

THE FUTURE OF OIL

June 1, 2004

A recent rise in gas prices has refueled debate over the long-term use of oil as an affordable energy source. Jeffrey Brown gets perspectives from Paul Roberts, author of a new book titled "The End of Oil," and Daniel Yergin, author of "The Prize: The Epic Quest for Oil, Money and Power."

JEFFREY BROWN: No one needs to be told what's going on at the local gas pump these days. But today's high prices have rekindled some provocative questions about the long-term future of oil and our use of it.

We explore some of these questions now with Paul Roberts, author of a new book titled "The End of Oil." Mr. Roberts writes regularly on economic and energy issues. And Daniel Yergin, chairman of Cambridge Energy Research Associates, an international consulting firm. Among his books is "The Prize: The Epic Quest for Oil, Money, and Power," which won the Pulitzer prize. Welcome to you both. Mr. Roberts, starting with you and playing directly off the title of your book, are we running out of oil?

PAUL ROBERTS: Well, you know, it would be interesting to look at the current prices and say one way or the other that this is the sign that everything is changing, that we are hitting a limit. But I think time will tell whether the market is fundamentally tight... whether prices are being driven by speculation.

The more interesting question is, what happens next? I think there are a couple of things we can look at that can speak to us about this notion of depletion, when oil runs out. We know oil is finite. The question is, when do we hit a peak in production? And you know, the optimist will tell you we don't need to worry until 2040, 2045, which means we have plenty of time to develop alternatives and to kind of prepare ourselves for that eventuality.

My sense, though, is that we're going to be running into trouble earlier, and here's why. In the first case, we can see that it's getting harder and harder to find oil. Discovery rates -- that is, the rate at which oil companies can find oil and put it on their books for later production -- that's been declining since 1961.

Right now, we burn about 29 billion barrels of oil a year -- cars, factories, furnaces. We're only discovering around nine billion barrels of oil. So with that ratio, it can't go on forever. And you can look at companies like Shell Oil, struggling to discover oil as fast as they need to, to keep shareholders happy... and Shell is not alone. A lot of companies are struggling. The second thing you need to look at, and we can do this briefly, is that when you're talking about when oil production peaks, you need to divide the world into two parts.

First there's OPEC, which has a lot of oil and will peak later, and then there's non-OPEC -- North Sea, Caspian, Africa, and elsewhere -- and there you're going to see a peak

in production sometime I think in the next ten to twelve years, and that is getting pretty close.

JEFFREY BROWN: All right, Mr. Yergin, what's your view on the...

DANIEL YERGIN: Well, actually, we're running out of oil. We've been running out of oil since 1859, when we discovered it. In the 1970s, we heard the same kind of things, that we're going to run out of oil tomorrow. Actually, last year, the oil companies replaced 117 percent of what they produced. Based on looking at prices today, if you look six years ago, oil was \$10 a barrel, and you would have said we we're going to have a glut forever. I think it's not optimist and pessimist. I think most well-informed opinions say the peak probably comes around 2040.

There's a small group who says it came last year or two years ago. But when we do our numbers, we show that oil production at the end of this decade worldwide will be 20 percent higher, more than 20 percent higher than it was at the beginning of this decade. And that's on a field-by-field analysis.

JEFFREY BROWN: So, do you see this as a cyclical period that we're going through?

DANIEL YERGIN: I think there are these patterns of running out. In the 1880s, one of the founders of Standard Oil started selling off his shares because they told him there was no oil outside Pennsylvania. It is a big challenge to replace reserves. But I think people who think we're at the peak underestimate the continuing impact of technology. And I think that the bigger constraint before geology is geopolitics.

JEFFREY BROWN: The question is whether we're at the end of cheap oil.

DANIEL YERGIN: I think it's going to go in cycles. I think the prices we're going to see now -- I think we see a surge of production coming in the second half of this decade. And that we might again be looking at lowerpriced oil, again. But I think, for the next two years or so, we're in a tight period. And right now, even with these increases now that OPEC says they're going to do, we're in a very tight situation where the market is vulnerable to significant shocks. And so we have to be prepared for that.

JEFFREY BROWN: Mr. Roberts, as you build your case in your book, you see the end of oil pushing us into a whole new energy regime. What do you think should happen?

PAUL ROBERTS: Well, right now, I think, I disagree with Dan. I think that we are in a period where, you know, cheap oil is the thing of the past. Where price settles, that remains to be seen, but even Arab analysts are saying now that the market can tolerate a much higher price band -- in the \$30s, the high \$30s. So that's where I think we're going to be.

The good news there is that tends to push the economy into a more efficient behavior. So we're going to see a reduction in demand increases, more efficiency. We're also going to see more interest in alternative fuels. Now, granted, we are nowhere near where we need to be in alternative technologies, and alternative fuels. They don't compete cost-wise with oil or natural gas or coal. But give them time, and I think we could see that, particularly if oil prices remain high. So, I think that's a positive -- actually a positive development and certainly going to hurt people at the wallets when they go to fill up their cars. But they should keep in mind that this isn't making the economy do what it's going to need to do. And the geopolitical question is relevant that Dan brings up.

You know, we are at a point now where sudden volatility, sudden instability in an oil producing nation is probably far more dangerous to oil supply than any chance of running out. But there's another factor we need to look at, and that is the environment. You know, we'll be able to find oil for decades and decades. The problem is that we may not have the time. We're going to have to do something about the way we produce our energy because it's impacting climate.

JEFFREY BROWN: Where do you come down on this when you consider the price swings, the geopolitical issues you brought up, the environmental issues that he just brought up?

DANIEL YERGIN: Well, I continue -- I believe that conservation -- I, for a long time, have believed that conservation is very important and is, in a sense, our cheapest energy source. Still, my brother sends me an email saying "the next car I buy is a hybrid." I mean, it does start to change people, and I think if it goes on for a couple years, it starts to change the conviction, what type of airline -- airplane engines and everything like that. But we've had a long period here where prices have been quite low. And I think now people say, "well, these are going to last a while." It will affect the decisions they make on new investments.

JEFFREY BROWN: How realistic is a move towards more alternative energies?

DANIEL YERGIN: We've been waiting a long time. Billions and billions of dollars have been spent on it. Currently, renewables and solar, excluding hydropower, is like 0.2 percent of our supply. So even if it quadruples, it's less than 1 percent. It takes time. Costs are coming down for things like wind power. But they're far from being competitive on a large scale. It may be ten, fifteen years. Obviously, we have to continue to invest in a whole panoply of research and development to be ready.

JEFFREY BROWN: Mr. Roberts, how high do prices have to go at the gas pump to change people's behavior and attitudes to move to a kind of future you're talking about?

PAUL ROBERTS: Well, there's two ways to look at it. One would be to look at Europe, where they pay as much as \$5 a gallon for gasoline. And it has, you know, clearly affected the way they use energy. But the other way to say that, you know, since we don't have a political climate here where we could have anything like a \$5-a-gallon tax or a price of \$5... so, maybe the question is at what point do consumers start to take this seriously?

You know, when do consumers and companies say, "okay, this isn't just a seasonal thing; it isn't simply cyclical. It may be here for the long term. I need to start making new decisions." And, you know, at that point, and it's hard to say when that could be. I mean, historically, oil prices come down after the summer driving season. And they if don't come down this year, that might be a signal to consumers that, might be a signal –

DANIEL YERGIN: -- they'll come down again and we're in a period of lower prices again. I think, you know, when you look -- in "The Prize," I had hundreds and hundreds of characters, but at the end of the day, I decided there are just two characters who really counted: Supply and demand. And this is a... we're dealing here with cycles.

JEFFREY BROWN: Mr. Roberts?

PAUL ROBERTS: Well, I mean, you know, that's been the historical pattern, and that's given the industry and a lot of government officials a great sense of optimism that this is self-correcting, you know, and we'll have a few years of pain. The high prices will encourage oil companies to go out and look for new oil. And all the money they're making now will be reinvested in additional oil exploration and production. And that's great if it works out. And I guess we'll have to wait it out.

DANIEL YERGIN:I think we can already see... we can see out to the year 2010, 2012, and we see some big increases coming. But, as Paul says, one major issue here is what governments want to do, not consuming governments, but governments...

JEFFREY BROWN: The geopolitical question you were talking about.

DANIEL YERGIN: Yeah, the geopolitical question. You know, what does Russia really do? Does it build a pipeline to Murmansk? Does it build a pipeline to Asia? Does it compete with the Middle East? Politics is very involved in all of this.

JEFFREY BROWN: Let me ask you briefly both, is there any question about oil's place in the future of our economy?

DANIEL YERGIN: Well, I think that it's possible by the year 2025 natural gas will have overtaken oil. But it looks, you know, you only have so far out to look. You look at China, where so much of the demand is coming. The next ten or 15 years, oil remains the primary energy source, perhaps even 20 years.

JEFFREY BROWN: Mr. Roberts, what's your answer?

PAUL ROBERTS: Well, I think that it's going to remain, in parts of the world it's going to remain critical. In China, obviously, they want a car culture. They're not going to be able to leapfrog into the 22nd century any faster than we can. But America clearly needs to take leadership here and say, and recognize, and publicly recognize that an oil-based economy can't go on forever and that if we're going to change, even if it takes, you know, twenty or thirty years for us to hit a peak, as Dan suggests -- and I don't happen to agree -- but even if it does, we need to start making investments now in all kinds of things. The technologies that today are taking up a tiny share of the market, they have to be grown. We have to be looking for the other technologies that are going to appear. We have to create an atmosphere...

DANIEL YERGIN: Is it the consumer? Is it government mandating it? Is it prices from the market? How does this happen?

PAUL ROBERTS: Well, I think if you want to include climate change in your equation, which you have to, you have to eventually get to a climate or a carbon-based economy. You have to charge people and companies for the carbon they produce. That sets a whole bunch of things in motion. It is not an attractive policy option in this country. This country can't even acknowledge that climate's a problem. You can't use the "c-word" in political discourse here.

JEFFREY BROWN: Okay. Big, long-term questions. Paul Roberts and Daniel Yergin, thank you very much.

DANIEL YERGIN: Thank you.

PAUL ROBERTS: Thank you.

U.S. Energy Supply at "Critical Juncture," Yergin Tells IPAA

June 16, 2004 | Press Release

"Demand Shock" Hits Global Energy Markets

Full Press Release

COLORADO SPRINGS, Colo., June 14, 2004 – A global “energy demand shock”—compounded by extremely tight world oil supplies, constraints on U.S. natural gas production, and geopolitical turmoil—is now putting the United States at a “critical juncture” in its energy position, where concerted actions by industry, energy users and policymakers are required to ensure energy security and environmentally sound economic growth, Cambridge Energy Research Associates (CERA) Chairman Daniel Yergin told the Independent Petroleum Association of America (IPAA) here today at its 75th anniversary Midyear Meeting.

“The risks will be different in the near-term from the long-term and among various energy users and regions,” Yergin said. “But there’s no question that the risks have gone up.” The solution will undoubtedly involve adapting to a new worldwide supply-demand profile, globalizing the liquefied natural gas (LNG) industry, adjusting current market psychology, promoting international cooperation, maintaining a strong domestic industry, and more realistically appraising energy reserves, environmental goals, technological potential and geopolitical limitations, he added.

Yergin said the world’s consumption of oil could increase over the next two decades by more than 40 percent – reaching 115 million barrels per day (mbd) by 2025 (compared to 81 mbd today), while LNG imports will be needed for over 30% of a substantially larger U.S. natural gas demand. Citing his Pulitzer-Prize winning book, *The Prize: the Epic Quest for Oil, Money, and Power*, he compared the magnitude of effort required to prepare for future growth with the role the American oil industry played in World War II, when it organized itself, against many obstacles, to supply almost 90 percent of all the oil that the Allies used on the road to victory.

Because history teaches that the energy industry moves in cycles amid constant surprises, with technology and overall economic activity changing production and consumption levels, determining the risks requires a close analysis of the market fundamentals as well as the politics, according to Yergin.

Oil

“Population and social change—in China and India, and in the Middle East— are doing much to drive today’s high oil prices,” he said. “Economic growth in China and India, as well as in the United States, is contributing to a demand shock on the oil market. China alone accounts for 40 percent of all the world’s growth in oil consumption since 2000. The generally very good news in 2004 of what looks like the best global economic growth in a generation is creating specific pressure on energy markets.”

“Turmoil in the Middle East and other producing regions,” he continued, “is adding a ‘security premium’ to the price of oil, a premium that is very ‘event-sensitive’.” Currently, CERA estimates the security premium at between \$6 and \$10 a barrel.

“Russia and the Caspian countries,” he said, “are in a position, if they maintain their momentum, to add as many new barrels to the world market this decade as the Middle East; and West Africa is not far behind.”

Natural Gas

“The North American natural gas industry is facing its highest sustained prices ever, reflecting a very tight market,” Dr. Yergin said. “The reason is geological maturity at a time of significant growth in demand.” Contention over development and access is adding to the pressures in the marketplace for natural gas, which has become the “fuel of choice.”

Pointing out that natural gas currently meets almost a quarter of United States’ energy requirements, he added, “The need for gas to fuel the new fleet of gas-fired electric power plants is the largest single driver of growth in gas demand. Gas consumed in the power sector is set to grow 5 percent a year over the next few years, overtaking industry as the biggest consumer of gas in North America.”

Liquefied Natural Gas

Dr. Yergin predicted that LNG will play a much larger role in the U.S. market in the coming years. “It’s not an either/or question. Both substantial new North American production and supplies from the world market, via LNG, will be necessary to relieve the pressures in the market.”

CERA expects that LNG will emerge as the second global energy business with construction of as much capacity in the next eight years as the global LNG industry has built in the past 40. “Success in this drive will require orchestration of a wide-ranging set of independently driven factors, including: development of very large liquefaction facilities;

ordering and deployment of a sufficient number of tankers for reliable, timely transport; and construction of regasification facilities,” Yergin said.

Cambridge Energy Research Associates (CERA) is a leading advisor to major North American and international companies, financial institutions and organizations, delivering strategic knowledge and independent analysis on energy markets, geopolitics, industry trends and strategy. CERA is headquartered in Cambridge, Mass., and has offices in Beijing, Calgary, Mexico City, Moscow, Oakland, Paris, São Paulo, and Washington, D.C.

The Next Prize

November 03, 2003 | News Article

In "The Next Prize," Daniel Yergin, CERA Chairman, and Michael Stoppard, CERA Director, present an analysis and projection for the development of LNG as a global business, including both the economic and geopolitical issues. The article appears in the November/December 2003 edition of the distinguished journal *Foreign Affairs*, published by the Council on Foreign Relations.

For more information on CERA's LNG Advisory Service, visit CERA's Service Offerings section.

A Global Gas Market

A new global energy business—natural gas—is emerging. It will have a far-reaching impact on the world economy, bringing new opportunities and risks, new interdependencies and geopolitical alignments. As natural gas becomes a traded global commodity, it will be critical to meeting a host of urgent needs. The United States needs it to keep the lights on and stave off a coming energy shortage, Europe to rejuvenate its industry, developing countries to boost growth, and all of them to meet their aspirations to have a cleaner environment.

The change will be accomplished both with long-distance pipelines and with natural gas that ironically is no longer in gaseous form, having been liquefied through cooling. This “liquefied natural gas” (LNG) will be carried in tankers that can change direction on the high seas to respond to sudden shifts in demand or prices. Thanks to this emerging global commodity market, lights, air conditioning, and factories in the United States will run on electricity that is sometimes generated with natural gas from Indonesia, the Algerian

desert, the seas of Trinidad or Nigeria, the island of Sakhalin in the easternmost part of Russia, the frigid northern waters of Norway, or the foothills of the Andes.

Yet, one of the more haunting aspects of this new global gas business is its reminder of the transformational years of the late 1960s and early 1970s, when the United States became integrated with the world oil market. In a few short years, the United States went from being a minor petroleum importer to a major one. The surge in demand from the world markets, pulled by the engine of the American economy, helped set the scene for the oil crises of the 1970s and created dependencies with which the world still wrestles.

For more than half a century, the United States has been broadly self-sufficient in natural gas, save for imports from Canada. In the next five years, it is likely to become a large gas importer; within ten years, it will overtake Japan as the world's largest. As it inevitably becomes part of this new global gas market, will the United States inadvertently trigger new security issues—or will new interdependencies help reduce future risks?

Many businesses have become truly global in their operations and perspectives over the last decade. Natural gas has been an exception until now. Although it is huge—a business worth over half a trillion dollars a year—it has been a local, national, or continental business, limited by the reach of pipelines and the absence of a global marketplace. But this picture is changing because LNG will allow the world's plentiful but long underdeveloped and “stranded” gas reserves to be efficiently carried to consumers.

The need for a global LNG market is growing urgent. In the United States, gas prices have doubled since the second half of the 1990s, placing a new burden on the economy and portending a shortage. Federal Reserve Chairman Alan Greenspan warned recently that dwindling domestic supplies were “a very serious problem” and a major threat to the U.S. economy and spoke out forcefully on the need to develop LNG supplies.

Much is now expected of LNG. But developing its full potential could cost as much as \$200 billion worldwide, and energy companies will have to choose between investments in LNG and other investments. Will the complex network of technology and investment be established in time, given uncertainties about markets, regulation, and government policies? Will geopolitical risks constrain—or disrupt—development? Can natural gas live up to the need, and the high expectations, that the world now has for it?

Growing Markets

Natural gas, like oil, is a hydrocarbon, and it is found either with oil or by itself. There is a joke from the early days of the oil business: a geologist reporting back on drilling a wildcat exploratory well says, “The bad news is that we didn't find oil. The good news is that we didn't find gas.” The punch line reflects the traditionally much more limited market for natural gas, its lower value compared to oil, and the general nuisance value of

something that could not be pumped into the tank of a car. Over the last few decades, however, gas' advantages have become increasingly clear.

Gas is the cleanest burning of the fossil fuels; it produces little pollution and emits less carbon dioxide—the key greenhouse gas—than either oil or coal. It also is abundant. Proven reserves total what, in oil terms, would amount to over one trillion barrels. Russia—with 30 percent of known reserves—is the “Saudi Arabia of natural gas.” Another 25 percent lies under Iran and Qatar, jointly pooled in the giant North Field/South Pars field, which straddles the waters between the two countries. Next, in terms of reserves, come Saudi Arabia and the United Arab Emirates. The United States falls sixth—but with only 3.3 percent of global reserves. Other countries with even smaller reserves, such as Indonesia and Malaysia, still rank among the largest LNG exporters. Large reserves that can serve as the foundation for LNG developments are also found in many other countries. Indeed, because of growing interest in natural gas, much larger gas reserves are expected to be discovered around the world. Nigeria, for instance, is normally thought of as a major oil country; but to those who know its prospects, its real promise is as a potentially huge natural gas province that also happens to have oil.

The modern U.S. gas industry was born during some of the darkest days of World War II, when energy shortages threatened the Allied war effort. “I wish you would get some of your people to look into the possibility of using natural gas,” President Franklin Roosevelt wrote to Interior Secretary Harold Ickes in 1942. “I am told that there are a number of fields in the West and the Southwest where practically no oil has been discovered but where an enormous amount of natural gas is lying idle in the ground because it is too far to pipe to large communities.”

After World War II, the gas did get hooked up and piped by newly constituted gas companies from the Southwest of the United States to the Northeast. Today, gas provides almost a quarter of the total energy for the U.S. economy. Although Europe's gas market only started up on a large scale in 1959, with a major discovery in the Netherlands, gas currently provides over 20 percent of the region's energy, and that share continues to rise.

Europe's leading source for this gas has been the Soviet Union (and now Russia). In the 1980s, the proposed expansion of Soviet gas deliveries to Europe caused a geopolitical imbroglio—the most divisive dispute between the United States and Europe of the decade. Proponents of new pipelines from the Soviet Union thought that the gas they would bring would reduce Europe's dependence on the Organization of the Petroleum Exporting Countries (OPEC) and enhance its economy. Opponents, primarily in the United States, argued that they would increase Europe's dependence on the Soviet Union and give the Kremlin both political leverage and additional hard currency to feed its military-industrial complex. Although moderated by intense diplomacy in the mid- 1980s, the conflict ended only with the collapse of the Soviet Union. But the development of what is now a 6,000-mile-long pipeline network from Siberia to the shores of the Atlantic was also one of the major harbingers of the internationalization of the gas business. Another was the emergence of LNG.

Liquid Power

Natural gas—in its gaseous form—can be carried efficiently only in pipelines. But when oceans get in the way, pipelines do not work. Fortunately, when natural gas is refrigerated down to temperatures of minus 260 degrees Fahrenheit, it contracts into a liquid, which can be put in a tanker and transported thousands of miles across the sea. On delivery, this liquefied gas is restored to its original state in a regasification terminal. Traditionally, the whole process has been relatively costly. But it is very effective—methane is 600 times less voluminous as a liquid than as a gas—and it allows large amounts of energy to be packed into a single cargo: one shipment holds the equivalent of five percent of the gas consumed in the United States on an average day.

The first commercial LNG business got started in the mid-1960s and ran between Algeria and both the United Kingdom and France. But that budding trade was soon supplanted by cheaper pipeline supplies from the Netherlands and the British North Sea—and then from Russia and Norway. It was not until the late 1990s that new projects in Nigeria and Trinidad, and later Qatar, brought more LNG to Europe.

LNG's real growth, however, came from Asia. Japan wanted to reduce air pollution by shifting from coal and oil to natural gas to generate electricity, but pipelines were not an option. So, in 1969, Japan began to import LNG from Alaska (which it still does today). Then, after the 1973 oil crisis, the Japanese government promoted LNG for energy security reasons: to reduce dependence on oil from the Middle East. Since then Japan has diversified its sources, importing LNG from various states, such as Abu Dhabi, Australia, Brunei, Indonesia, Malaysia, and Qatar. South Korea became the second major importer in Asia at the end of the 1980s, and Taiwan joined the Asian importers' club in the 1990s. Faced with an ever-rising demand for electricity, the huge economies of China and India are set to join the ranks of LNG importers in the next few years.

In the 1970s, it looked as though the United States was going to climb onto the bandwagon when it started importing LNG from Algeria. But then the growing availability of North American gas cut the boomlet short and created the extended surplus of domestic supply that became known as “the gas bubble.” LNG moved out of the ships and into the courts, as disputed contracts gave way to financial distress and litigation. Regasification terminals were closed down, and for several years no LNG at all was imported into the United States.

LNG projects in Asia and Europe developed according to a very particular set of unwritten rules—what might be called “the LNG paradigm.” The paradigm aims to ensure that a logistic, financial, and commercial chain links suppliers to consumers through contracts that govern every step of the process, from extraction and liquefaction to shipping, delivery, and regasification. Specific reserves are earmarked and developed for specific liquefaction facilities, the output of which is delivered by specified tankers to specific markets. All the elements of the projects—which last for 20 or more years—are laboriously worked out and settled before any serious dollars are spent. Gas prices are set

according to formulas that link LNG prices to oil prices, keeping them competitive and insulating them from subsequent decisions by buyers and sellers.

The LNG paradigm developed for two reasons: the huge capital costs of LNG projects and the inevitable interdependence of gas buyers and gas sellers. Simply put, there is no point in developing reserves if the market is not there—and vice versa. Supply and demand, according to the paradigm, need to be developed in tandem. The costs of LNG projects—which run from three billion to as much as ten billion dollars for a single project—mean that investors want to lock in future sales and revenue streams, protecting themselves from unanticipated or unpredictable shifts in the market.

This paradigm is very much at odds with the way the gas business has been organized in the United States since its deregulation in the 1980s. The U.S. market is anything but long term: it runs on spot and futures markets and short-term contracts. The mismatch between the LNG paradigm and the way the business works in the United States had led many observers to conclude that the United States is unlikely ever to import significant quantities of LNG. At least that was the view until very recently.

Guiding Light

If there is a single thing responsible for the emergence of natural gas as a global commodity, it is the rising demand for electricity. Today, natural gas is the “fuel of choice” for meeting escalating electricity needs, whether in the developed or the developing world. In the United States, demand grows at a rate that is about two-thirds of the growth rate of the overall economy. In the developing world, growth rates are much higher. China’s electricity consumption today is more than three times what it was in 1990; lately, it has been growing at an extraordinary 17 percent a year.

The “combined cycle gas turbine” (CCGT), a new technology for generating electricity that was borrowed from jet engines, has given gas a major advantage against its competitors—coal, nuclear power, hydropower, and oil. CCGT plants are easier to finance, quicker to build, and more efficient in their consumption of energy than existing coal plants. Environmental considerations also have reinforced the position of gas as the new fuel of choice. Of all the fossil fuels, it is the best suited to the post-Kyoto world: electricity generated from it emits only 40 percent of the carbon dioxide produced by electricity generated from coal. And because these gas-fired power plants are smaller and much cleaner, they can be located within or near cities, which obviates the need for long-distance power lines.

Policymakers around the world have been deregulating the power business to move from “natural monopolies” to a marketplace of multiple parties that trade and compete with one another. New, independent powergenerating companies have been encouraged to enter the business. The gas-fired turbines—small, cheap, quick, and clean—have proved well suited for the era of deregulating energy markets. Technology has also affected the supply

side of the market. The costs of LNG terminals and tankers once appeared to be irreducibly high, but they have in fact been reduced. Recent improvements in engineering and construction brought those costs down by as much as 30 percent. And reductions continue.

But there was one missing ingredient to the formation of a global marketplace—the United States.

The American Engine

In the last two years, the United States has emerged as a key—indeed the key—future growth market for LNG. It alone accounts for a fourth of the natural gas consumed in the world each day. As American imports from Canada increased over the 1990s, what had been national self-sufficiency slowly evolved into continental self sufficiency—and interdependence. And now, in addition, Mexico imports gas from the United States.

The United States enthusiastically embraced the new gas-fired technology to generate power. Altogether its use of natural gas in electric power production has increased almost 40 percent since 1990—with much more growth to come. Over 200,000 megawatts of new power-plant capacity has been recently constructed or will soon start production. This is a huge amount of power capacity, equivalent to more than a quarter of the country's entire installed capacity in the year 2000—and larger than the entire electric power industries of the United Kingdom and France combined. Well over 90 percent of the new capacity is fueled with natural gas.

But rising demand for gas has collided with what is now emerging as a natural gas shortage in the United States. Traditional sources of supply can no longer keep up with electricity-driven rising consumption. Very disappointing results from the drilling boom of 2000–2001 were the first indicator of this disparity. Since 2001, supply has declined by four percent. New wells will be drilled in the years ahead, and new supplies added. (Owing to the depletion of existing wells, in ten years more than half of domestic supply will have to come from wells that have not yet been drilled.) There may be a modest rebound in supply over the next couple of years, which, together with a weak economy and mild weather, may temporarily mask the reality of the shortage. But, as the U.S. National Petroleum Council observes in its new study, the reality remains that the geological base in the United States is mature—that is, it has been thoroughly explored. Supply shortages, and the resulting jump in the cost of producing electricity from natural gas, were one of the reasons for the California power crisis of 2000–2001.

In response to the tightening of supply and demand in the United States, domestic gas prices have doubled, weighing the economy down. And today's supply gap is small in comparison to what it could be a few years from now, when the real North American gas production decline begins. Higher prices will hurt homeowners and such industries as fertilizer, chemical, and plastics that depend on gas. Companies in those sectors are already

cutting back on production and closing plants. But the full effect of higher gas prices has not yet been felt. When it is, factories will be exported, and jobs—measured in hundreds of thousands or even millions—will be lost. In a very painful way, that will lower consumption in the industrial sector. Some of this is already happening.

Conserving energy will play an important role in mitigating the tight supply problem, but there will be limits as to what it can do, especially with the demand for electric power inexorably increasing—thus increasing demand for natural gas—and outpacing improvements in energy efficiency. Major new discoveries or breakthroughs in drilling technology could increase domestic supplies. And there are major prospective areas in the United States—the eastern Gulf of Mexico, the Rockies, and off the eastern and western coasts of the United States. But they are currently off-limits for environmental reasons, and any efforts to improve access to them would inevitably lead to a political storm. A new gas pipeline will eventually bring large amounts of new supply from Alaska’s North Slope (not to be confused with Alaska’s controversial Arctic National Wildlife Refuge), but that project will probably take a decade or more to realize and, even then, would only make up part of the shortfall.

Thus, LNG is needed to fill a big part of the supply shortfall. In 2002, LNG accounted for just one percent of the United States’ natural gas supply. By 2020, it could exceed 20 percent. But if LNG is to meet its potential, the United States needs to invest reasonably swiftly in regasification terminals—the portals that link the global gas network to our domestic markets. Environmental controversies over licensing and siting issues, which could disrupt investment, need to be managed sensibly, and regulations coherently applied. As Greenspan commented to Congress, “We cannot, on the one hand, encourage the use of environmentally desirable natural gas in this country while being conflicted on larger imports of LNG.”

The market appears to be responding: more than 30 regasification projects have already been proposed. Some plants will be on land. Others may be offshore floating terminals. And to satisfy the states that most desperately need them but are among the most environmentally conscious, terminals may be built in neighboring countries—in Mexico to feed California, in the Bahamas to supply Florida, and in Canada to meet New England’s needs. At least a third of the proposed projects need to be built over the next decade to counter the United States’ shortfall. All of them will need to wind their way through a complicated maze of permit and approval processes.

An even more critical question is whether gas fields and liquefaction plants will be developed to supply the regasification terminals. Much still needs to be done to turn the vision of having LNG from around the world supply the United States into the reality of steel and concrete. The single largest hurdle is the sheer scale of the capital required: developing reserves to serve a single terminal in the United States costs billions of dollars. And for companies providing the capital, LNG projects are only one of several possible investment opportunities. It is not enough for LNG projects to be attractive; they must be more attractive than other prospects. Realistic and timely negotiations between companies and countries is one essential step toward overcoming the financing hurdles.

Looking into the Future

What could capsize LNG's development? At a time when oil and gas prices are high, optimism about the prospects for a new LNG market is only to be expected. But the industry will not develop along a straightforward course; it will have to weather disruptions and make midcourse adjustments. Low gas prices, even if they are only temporary, could discourage investors and stifle growth. It takes more than growing demand, plentiful reserves, and competitive costs to make a global market. Private companies need to commit the necessary capital and human resources. State-controlled companies have to resolve the conflicts between the commercial attractiveness of LNG and other political and social imperatives. Banks and other lenders need to be confident about the projects' financial soundness. All participants need the ability to weather the ups and downs of a commodities market.

High energy prices could also disrupt the business, by renewing the traditional battle over economic rent between governments and foreign companies. Encouraged by market demand, financial pressures, and nationalist sentiments, governments could be tempted to try to renegotiate deals to extract more value for their resources. Ultimately, large gas projects will only move ahead when the deals' terms are equitable, fair, and stable for all parties. New fiscal regimes are likely to evolve to reflect the perceived risk and anticipated profitability of gas developments and to bridge the gap between the volatile U.S. gas market and the traditionally stable long-term LNG paradigm.

Governments in consuming countries will also need to resist a series of temptations. If the market is allowed to work, the textbooks say, rising gas prices should create more supply, bringing the market and prices back into balance. In reality, however, such prices could also prompt governments to adopt policies that, although politically popular, may be economically counterproductive. There is already talk in the United States of imposing price controls and restricting gas consumption with "fuel use acts." Serious consideration of such measures will increase the risk and uncertainty for new projects and thus delay much-needed investment. Implementation of such restrictions might stop development altogether.

The globalization of the gas market also raises geopolitical questions. Some analysts anticipate that the new interests and interdependencies brought by the LNG trade will bolster relations between producing and consuming countries. Others, however, worry that it will only lead to dependence on imports for yet another key commodity, which will create vulnerability to deliberate machinations, political upheavals, or economic problems.

These concerns cannot be dismissed. In 2001, an Islamic secessionist insurgency on the island of Sumatra temporarily shut down LNG facilities that supply Japan, although LNG from elsewhere in Indonesia made up for the shortfall. In the last year, oil production was disrupted in Venezuela by a virtual civil war between President Hugo Chávez and his opponents and in Nigeria by ethnic tensions and regional conflicts—with much impact on the world oil market. One can well envision scenarios in which the future large LNG

exports could be subject to some kind of interruption, even if only short-lived. But the best response to such security concerns is to develop the global LNG business and ensure that ample supplies come from many countries. Encouraging LNG projects in various countries is a safeguard against undue dependence on too few nations.

What about an “OGEC”—a gas version of OPEC? Might a few countries come to dominate the supply of LNG and adopt policies harking back to the confrontational OPEC of the 1970s? An association of some kind among LNG exporters is likely. Many of them are also oil exporters, and the desire to compare fiscal terms will be irresistible. But there will be limits to how far they can go. For one thing, there will likely be too many too diverse countries to form a single bloc. Australia, Yemen, and Angola will each see the world very differently. Moreover, exporting countries will compete not only among themselves but also with local production in consuming countries and with pipeline supplies, which will reduce their leverage. Ultimately, exporting countries themselves also need to maintain good relations with their customers, to protect their market share and promote additional investment. Therefore, they will likely be cautious about taking actions that could disrupt the critical flow of revenues back into their national treasuries.

These geopolitical issues should serve as a reminder that the gas trade will also have political implications, although not necessarily any that would spark confrontations. Gas is not just another commodity. Because it is traded internationally, it is also an opportunity for states to establish lasting relationships, as nations in Asia and Europe have done over the past three decades. Energy-short Japan has long seen the need to forge strong political bonds with its gas suppliers. The Sakhalin LNG project, a \$10 billion investment to supply Russian gas to Japan, for example, is the single largest private foreign investment in Russia—a monumental undertaking that has depended critically on government-to-government commitment to bolster private-sector investment.

The natural gas business is on the brink of profound change. It is set to become global and to adopt a more flexible market model. Gas may indeed become the fuel that helps keep the world's lights on. But this development is not predetermined; the United States needs to embrace the LNG market to complete the transformation. That engagement is also necessary to meet U.S. energy and economic needs. Company strategies and government policies need to move forward together to make this happen. A variety of risks will come from increased interdependence, but, in a growing, diversified global market, they can be managed. And they are dwarfed by the much greater risk that the United States and Europe could face a persistent shortfall in natural gas. There is a growing urgency to make investments in LNG in the near term in order to avoid more serious disruptions in gas markets and economies later in the decade.

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Thirty Years of Petro-Politics

October 17, 2003 | News Article

On the anniversary of the oil embargo, CERA Chairman Daniel Yergin looks back at its effects in an op-ed for the Washington Post.

Thirty years ago today, a group of oil ministers gathered in Kuwait City and made a decision that shook world politics and ignited the energy crisis of the 1970s. It continues to shape the way we see energy issues today, when tight oil and gas markets and high prices are a key factor in our economy -- and when the strategic significance of oil is once again evident.

The 1973 oil embargo was the unsheathing of "the Arab oil weapon." Coming the day after a decision to double prices, it was meant to be an act of retribution -- punishing the United States for resupplying arms to Israel, which at that moment was still reeling from the surprise attack on Yom Kippur, several days earlier. Beyond that, it was also meant to pressure the entire Western world, whose oil consumption had been rising rapidly, into supporting the Arab side in the Arab-Israeli confrontation.

Though hardly anyone anticipated such cuts, there had been warnings. Indeed, during the 1967 Arab-Israeli war, some of the Arab exporters had tried to impose an embargo. It failed because there was plenty of extra production capacity that could be called into service. But by 1973 the world market had changed: Every well in the world, it seemed, was producing flat-out, at full capacity. The reason was the torrid growth in demand. The United States, its domestic production having flattened, had turned to the world market, and in a few short years went from minor importer to the world's largest importer. And this time there was no place to go for extra oil.

The embargo created a massive global panic as buyers competed furiously with each other to get what they could, pushing the price up further. In the United States, it hit home for most consumers in infuriating gas lines - long waits for limited amounts of gasoline. (The lines were in fact largely self-inflicted, a result of government controls that prevented flexibility and accentuated shortages in the marketplace).

The whole international order seemed to have been transformed. Now politics was also about economics. On the day the embargo was announced, President Nixon told his advisers, "No one is more keenly aware of the stakes: oil and our strategic position." The vast flood of "petro-dollars" to the exporters turned "petro-power" into a central fact of international politics.

Prices went up fourfold in the crisis; then, a few years later, with the Iranian revolution, they doubled again. The oil crisis marked the end of the postwar economic boom and did much to turn the 1970s into the worst decade, in economic terms, since the Great Depression. Moreover, there were fears that the crisis portended a permanent shortage of oil. People speculated that the price of oil might go to \$100 a barrel.

That's not how things turned out, of course. Within less than a decade, the "permanent shortage" turned into a glut, triggering a price collapse that, among other things, hastened the end of the Soviet Union, which had been depending on its oil exports as the lifeline to keep its economy alive.

There are many lessons here. Nations that had taken their energy supplies for granted suddenly realized how important reliable, reasonably priced supplies were to their well-being. Oil became high politics, and energy became part of public policy.

One of the less obvious but lasting lessons is that markets work, even in circumstances as dramatic as these were. Supply and demand adjusted. The United States and other industrial countries have since become much more efficient in the use of oil. Today -- SUVs notwithstanding -- the United States uses only half as much oil per unit of GDP as it did in the 1970s. New, non-OPEC sources of oil, led by Alaska and the North Sea, came on stream quickly. And the world switched from oil to other energy sources.

It is also now clear that the starting point for energy security is diversification of supplies -- that is, production coming from many sources. The United States now imports oil from a large number of countries; it has a Strategic Petroleum Reserve as a supply source of last resort and can coordinate with other countries through the International Energy Agency. The response to the crisis also demonstrates the power of technology. Technological advances have brought both greater efficiency in oil consumption and greater range in production. The oil industry is able to accomplish feats -- such as drilling beneath the ultra-deep waters of the Gulf of Mexico -- that were simply inconceivable in the 1970s.

Exporters learned their own powerful lesson: Customers matter. When prices skyrocketed, the exporters found that they were losing market share; customers had choices. After the price collapse, most of the exporters set out to rebuild their credibility as reliable suppliers, which meant making oil nonpolitical again. Consumers worry about security of supply, but producers -- who often depend overwhelmingly on petroleum earnings for their national budgets -- learned they need to worry about security of demand.

Are we less vulnerable today than in the 1970s? Oil is still the preeminent strategic commodity. And in a tight market, even without the political motives that brought on the 1973 embargo, the oil market is vulnerable to shocks and disruptions. True, markets are flexible and can adjust more quickly, but extensive turmoil in the Middle East -- or other major oil-producing regions -- could send new shocks throughout the world. After the last OPEC meeting, oil prices are again hovering around \$30 a barrel. All this has had a significant impact on the world economy.

In November 1973, a few weeks after the embargo went into effect, President Nixon announced Project Independence to make the United States self-reliant in energy. Thirty years of rhetoric later, we are no closer to that goal -- indeed, we're farther away. At the time of the embargo, the United States was importing a third of its oil; today it's almost 60 percent. We will continue to hear much about energy independence, but the real challenge is how to manage our dependence through diversification, efficiency, technological advances and the stability of relations with a wide range of suppliers.

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This article first appeared in the October, 17, 2003 edition of The Washington Post.