Ensuring Energy Security

Daniel Yergin

OLD QUESTIONS, NEW ANSWERS

ON THE EVE of World War I, First Lord of the Admiralty Winston Churchill made a historic decision: to shift the power source of the British navy's ships from coal to oil. He intended to make the fleet faster than its German counterpart. But the switch also meant that the Royal Navy would rely not on coal from Wales but on insecure oil supplies from what was then Persia. Energy security thus became a question of national strategy. Churchill's answer? "Safety and certainty in oil," he said, "lie in variety and variety alone."

Since Churchill's decision, energy security has repeatedly emerged as an issue of great importance, and it is so once again today. But the subject now needs to be rethought, for what has been the paradigm of energy security for the past three decades is too limited and must be expanded to include many new factors. Moreover, it must be recognized that energy security does not stand by itself but is lodged in the larger relations among nations and how they interact with one another.

Energy security will be the number one topic on the agenda when the group of eight highly industrialized countries (G-8) meets in St. Petersburg in July. The renewed focus on energy security is driven in part by an exceedingly tight oil market and by high oil prices, which have doubled over the past three years. But it is also fueled by the threat of terrorism, instability in some exporting nations, a nationalist backlash, fears of a scramble for supplies, geopolitical rivalries, and countries' fundamental need for energy to power their economic growth.

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In the background—but not too far back—is renewed anxiety over whether there will be sufficient resources to meet the world's energy requirements in the decades ahead.

Concerns over energy security are not limited to oil. Power blackouts on both the East and West Coasts of the United States, in Europe, and in Russia, as well as chronic shortages of electric power in China, India, and other developing countries, have raised worries about the reliability of electricity supply systems. When it comes to natural gas, rising demand and constrained supplies mean that North America can no longer be self-reliant, and so the United States is joining the new global market in natural gas that will link countries, continents, and prices together in an unprecedented way.

At the same time, a new range of vulnerabilities has become more evident. Al Qaeda has threatened to attack what Osama bin Laden calls the "hinges" of the world's economy, that is, its critical infrastructure—of which energy is among the most crucial elements. The world will increasingly depend on new sources of supply from places where security systems are still being developed, such as the oil and natural gas fields offshore of West Africa and in the Caspian Sea. And the vulnerabilities are not limited to threats of terrorism, political turmoil, armed conflict, and piracy. In August and September 2005, Hurricanes Katrina and Rita delivered the world's first integrated energy shock, simultaneously disrupting flows of oil, natural gas, and electric power.

Events since the beginning of this year have underlined the significance of the issue. The Russian-Ukrainian natural gas dispute temporarily cut supplies to Europe. Rising tensions over Tehran's nuclear program brought threats from Iran, the second-largest OPEC producer, to "unleash an oil crisis." And scattered attacks on some oil facilities reduced exports from Nigeria, which is a major supplier to the United States.

Since Churchill's day, the key to energy security has been diversification. This remains true, but a wider approach is now required that takes into account the rapid evolution of the global energy trade, supply-chain vulnerabilities, terrorism, and the integration of major new economies into the world market.

Although in the developed world the usual definition of energy security is simply the availability of sufficient supplies at affordable

prices, different countries interpret what the concept means for them differently. Energy-exporting countries focus on maintaining the "security of demand" for their exports, which after all generate the overwhelming share of their government revenues. For Russia, the aim is to reassert state control over "strategic resources" and gain primacy over the main pipelines and market channels through which it ships its hydrocarbons to international markets. The concern for developing countries is how changes in energy prices affect their balance of payments. For China and India, energy security now lies in their ability to rapidly adjust to their new dependence on global markets, which represents a major shift away from their former commitments to self-sufficiency. For Japan, it means offsetting its stark scarcity of domestic resources through diversification, trade, and investment. In Europe, the major debate centers on how to manage dependence on imported natural gas—and in most countries, aside from France and Finland, whether to build new nuclear power plants and perhaps to return to (clean) coal. And the United States must face the uncomfortable fact that its goal of "energy independence"—a phrase that has become a mantra since it was first articulated by Richard Nixon four weeks after the 1973 embargo was put in place—is increasingly at odds with reality.

SHOCKS TO SUPPLY AND DEMAND

AFTER THE Persian Gulf War, concerns over energy security seemed to recede. Saddam Hussein's bid to dominate the Persian Gulf had been foiled, and it appeared that the world oil market would remain a market (rather than becoming Saddam's instrument of political manipulation) and that supplies would be abundant at prices that would not impede the global economy. But 15 years later, prices are high, and fears of shortages dominate energy markets. What happened? The answer is to be found in both markets and politics.

The last decade has witnessed a substantial increase in the world's demand for oil, primarily because of the dramatic economic growth in developing countries, in particular China and India. As late as 1993, China was self-sufficient in oil. Since then, its GDP has almost tripled and its demand for oil has more than doubled. Today, China imports

3 million barrels of oil per day, which accounts for almost half of its total consumption. China's share of the world oil market is about 8 percent, but its share of total growth in demand since 2000 has been 30 percent. World oil demand has grown by 7 million barrels per day since 2000; of this growth, 2 million barrels each day have gone to China. India's oil consumption is currently less than 40 percent of China's, but because India has now embarked on what the economist Vijay Kelkar calls the "growth turnpike," its demand for oil will accelerate. (Ironically, India's current high growth rates were partly triggered by the spike in oil prices during the 1990–91 Persian Gulf crisis. The resulting balance-of-payments shock left India with almost no foreign currency reserves, opening the door to the reforms initiated by then Finance Minister Manmohan Singh, now India's prime minister.)

The impact of growth in China, India, and elsewhere on the global demand for energy has been far-reaching. In the 1970s, North America consumed twice as much oil as Asia. Last year, for the first time ever, Asia's oil consumption exceeded North America's. The trend will continue: half of the total growth in oil consumption in the next 15 years will come from Asia, according to projections by Cambridge Energy Research Associates (CERA). However, Asia's growing impact became widely apparent only in 2004, when the best global economic performance in a generation translated into a "demand shock"—that is, unexpected worldwide growth in petroleum consumption that represented a rate of growth that was more than double the annual average growth rates of the preceding decade. China's demand in 2004 rose by an extraordinary 16 percent compared to 2003, driven partly by electricity bottlenecks that led to a surge in oil use for improvised electric generation. U.S. consumption also grew strongly in 2004, as did that of other countries. The result was the tightest oil market in three decades (except for the first couple of months after Saddam's invasion of Kuwait in 1990). Hardly any wells were available to produce additional oil. That remains the case today, and there is a further catch. What additional oil might be produced cannot be easily sold because it would not be of sufficiently good quality to be used in the world's available oil refineries.

Refining capacity is a major constraint on supply, because there is a significant mismatch between the product requirements of the world's consumers and refineries' capabilities. Although often presented solely as a U.S. problem, inadequate refining capacity is in fact a global phenomenon. The biggest growth in demand worldwide has been for what are called "middle distillates": diesel, jet fuel, and heating oil. Diesel is a favorite fuel of European motorists, half of whom now buy diesel cars, and it is increasingly used to power economic growth in Asia, where it is utilized not just for transportation but also to generate electricity. But the global refining system does not have enough so-called deep conversion capacity to turn heavier crudes into middle distillates. This shortfall in capacity has created additional demand for the lighter grades of crude, such as the benchmark WTI (West Texas Intermediate), further boosting prices.

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Other factors, including problems in several major energy-exporting countries, have also contributed to high prices. Indeed, the current era of high oil prices really began in late 2002 and early 2003, just before the start of the Iraq war, when President Hugo Chávez's drive to consolidate his control over Venezuela's political system, state-owned oil company, and oil revenues sparked strikes and protests. This shut down oil production in Venezuela, which had been among the most reliable of oil exporters since World War II. The loss of oil to the world market from the strikes was significant, greater than the impact of the war in Iraq on supplies. Venezuela's output has never fully recovered, and it is currently running about 500,000 barrels per day below the prestrike level.

Saddam's failing regime in Iraq did not torch oil facilities during the 2003 war, as many had feared, but the large postwar surge in Iraqi output that some had expected has certainly not occurred. The tens of billions of dollars required to bring the industry's output back up to its 1978 peak of 3.5 million barrels per day have not been invested both because of the continuing attacks on the country's infrastructure and work force and because of uncertainty about Iraq's political and legal structures and the contractual framework for investment. As a result, Iraqi oil exports are 30 to 40 percent below prewar levels.

Over the past five years, by contrast, Russia's oil fields have been central to the growth of worldwide supply, providing almost 40 percent of the world's total production increase since 2000. But the growth of Russia's output slowed substantially last year because of political risks, insufficient investment, uncertainties over government policy, regulatory obstacles, and, in some regions, geological challenges. Meanwhile, despite such problems in some major supplier countries, other sources that get less attention, such as Brazil's and Angola's offshore fields, were increasing their output—until Hurricanes Katrina and Rita shut down 27 percent of U.S. oil production (as well as 21 percent of U.S. refining capacity). As late as January 2006, U.S. facilities that before the hurricanes had produced 400,000 barrels of oil a day were still out of operation. Altogether, the experience of the last couple of years confirms the maxim that a tight market is a market vulnerable to events.

All of these problems have provoked a new round of fears that the world is running out of oil. Such bouts of anxiety have recurred since as far back as the 1880s. But global output has actually increased by 60 percent since the 1970s, the last time the world was supposedly running out of oil. (The demand shock of 2004 attracted more notice than the cooling off of the growth in demand that occurred in 2005, when Chinese consumption did not grow at all and world demand returned to the average growth rates of 1994–2003.) Although talk about an imminent peak in oil output followed by a rapid decline has become common in some circles, CERA's field-by-field analysis of projects and development plans indicates that net productive capacity could increase by as much as 20 to 25 percent over the next decade. Despite the current pessimism, higher oil prices will do what higher prices usually do: fuel growth in new supplies by significantly increasing investment and by turning marginal opportunities into commercial prospects (as well as, of course, moderating demand and stimulating the development of alternatives).

A good part of this capacity growth is already in the works. A substantial part of it will come from the exploitation of nontraditional supplies, ranging from Canadian oil sands (also known as tar sands) to deposits in ultradeep water to a very high-quality diesel-like fuel derived from natural gas—all made possible by continuing advances

in technology. But conventional supplies will grow as well: Saudi Arabia is on track to increase its capacity by about 15 percent, to over 12 million barrels per day, by 2009, and other projects are under way elsewhere, such as in the Caspian Sea and even in the United States' offshore fields. Although energy companies will be prospecting in more difficult environments, the major obstacle to the development of new supplies is not geology but what happens above ground: namely, international affairs, politics, decision-making by governments, and energy investment and new technological development. It should be noted, however, that current projections do show that after 2010 the major growth in supplies will come from fewer countries than it comes from today, which could accentuate security concerns.

A NEW FRAMEWORK

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, not 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 the potential problems arising from the Y2K computer bug, during the shutdown of production in Venezuela in 2002–3, and in the spring of 2003, before the invasion of Iraq.)

Experience has shown that to maintain energy security countries must abide by several principles. The first and most familiar is what

Churchill urged more than 90 years ago: diversification of supply. 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 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 IEA 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, and fear. 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 and permitting the exchange of information among them, with appropriate antitrust safeguards, when necessary.

As important as these principles are, the past several years have highlighted the need to expand the concept of energy security in two critical dimensions: the recognition of the globalization of the energy security system, which can be achieved especially by engaging

China and India, and the acknowledgment of the fact that the entire energy supply chain needs to be protected.

China's thirst for energy has become a decisive plot element in suspense novels and films. Even in the real world there is no shortage of suspicion: some in the United States see a Chinese grand strategy to preempt the United States and the West when it comes to new oil and gas supplies, and some strategists in Beijing fear that the United States may someday try to interdict China's foreign energy supplies. But the actual situation is less dramatic. 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 10 percent 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 desired, 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. Engaging India and China will require understanding what energy security means for them. Both countries are rapidly moving 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. For India, where the balance-of-payments crisis of 1990 is still on policymakers' minds, international production is also a way

to hedge against high oil prices. 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.

SECURITY AND FLEXIBILITY

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 because they were damaged, but because they could not get 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, liquefied natural gas (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. Ships commandeered and scuttled in these strategic waterways could disrupt supply lines for extended periods. Securing pipelines and chokepoints will require augmented monitoring as well as the development of multilateral rapid-response capabilities.

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. By then, the United States could be importing 70 percent of its oil (compared to 58 percent today and 33 percent in 1973), and so could China. The amount of natural gas crossing oceans as LNG will triple to 460 million tons by 2020. The United States will be an important part of that market: although LNG meets only about 3 percent of U.S. demand today, its share could reach more than 25 percent by 2020. 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. As Stephen Flynn, a homeland security expert at the Council on Foreign Relations, observes, "Security is not free." 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 be part of both the price of energy and the cost of homeland security.

Markets need to be recognized as a source of security in themselves. 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. Such markets will guarantee security for the growing LNG market and thereby boost the confidence of the countries that import it. Thus, governments must resist the temptation to bow to 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 memory of the infamous gas lines of the 1970s—even for those who were only toddlers then (and perhaps even for those not yet born at the time). 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 along the East Coast. Yet the markets were back in balance sooner and prices came down more quickly than almost anyone had 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. The 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.

The U.S. government and the private sector should also make a renewed commitment to energy efficiency and conservation. Although often underrated, the impact of conservation on the economy has been enormous over the past several decades. Over the past 30 years,

U.S. GDP has grown by 150 percent, while U.S. energy consumption has grown by only 25 percent. In the 1970s and 1980s, many considered that kind of decoupling impossible, or at least certain to be economically ruinous. True, many of the gains in energy efficiency have come because the U.S. economy is "lighter," as former Federal Reserve Chair Alan Greenspan has put it, than it was three decades ago—that is, GDP today is composed of less manufacturing and more services (especially information technology) than could have been imagined in the 1970s. But 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).

Finally, the investment climate itself must become a key concern in energy security. There needs to be a continual flow of investment and technology in order for new resources to be developed. The IEA recently estimated that as much as $17 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 will be one of the critical questions on the G-8's energy security agenda in 2006.

FUTURE SHOCKS

INEVITABLY, there will be shocks to energy markets in the future. Some of the possible causes may be roughly foreseeable, such as coordinated attacks by terrorists, disruptions in the Middle East and Africa, or turmoil in Latin America that affects output in Venezuela, the third-largest OPEC producer. 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. And 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.

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.

Yet energy security also exists in a larger context. 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. Part of that challenge will be anticipating and assessing the "what ifs." And that requires looking not only around the corner, but also beyond the ups and downs of cycles to both the reality of an ever more complex and integrated global energy system and the relations among the countries that participate in it.