position of the United States in the world.

■ A good part of the growth in world energy supply after 2010 will occur in countries going through transitions or subject to turbulence. This will reinforce the focus on energy security.

■ Beyond the obvious importance of the Middle East, energy figures as either a central or significant component in major relationships and issues around the world. For instance, concerns about natural gas loom large in the European Union's relationship with Russia, and energy is an important component in the U.S. relationship with China.

■ Concern is rising about "oil power" —that is, about the use of energy as a political instrument rather than a commercial commodity.

■ Climate change will lead to a continuing focus on energy, and the two sets of issues will become increasingly intertwined in international relations.

All of these considerations point to a further—and most important—reason for this subject to lie within the province of this committee. For energy security inevitably exists in a larger context of overall security and international relationships. In a world of increasing interdependence, energy security will depend much on how countries manage their relations with one another, whether bilaterally or within multilateral frameworks. That is why energy security will be one of the main challenges for U.S. foreign policy in the years ahead. And that in turn requires us to look, beyond the ups and downs of market cycles, both to the reality of an ever more complex and integrated global energy system and to the relations among the countries that participate in it.

What I will seek to do today is address the fundamentals of energy security—that is, a set of observations and principles based upon U.S. and international experience over several decades, analysis of energy markets, and recognition of the interdependencies, scale and complexity of the energy supply system. In addition, this testimony points to two critical new needs: to expand the focus of energy security to include infrastructure and the entire supply chain; and to bring China and India into the global system (see Table 1).

"Energy Independence" versus "Energy Security"

In framing these issues, I am deliberately using the phrase "energy security" rather than "energy independence." Energy independence is a very popular and appealing term, with deep political resonance. Yet, if it is taken literally, it is a less useful guide. If, however, it is taken as a metaphor, meaning an energy security system that is robust and resilient and less vulnerable, then it is a much more relevant and useful concept.

Table 1: Fundamentals of Energy Security

1. Diversification
2. Resilience – a "security margin"
3. High-quality and timely information
4. Collaboration among consumers and between consumers and producers
5. Expand "IEA System" to include China and India
6. Include infrastructure and supply chain
7. Robust markets and flexibility
8. Renewed emphasis on efficiency for both energy and climate reasons
9. Investment flows
10. R&D, technological advance, and new technologies

To elaborate, if energy independence is taken in a literal sense, it runs the risk of disappointment and cynicism and loss of focus. Today about 70 percent of our total energy is produced within the United States. But, in terms of oil, the reality is that, in the last 30 years, we have gone from importing a third of our oil to importing 60 percent. Moreover, we are on track to go from meeting 3 percent of our total natural gas demand with imports of LNG today to more than 25 percent in a decade and a half. Large amounts of new natural gas fired electric generation have been added over the last few years. To the degree that coal's market share is reduced, we will import more natural gas. The growth of ethanol production is creating a new industrial market for natural gas, and again, the marginal supplies will be imported.[1]

In 2006, the largest share of our energy imports came from Canada as a part of a very dense overall economic partnership. Canada also supplies about 15 percent of our natural gas. The next largest source of imported oil was Mexico, our key neighbor, which depends upon oil to generate almost 40 percent of government revenues. The third source was Saudi Arabia. The picture changes in Venezuela, which was the fourth largest source of imports and, as this Committee knows, the indications are that relations between the United States and Venezuela will only become more challenging in the years ahead (see Table 2). Middle East imports comprise 19 percent of our total imports, and 11 percent of consumption. Yet, at the end of the day, there is only one world oil market, and upheavals in one part affect all participants.

Table 2: 2006* Top 5 Suppliers: US Crude Oil & Product Imports

(million barrels per day)	Volume	percent of total imports
Canada	2.29	17%
Mexico	1.73	13%
Saudi Arabia	1.46	11%
Venezuela	1.42	10%
Nigeria	1.13	8%

Source: Energy Information Administration

*average imports January-November 2006

[1] Cambridge Energy Research Associates, *The Ethanol Boom: Creating a New Market for Natural Gas*.

"The Great Bubbling": Innovation and R&D

What about new technologies and alternatives? Today, there is what we have dubbed "the Great Bubbling"-- the R&D efforts all along the energy spectrum, involving both conventional and alternative energies. There has never been so broad an effort. A little over a decade ago, I chaired a Task Force for the Department of Energy on Strategic Energy R&D. It is striking how much less interest there was then in new technologies than today. The change is palpable. In the last couple of years, substantial amounts of venture capital funds have begun to flow into "clean energy," adding to the funds from government, industry, and research institutions. With this much greater effort there is higher probability that new technologies will make their impact felt on both supply and demand.

One of the most important impacts could come from the application of biotechnology to energy, which has only recently begun in earnest. This could in due course provide alternative liquid fuels for transportation. There is also a good deal of innovation in the electric power sector, but there is very little oil to replace. In 2006, for example, only 1.6 percent of U.S. power was generated with oil.

This level of activity—this great bubbling—should be a source of optimism. But, at the same time, tomorrow's promise should not be confused with delivery of commercially-competitive new technologies on a scale large enough, with the appropriate logistical infrastructure, to have material impact on the vast U.S. energy supply system. For instance, all the renewable investment in electric power adds up to a fraction of our total system. We have gone through other periods of technological optimism that have faded away. In short, even with continuing innovation, energy security is likely to be a major concern for some time to come. Thus, in terms of anticipating risks, we need to focus on the challenges before us and on how to enhance our energy security.

Meeting the Growth Challenge – and the "0-15" – the Top 15 Sources of Supply Growth

After two decades of working off excess capacity, global energy supply is now dominated by the growth challenge—the ability to increase energy supplies in sufficient volume to meet global energy demand. Perhaps major new technological developments will dramatically transform the energy mix. We seek to explore that possibility in a scenario called *Break Point*, one of three scenarios describing the energy future to 2030 in our new study, *Dawn of a New Age.*[2] Yet even with major changes in the energy mix,

[2] Cambridge Energy Research Associates, *Dawn of a New Age: Global Energy Scenarios—The Energy Future to 2030.*

even with increased efficiency, energy demand continues to grow. Over the next 25 years, world oil consumption could still increase by 45 percent. The more successful the world economy, the higher the demand growth.

One of the most striking conclusions from this year-long scenario project is that, in a world of solid economic growth, over half of the future growth in world oil demand takes place in Asia. Demand growth is also quite large in the Mideast itself. All this adds to the imperative for broad cooperation, including on new technologies.

But there is another important observation. CERA sees substantial growth in world production capacity over the next decade or more. But a key feature of CERA's baseline energy scenario is the concentration of *growth* in liquid production capacity within a group of 15 countries that we call the "O-15"— as in "Oil-15"—those countries that have the greatest potential to increase supply over the next one to two decades. Most of the O-15 countries are in Africa, Eurasia, and the Middle East, but Brazil, Canada, and Venezuela are also included (see Table 3).

Table 3: The "O-15": Top Sources of Growth in Net Production Capacity to 2015
(million barrels per day)

	2005	2015	change 2005-2015
Saudi Arabia*	12.7	14.3	1.6
Russia	9.6	11.5	1.9
Iran	4.3	5.7	1.4
Iraq	2.6	5.5	2.9
Canada	3.5	5.3	1.8
Venezuela	3.0	4.5	1.5
UAE	3.1	3.9	0.8
Kuwait*	2.9	3.7	0.8
Nigeria	2.9	3.6	0.7
Kazakhstan	1.2	3.1	1.9
Algeria	2.3	2.9	0.6
Libya	2.0	2.8	0.8
Brazil	1.8	2.6	0.8
Angola	1.2	2.3	1.1
Azerbaijan	0.5	1.0	0.5
O-15 totals	**53.6**	**72.7**	**19.1**
Share of World Liquid Capacity	**61%**	**69%**	

Source: Cambridge Energy Research Associates.
*Includes 50 percent of the Neutral Zone.
March 2007

II The Energy Security System

The current energy security system was created in response to the 1973 Arab oil embargo to ensure coordination among the industrialized countries in the event of a disruption in supply, encourage collaboration on energy policies, avoid bruising scrambles for supplies, and deter any future use of an "oil weapon" by exporters. Its key elements are the Paris-based International Energy Agency (IEA), whose members are the industrialized countries; strategic stockpiles of oil, including the U.S. Strategic Petroleum Reserve; continued monitoring and analysis of energy markets and policies; and energy conservation and coordinated emergency sharing of supplies in the event of a disruption. The emergency system was set up to offset major disruptions that threatened the global economy and stability. It was not established to manage prices and the commodity cycle.

Since the system's inception in the 1970s, a coordinated emergency drawdown of strategic stockpiles has occurred only twice: on the eve of the Gulf War in 1991 and in the autumn of 2005 after Hurricane Katrina. (The system was also readied in anticipation of possible use before January 1, 2000, because of concerns over potential Y2K computer problems, during the shutdown of production in Venezuela in 2002–3, and in the spring of 2003, before the invasion of Iraq.) We can be sure that the creators of the IEA emergency sharing system in the 1970s never for a moment considered that it might have to be activated to blunt the effects of a disruption in the United States—as happened in the immediate aftermath of the hurricanes.

Principles of Energy Security

Several principles underpin energy security. The first is what Winston Churchill urged more than 90 years ago: diversification of supply. On the eve of the First World War, Churchill—then the First Lord of the Admiralty—made the historic decision to shift the propulsion of the Royal Navy from coal to oil. "Safety and certainty in oil," he said, "lie in variety and variety alone."[3] Multiplying one's supply sources reduces the impact of a disruption in supply from one source by providing alternatives, serving the interests of both consumers and producers, for whom stable markets are a prime concern. But diversification is not enough. A second principle is resilience, a "security margin" in the energy supply system that provides a buffer against shocks and facilitates recovery after disruptions. Resilience can come from many factors, including sufficient spare production capacity, strategic reserves, backup supplies of equipment, adequate storage capacity along the supply chain, and the stockpiling of critical parts for electric power

[3] Daniel Yergin, *The Prize: the Epic Quest for Oil, Money, and Power* (Simon and Schuster, 1991,) p. 160

production and distribution, as well as carefully conceived plans for responding to disruptions that may affect large regions.

Hence the third principle: recognizing the reality of integration. There is only one oil market, a complex and worldwide system that moves and consumes about 86 million barrels of oil every day. For all consumers, security resides in the stability of this market. Secession is not an option.

A fourth principle is the importance of information. High-quality information underpins well-functioning markets. On an international level, the International Energy Agency has led the way in improving the flow of information about world markets and energy prospects. That work is being complemented by the new International Energy Forum, which will seek to integrate information from producers and consumers.

Information is no less crucial in a crisis, when consumer panics can be instigated by a mixture of actual disruptions, rumors, media images, and fear. Members of this Committee will recognize that kind of situation. Many of you have seen it more than once! Reality can be obscured by accusations, acrimony, outrage, and a fevered hunt for conspiracies, transforming a difficult situation into something much worse. In such situations, governments and the private sector should collaborate to counter panics with high-quality, timely information. The U.S. government can promote flexibility and market adjustments by expediting its communication with companies that are responding to disruptions and permitting the exchange of information among them when necessary, with appropriate antitrust safeguards.

As important as these principles are, recent years have highlighted the need to expand the concept of energy security in two critical dimensions: (1) the recognition of the globalization of the energy security system, which can be achieved especially by engaging China and India, and (2) the acknowledgment of the fact that the entire energy supply chain needs to be protected.

III Bringing China and India "In"

Despite all the attention being paid to China's efforts to secure international petroleum reserves, for example, the entire amount that China currently produces per day outside of its own borders is equivalent to just a fraction of the daily production of one of the supermajor oil companies. If there were a serious controversy between the United States and China involving oil or gas, it would likely arise not because of a competition for the resources themselves, but rather because they had become part of larger foreign policy issues (such as a clash over a specific regime or over how to respond to Iran's nuclear program). Indeed, from the viewpoint of consumers in North America, Europe,

and Japan, Chinese and Indian investment in the development of new energy supplies around the world is not a threat but something to be encouraged, because it means there will be more energy available for everyone in the years ahead as India's and China's demand grows.

It would be wiser—and indeed it is urgent—to engage these two giants in the global network of trade and investment rather than see them tilt toward a mercantilist, state-to-state approach. But, for that to happen, both countries need to be encouraged to see that their interests can be protected in global markets and that they will not be disadvantaged compared to other consumers. Engaging India and China will require understanding what energy security means for them. Both countries have already moved from self-sufficiency to integration into the world economy, which means they will grow increasingly dependent on global markets even as they are under tremendous pressure to deliver economic growth for their huge populations, which cope with energy shortages and blackouts on a daily basis. Thus, the primary concern for both China and India is to ensure that they have sufficient energy to support economic growth and prevent debilitating energy shortfalls that could trigger social and political turbulence. And so India and China, and other key countries such as Brazil, should be brought into coordination with the existing IEA energy security system to assure them that their interests will be protected in the event of turbulence and to ensure that the system works more effectively.

A strong continuing high-level dialogue with China on energy-related issues is a very high priority to allay suspicion and misunderstanding and to identify common interests and objectives, including on new technologies. There is much talk of a clash between the United States and China over oil. But there is nothing inevitable about it. Commercial competition need not turn into national rivalry. A fundamental reason for establishing the International Energy Agency in the 1970s was to modulate that mad scramble to preempt barrels. This contest threatened not only to rip apart the Western alliance, but also sent oil prices—after the Iranian Revolution—to what is still their highest level ever. The innovations of the 1970s transformed the scramble into more durable cooperation. That same kind of approach is needed now with the emergence of these two huge (and anxious) consumers, China and India, in the world market.

IV Securing Infrastructure and the Supply Chain

The current model of energy security, which was born of the 1973 crisis, focuses primarily on how to handle any disruption of oil supplies from producing countries. Today, the concept of energy security needs to be expanded to include the protection of the entire energy supply chain and infrastructure—an awesome task. In the United States alone, there are more than 150 refineries, 4,000 offshore platforms, 160,000 miles of oil pipelines, facilities to handle 15 million barrels of oil a day of imports and exports, 10,400 power plants, 160,000 miles of high-voltage electric power transmission lines and

millions of miles of electric power distribution wires, 410 underground gas storage fields, and 1.4 million miles of natural gas pipelines. None of the world's complex, integrated supply chains were built with security, defined in this broad way, in mind. Hurricanes Katrina and Rita brought a new perspective to the security question by demonstrating how fundamental the electric grid is to everything else. After the storms, the Gulf Coast refineries and the big U.S. pipelines were unable to operate—not just because some were damaged, but also because they could not get electric power.

Energy interdependence and the growing scale of energy trade require continuing collaboration among both producers and consumers to ensure the security of the entire supply chain. Long-distance, cross-border pipelines are becoming an ever-larger fixture in the global energy trade. There are also many chokepoints along the transportation routes of seaborne oil and, in many cases, LNG that create particular vulnerabilities: the Strait of Hormuz, which lies at the entrance to the Persian Gulf; the Suez Canal, which connects the Red Sea and the Mediterranean; the Bab el Mandeb strait, which provides entrance to the Red Sea; the Bosporus strait, which is a major export channel for Russian and Caspian oil; and the Strait of Malacca, through which passes 80 percent of Japan's and South Korea's oil and about half of China's.

The challenge of energy security will grow more urgent in the years ahead, because the scale of the global trade in energy will grow substantially as world markets become more integrated. Currently, every day some 40 million barrels of oil cross oceans on tankers; by 2020, that number could jump to 67 million. The amount of natural gas crossing oceans as LNG could triple to 460 million tons by 2020. The United States will be an important part of that market. Assuring the security of global energy markets will require coordination on both an international and a national basis among companies and governments, including energy, environmental, military, law enforcement, and intelligence agencies. But in the United States, as in other countries, the lines of responsibility—and the sources of funding—for protecting critical infrastructures, such as energy, are far from clear. The private sector, the federal government, and state and local agencies need to take steps to better coordinate their activities. Maintaining the commitment to do so during periods of low or moderate prices will require discipline as well as vigilance. Both the public and private sectors need to invest in building a higher degree of security into the energy system—meaning that energy security will become part of both the price of energy and the cost of homeland security.

V The Important Role of Markets

Let me address another element of energy security: markets *themselves* need to be recognized as a source of security. The energy security system was created when energy prices were regulated in the United States, energy trading was only just beginning, and futures markets were several years away. Today, large, flexible, and well-functioning energy markets provide security by absorbing shocks and allowing supply and demand to

respond more quickly and with greater ingenuity than a controlled system could. Thus, governments do well to resist the temptation to respond to short-term political pressure and micromanage markets. Intervention and controls, however well meaning, can backfire, slowing and even preventing the movement of supplies to respond to disruptions. At least in the United States, any price spike or disruption evokes the images of the infamous gas lines of the 1970s. Yet those lines were to a considerable degree self-inflicted—the consequence of price controls and a heavy-handed allocation system that sent gasoline where it was not needed and denied its being sent where it was.

Contrast that to what happened immediately after Hurricane Katrina. A major disruption to the U.S. oil supply was compounded by reports of price gouging and of stations running out of gasoline, which together could have created new gas lines in the Southeast and along the East Coast. Yet the markets were back in balance much sooner, and prices came down more quickly, than had generally been expected. Emergency supplies from the U.S. Strategic Petroleum Reserve and other IEA reserves were released, sending a "do not panic" message to the market. At the same time, two critical regulatory restrictions were eased. One was the Jones Act (which bars non-U.S.-flagged ships from carrying cargo between U.S. ports), which was waived to allow non-U.S. tankers to ship supplies bottlenecked on the Gulf Coast around Florida to the East Coast, where they were needed. The other was the set of "boutique gasoline" regulations that require different qualities of gasoline for different cities, which were temporarily lifted to permit supplies from other parts of the country to move into the Southeast.

This experience highlights the need to incorporate regulatory and environmental flexibility—and a clear understanding of the impediments to adjustment—into the energy security machinery in order to cope as effectively as possible with disruptions and emergencies. Markets can more efficiently and effectively—and more quickly—resolve shortfalls and disruptions than controls can.

VI Efficiency, Investment, and New Technologies

The U.S. government and the private sector should also make a renewed commitment to energy efficiency and conservation. For the first time in many years, energy efficiency is once again a high priority. Although often underrated, the impact of conservation on the economy has been enormous over the past several decades. Over the past 30 years, the United States has doubled its energy efficiency—defined as the amount of energy needed to produce a unit of gross domestic product. We could aim to double efficiency once again.

The basic point remains: conservation has worked. Current and future advances in technology could permit very large additional gains, which would be highly beneficial not only for advanced economies such as that of the United States, but also for the

economies of countries such as India and China. In fact, China has recently made conservation a priority. The potential growth highlighted earlier underlines the importance of moving on efficiency. This also is one of the most important things to do for climate change.

Finally, the investment climate itself must become a key concern in energy security and should be on the international energy agenda. There needs to be a continuous flow of investment and technology in order for new resources to be developed. Costs for energy development have been going up dramatically in recent years because of a shortage of people and equipment.

Our new IHS/CERA Upstream Capital Cost Index indicates that the cost for developing new oil and gas projects increased more than 50 percent over the last two years.[4] It is now estimated that as much as $20 trillion will be required for new energy development over the next 25 years. These capital flows will not materialize without reasonable and stable investment frameworks, timely decision-making by governments, and open markets. How to facilitate energy investment should be one of the questions for international discussions.

Inevitably, there will be shocks to energy markets in the future. Some of the possible causes may be foreseeable, such as coordinated attacks by terrorists, disruptions in the Middle East and Africa, or turmoil in Latin America. Other possible causes, however, may come as a surprise. The offshore oil industry has long built facilities to withstand a "hundred-year storm," but nobody anticipated that two such devastating storms would strike the energy complex in the Gulf of Mexico within a matter of weeks, requiring the activation of the IEA emergency sharing system to relieve a disruption in the United States.

Diversification will remain the fundamental starting principle of energy security for both oil and gas. Today, however, it will likely also require developing a new generation of nuclear power and "clean coal" technologies and encouraging a growing role for a variety of renewable energy sources as they become more competitive. It will also require investing in new technologies, ranging from near-term ones, such as the conversion of natural gas into a liquid fuel, to ones that are still in the lab, such as the biological engineering of energy supplies. Investment in technology all along the energy spectrum is surging today, and this will have a positive effect not only on the future energy picture but also on the environment and in meeting climate change objectives.

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[4] *CERA Capital Costs Analysis Forum: A White Paper*