

The New Energy Security
2005 Global Oil and Gas Forum

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Foreword

Energy is at the forefront of global economic and geopolitical discussions in a way not seen in a quarter century. Recent increases in oil and gas prices, growth in demand from China, India and other rapidly growing economies, the impact of demand and prices on economic growth and the health of energy intensive industries, competition for reserves, debates about when oil production will peak, and the links between energy and perceptions of national security and national interest have all combined to highlight the importance of energy in global economic and security questions.

To explore these issues, the Aspen Institute organized a forum on issues at the intersection of energy, economics, geopolitics, and security. A select group of U.S. and international leaders and policy experts from energy producing and consuming industries, governments, and research organizations assembled for a dialogue designed to encourage new, collaborative, cross-disciplinary thinking on issues of critical national and global importance. An informal atmosphere and a not-for-attribution rule encouraged candid exchanges and creative thinking.

The dialogue was co-chaired by James R. Schlesinger, Senior Advisor, Lehman Brothers, and former U.S. Secretary of Defense and Energy; and Luis Giusti, Senior Advisor, CSIS, and former Chairman and CEO of Petrol eos de Venezuela S.A. (PDVSA). Their extensive experience enabled them to frame the discussion and elicit contributions from diverse expert participants. The highly qualified group

of speakers listed in the agenda provided a wealth of information and a variety of perspectives, contributing substantially to the richness of the dialogue.

The Institute acknowledges and thanks our sponsors - Aramco Services Company, Chevron, Centrica, DaimlerChrysler, The GHK Companies, and Shell Oil Company - for their financial support. Without their generosity and commitment to our work, the Forum could not have taken place.

On behalf of the Institute and the Forum participants, I also thank Leonard Coburn, who served as rapporteur. With a strong background in energy, he was able to identify the important threads from a wide-ranging discussion and skillfully weave them into this summary report.

Katrin Thomas managed the administrative arrangements for the Forum with her usual efficiency and grace. Her hard work was responsible for a pleasant and smoothly run meeting. Along with the participants, I am grateful for her cheerful and conscientious support.

This report is issued under the auspices of the Aspen Institute, and neither the Forum speakers, participants, nor sponsors are responsible for its contents. Although it is an attempt to represent views expressed during the Forum, all views expressed were not unanimous and participants were not asked to agree to the wording.

John A. Riggs
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Introduction

Energy security means different things to different countries. Importing countries primarily focus on supply. Since the oil price shocks of the 1970s, the focus of energy security has been on achieving adequate supplies at reasonable prices, without incurring serious disruptions. Recent high prices have intensified this concern and renewed interest in policies to bring prices down.

Oil exporting countries focus on the unimpeded flow of energy, namely, ensuring steady long-term demand for their oil at prices that will maximize their returns without undermining long-term economic growth. Some producers with large reserves are interested in moderating prices to maintain their market over the long-term, while other producers with smaller reserves are more interested in getting the most for their reserves now. Some consumers and producers want to let the market work unencumbered while others are more interested in intervening to moderate prices or to guarantee access to supplies. Oil prices, supply, demand, and government policies have converged in a renewed debate over what constitutes energy security today.

With this renewed focus on energy security, many questions arise. Are the consumer and producer goals reconcilable, or are they merely two sides of the same issue with long-term policy convergence? Is the global oil market beginning to shift from abundance to scarcity? Is the current shortage transitory, or is it likely to become substantial and lasting, auguring a paradigm shift in the market? Or, is the

market going through another cycle that eventually will lead back to a more stable supply or even a surplus again? Will such a stable supply require reliance on unconventional oil, and what price will be required? What new policies are necessary to enhance the energy security of consumers and producers? Do consumers need to adjust demand rather than emphasizing supply to alleviate the pressure on oil prices? How much pain will consumers accept to reduce demand? How should policy makers consider the question of energy security in light of the current tight market and possible future developments? Is there likely to be a new energy security, or merely increasing energy insecurity that must be faced by producing and consuming countries alike?

To address these and other questions, the Aspen Institute convened a group of international energy experts from both consuming and producing countries. In the first session, these experts grappled with the questions of the adequacy of future oil supplies.

Some suggested that conventional oil supplies will peak relatively soon and then start to decline, leading to much higher prices as demand continues to increase. Others suggested that the production of conventional oil will reach a plateau and will stay at about the current level for quite some time, also leading to higher oil prices as long-term demand continues to increase. Lastly, some suggested that the global oil market is experiencing another of its cycles, whereby today's high oil prices will bring forth both new supplies of oil (conventional and unconventional) and reduced consumption that will alleviate the pressure on prices until another cycle begins. The group analyzed the peak, plateau and cyclical theories without reaching a consensus on what the shape of the future world oil market will look like. There was widespread agreement, however, that the policies that would be necessary in response to an imminent peak in supplies should also be taken in anticipation of a plateau and, to a lesser extent, in the expectation of continuing cycles of high and low prices. Only the urgency of action, and the difficulty of the transition, would differ.

In the second session, the experts focused on several regions that will have an important role in the future shape of this market - Saudi Arabia and Russia on the producing side and China and India on the consuming side. Saudi Arabia and Russia are the two largest oil producers and oil exporters. What happens in each will contribute significantly to future oil supplies. China and India have been the two consuming countries experiencing the largest recent percentage growth in oil demand. Along with the U.S., these three countries comprise about 60 percent of recent oil demand growth. What happens in each will contribute significantly to future oil demand.

In the third session, the experts discussed transportation, which constitutes more than two thirds of overall oil demand in the U.S. and other developed countries. The discussion focused on the short- and medium-term market for passenger vehicles. It also looked out into the future to find out what kinds of transportation options may make a difference in how the world uses oil.

Finally, the last session focused on natural gas, the fuel experiencing the fastest growth in demand. More countries are now expanding the concept of energy security, often applied primarily to oil, to include natural gas. Europe, Japan, Korea and other economies heavily dependent on imported gas have long used this expanded definition, and the U.S. and other economies facing rapidly rising gas demand are beginning to do so. The group discussed the adequacy of world natural gas supplies and the most efficient strategies for moving this natural gas to consumers from the remote areas where much of it is found. These strategies included extensions of existing pipelines, building new pipelines, and expanding the growing trade in liquefied natural gas (LNG) where pipelines cannot be built economically.

The goal of the discussion was not to propose solutions or recommendations, but rather to seek insights so that non-experts and policy-makers alike can understand better the complexity of the issues. This enhanced understanding then may help to provide the foundations for new energy security policies.

Tight Oil Markets and the New Energy Security

The discussion of oil markets centered around three different scenarios, which in reality are not as distinct as described here: 1) oil supply reaching a peak in the relatively near term and then declining; 2) supply reaching a plateau in the near to mid-term that will last for quite a while; and 3) prices declining in the near term as supply and demand respond to current high prices, followed by higher and volatile prices in the long term with unconventional oil helping to offset declining supplies of conventional oil as demand continues to increase. The group called these scenarios peak, plateau and cyclical.

The peak scenario posits that higher prices are here to stay or at least will be the norm in the long-term even if prices fluctuate in the short and mid-term. Stripped to its bare essence, it is a problem of constrained supply leading to unacceptably high prices. The problem stems from the growing gap between world oil demand and the ability or willingness of producers to keep pace. How will this gap come about and what can be done about it?

The gap is the result of the convergence of many factors. OPEC and non-OPEC countries are producing over two barrels of oil for every new barrel they find. Depletion of proven reserves in many non-OPEC countries has reached or exceeded 50%. Where depletion is at that level, the ability to maintain or even increase production will be a significant challenge. In addition, companies are having less success in finding new, large oil fields. Essentially, the “elephants” have been dis-

covered and are under development or production. What the world is left with is smaller, harder to develop fields at higher costs - the "prairie dogs." Those advancing the peak theory maintain that after about 2010, sustaining production growth in the non-OPEC countries will meet with serious challenges. Their conclusion is that non-OPEC production will not keep up with past successes, leaving the gap to be filled by OPEC. In looking at OPEC and its ability to fill the gap, these analysts are not optimistic.

On the demand side, the peak oil analysts point to the strong demand coming from China, India, other emerging Asian economies, and the U.S. Suppliers seriously underestimated China's demand for oil in 2004, leading to a severe tightening of the oil market and upward pressure on prices. Projections of demand growth from China indicate a doubling of oil demand from 6 to over 12 million barrels per day by 2020. Imports are expected to climb to more than 10 million barrels per day by 2020, the level of today's U.S. imports. While the projections for India are not as dramatic, they are still robust.

Largely as a result of continued demand growth in the U.S. and emerging Asian economies, the U.S. Energy Information Administration (EIA) projects that the world oil market will grow from today's 78 million barrels per day to 103 million barrels per day in 2015 and to just over 119 million barrels per day in 2025. The proponents of the peak oil theory are skeptical that economically recoverable reserves can support production of over 100 million barrels per day.

These analysts argue that the world cannot supply its way out of the problem but must address demand. Adjustments in demand will be painful. Despite shifts that have made many developed economies much more efficient today in their use of energy compared to the 1970s, energy use and particularly oil consumption continue to grow.

However, some argue that a more detailed analysis of the demand side of the equation is needed. In one example, albeit unique, Russian GDP grew by more than 40 percent since 1998, but oil consumption remained flat. A deeper analysis shows that there has been a massive move to more efficient automobiles in Russia. Thus even with increased cars on the

road, more Russians are abandoning the old inefficient Russian-made cars for more efficient foreign cars. This shift is the primary reason that oil demand has not grown as GDP expanded. In China, part of the explosive growth in oil demand in the previous two years stemmed from an acute power shortage and the use of diesel generators to supply electricity. As the power gap diminishes, Chinese demand for diesel fuel is beginning to decline and the growth of demand for crude oil should lessen as well. The conclusion is that oil demand growth at the levels of recent years cannot be taken for granted.

Proponents of the peak oil theory indicate that since 1998, growth in non-OPEC oil production essentially has been flat if growth in the Former Soviet Union is excluded. The robust increase in demand since 1998, led by China, India and the U.S., was met primarily by increases in Russian oil production. Russian production alone grew by more than 50 percent since 1998. Growth in the Caspian region also has been significant. As the discussion in a subsequent session showed, the ability of Russia to sustain this performance into the future is highly questionable.

Depletion rates have a significant impact on the ability of non-OPEC producers to meet future demand. A production profile for a typical producing country shows that oil production ramps up over a period of time, reaches a plateau, and then declines unless significant new reserves are found to extend the plateau. Once large discoveries are no longer made, and especially if production rates increase, depletion levels accelerate.

Analysis shows that many non-OPEC producers either have gone into decline or have reached a plateau since the mid-1990s. More countries are in the decline phase of their production than in the increase phase. This decline normally occurs when a country's fields are at about 50 percent of depletion. In addition to the U.S. and Canada, where conventional oil production has been declining for some time, production in other non-OPEC countries is now exceeding new discoveries by as much as 8 billion barrels per year. The conclusion from this analysis is that continuing depletion of the reserve base will over time lead to the inability to increase non-OPEC production. In addition, other than West Africa, significant percentages of the non-OPEC

reserves were produced since 1990, again confirming that these countries are producing at an extremely high level but are not adding new discoveries fast enough to keep up.

The proponents of the peak theory also examined OPEC production, since in the past OPEC always has been able to absorb increased demand and provide sufficient oil supplies to maintain reasonable prices. OPEC also has been producing more in recent years than it has discovered, producing over 8 billion barrels per year more than it is finding. But there is a huge question mark hanging over the analysis - what are the actual depletion levels for OPEC countries? Some evidence indicates that three OPEC countries - Venezuela, Qatar and Indonesia - have exceeded the 50 percent depletion level, while three others - Algeria, Nigeria and Iran - are approaching the 50 percent depletion level. That leaves only Iraq, UAE, Kuwait, Libya and Saudi Arabia at levels of depletion below the point at which production normally starts to decline. Even if these latter countries can increase their production in the future, the question is whether the increase will be sufficient to offset declines elsewhere and meet growing demand.

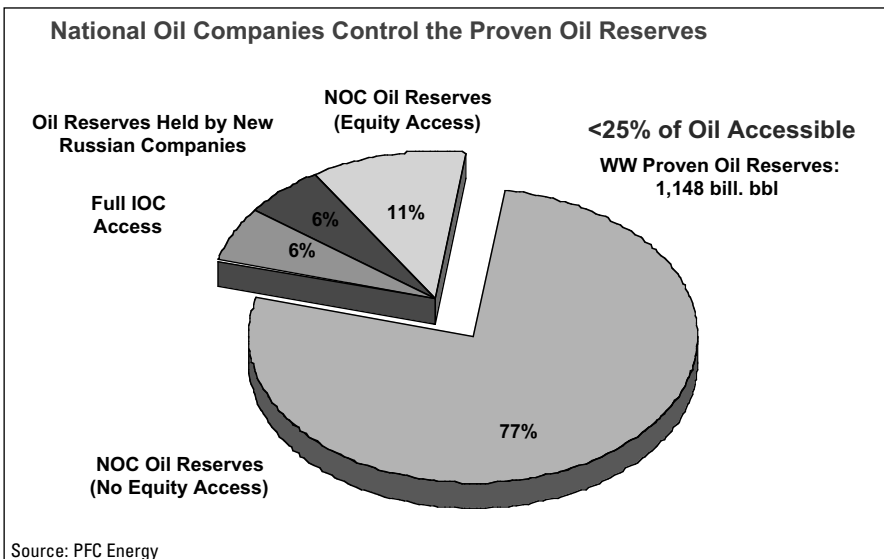
The critical questions for the peak theory come down to these:

1. How credible are the studies that suggest a non-OPEC peak by the early to middle part of the next decade? If they are to be believed, then there is no escaping the conclusion that OPEC would need to increase output at whatever rate is required to meet global demand increases.
2. Does OPEC - more specifically Saudi Arabia, Kuwait, Iran, Iraq, Venezuela, and the UAE - have the reserves necessary to fill the gap in production when global demand exceeds 100 million barrels per day? The EIA projects that demand will reach this level in 2015, and will be almost 120 million barrels per day by 2025. Neither the proponents of the peak theory nor their critics outside the national oil companies in question know the answer to this question with certainty. At this point it becomes a matter of whether one believes that these countries have sufficient reserves to support higher levels of production as well as the willingness

to invest sufficiently and quickly to meet rising demand. Even if these countries do have the oil, are they willing to make the necessary investment to produce the volumes required by the market, or will their production be governed by other agendas ?

Some analysts of the peak theory project that between now and 2010 production may temporarily outstrip demand. But once beyond 2010, they believe there will be a significant supply problem as the inventory of new projects held by companies and production start declining.

Their analysis also looks at the ability of international oil companies (IOCs) to gain access to new reserves so that they can enhance their inventory of projects and stem the decline in oil production. A breakdown of access to proven oil reserves indicates that IOCs have access to less than 25 percent. The producing national oil companies (NOCs) that do not permit investment by private companies hold about 77 percent of global oil reserves. Thus, even with sufficient capital availability to invest in new projects and new production, the lack of access by IOCs limits their ability to close the future supply gap.



Oil exporting countries with large reserves will gain in influence due to limited access to proven reserves by international oil companies and the national oil companies of importing countries.

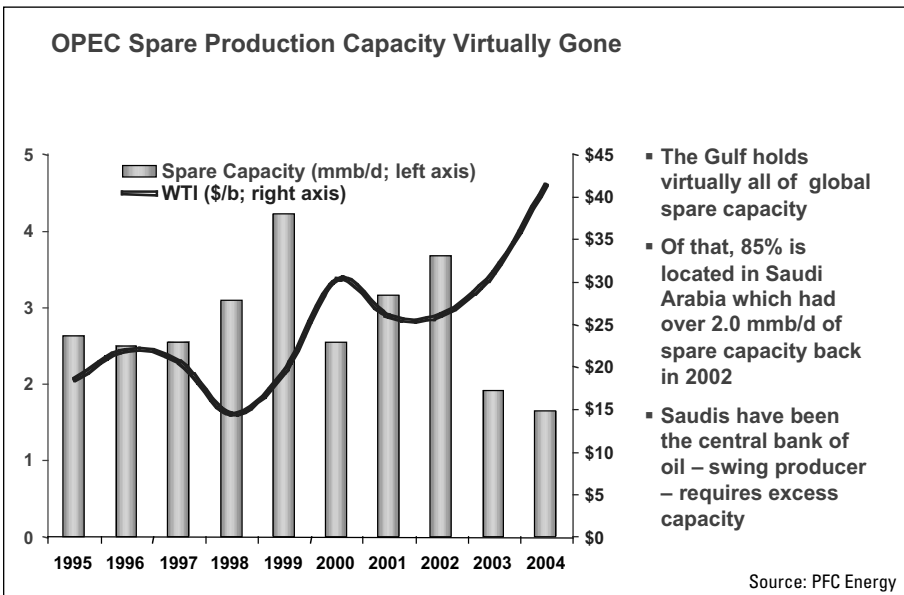
Importantly, many NOCs have different agendas from IOCs. While IOCs invest with an eye to the bottom line, some NOCs may have other concerns, such as social welfare and meeting the needs of expanding populations. Some NOCs may not always make rational economic choices and may limit re-investment in their oil sector so that future production suffers. There was general agreement, however, that not all NOCs are the same. Some operate as commercial companies, while others are heavily influenced by the country's politics. It would be an error to paint with a broad brush when discussing the NOCs.

What about consuming country NOCs? How do they fit in this analysis? The discussion focused on the recent activities of NOCs in China and India and their efforts to secure energy reserves in many oil-producing countries. Some argued that the playing field was not always level in their competition with IOCs since the Chinese NOCs tended to have lower cost of capital due their access to government funds. A counter argument was made that this advantage may be overstated if China does not make funds available at below market rates. Or, even if they do, cheaper money may not provide positive results, as the Japan National Oil Company found out a decade or more ago when it tried to find oil reserves in other countries through equity investments. Another participant thought that IOC access to export agency financing, such the U.S. Export-Import Bank or European Bank for Reconstruction and Development, may level the playing field somewhat. Another argued that if cheaper funds led to more global oil production, wasn't that a better outcome for all?

The participants agreed that in producing countries that do not allow IOC equity participation, the NOCs had a decisive advantage. But new thinking could change the current dynamics of the marketplace. Emerging upstream-downstream relationships such as ExxonMobil-Saudi Aramco's project in China, or the possible BP-Sinopec relationship, could redefine the roles of IOCs and NOCs and their relative positions.

Another generally acknowledged factor that exacerbates the near-term risks of the peak oil scenario is the disappearance of sufficient spare crude oil production capacity to alleviate the pressure on prices.

In the recent past, the Middle East and specifically the Persian Gulf region held virtually all of the spare capacity. Saudi Arabia held about 85 percent of it. For at least a decade the spare capacity level exceeded 2 million barrels per day, a level that provided one of the pillars of global energy security, that is, the market had confidence that almost any disruption to oil supplies could be met by surge production. In the last two years, Gulf spare capacity has dwindled to less than 2 million barrels per day, with almost all of it concentrated in Saudi Arabia and consisting of hard-to-refine heavy, sour crude. This has brought about fears of increased vulnerabilities to oil supply disruptions, enhanced market volatility, and upward pressure on prices. Moreover, this oil generally has limited marketability, since there is not enough global refinery capacity available to process this rather difficult to handle, heavy, high sulfur oil.



Plentiful spare production capacity can help minimize price increases. Due to low investments following the 1998 price slump and large demand increases in 2003 and 2004, spare capacity has virtually disappeared outside of Saudi Arabia.

Another pillar of global energy security, along with spare production capacity, is the stocks held by member countries of the International Energy Agency (IEA), who have a requirement to hold

or have access to 90 days of imports. The stockpile strategy has been weakened as well because of the increasing importance of countries that are not members of the IEA, such as China and India. Although China and India are building stockpiles, they do not currently provide the level of protection relative to imports required of IEA member countries.

Those who worry about a near-term peak in the supply of oil note that several other phenomena are occurring simultaneously. In the short run, the forces driving oil prices higher include high demand due to robust economic growth in several important economies, low oil discoveries, dwindling spare capacity, and increasing uncertainty whether the market can handle supply disruptions. Severely stretched refining capacity also contributes to current high prices. These global pressures have been exacerbated by the impact of two recent hurricanes that interrupted oil and gas production and temporarily shut down many refineries in the U.S. In the longer term, the inability of non-OPEC producers to maintain their aggressive production of the last decade, along with uncertainty whether OPEC can or will increase production to fill the expected supply demand gap after 2010 will lead to higher prices. In other words, the analysts believe, the global oil market is entering a sustained high price era with little relief in sight.

In addition to these economic factors, the oil market has to take cognizance of the political turmoil occurring in the Middle East. The political pressures to democratize may create so much domestic uncertainty in key producing countries that their decisions regarding their oil industries may be influenced. Thus politics and economics may conspire to produce a future so uncertain that oil market volatility and high oil prices will be inevitable.

The advocates of the plateau theory argue that depleting reserves will not cause production to reach a peak and start to decline, but rather that production from existing reserves, including in the Middle East and specifically from Saudi Arabia, will increase enough to meet short- and mid-term needs. Their argument focuses on the deliverability of oil rather than the availability of oil reserves, given the appropriate level of investment. Relatively low oil prices have

limited investment in the recent past. In addition, the upward pressure on current oil prices stems, in part, from the mismatch between crude oil production and refinery configurations. For example, Saudi Arabia indicates that it has about 1.5 million barrels per day of heavy crude oil that it is not selling since there is insufficient global refinery capacity to process this grade.

Saudi Arabia already has taken the necessary steps to increase its production capacity from about 10 to 12 million barrels per day within the next four years. Saudi Arabia also has analyzed the potential to increase capacity to 15 million barrels per day and indicates that given the right economics and demand, it is technically feasible for it to move to that level. Based on Saudi Aramco's technical know-how and its sophisticated ability to run its current oil production, the Saudis are confident that the indicated increases are within its capacity. Some, however, expressed concern about whether the market can rely on the assertions of the Saudis without more concrete evidence of the level of reserves and the ability of the Saudis to produce from them. Another worried that even with the proper application of technology, its use could lead to unforeseen results so that oil production in a particular field or region suffers. Others responded that the Saudis have to date never failed to produce at the level they had said they would and that new technology, introduced cautiously, can prevent damage to the fields.

It was noted that these abilities and the flexibility built into the Saudi supply system were the result of investments made on a continuous basis in both excess production capacity and redundant distribution and transportation systems. One participant said that if the other major firms and importing nation governments had followed a similar pattern, the current "supply crisis" would have never arisen. This view was based on the observation that the current supply shortage was in fact a misalignment of refinery capacity with the available crude supply. What is needed to adequately provide energy security, according to this view, is a willingness to make steady and consistent investments in the infrastructure required to meet future demand, and that also implies a willingness to build "surplus" capacity into such an investment program.

A problem with the plateau theory is whether enough producers will be expanding fast enough to offset the normal decline in production and at the same time increase production beyond current production to meet growing demand. Even if Saudi Arabia can achieve its goals, the Saudi increase sufficient to fill the supply demand gap without significant price increases and demand reduction.

The proponents of the cyclical theory argue that the oil market is currently going through one of its typical cycles with underinvestment in production leading to high prices, which in turn will bring forth new supplies and demand reduction that will lead to a decline in prices. Further, there will be a pronounced shift to unconventional oil production, which has greater long-term potential than conventional oil and which will be increasingly economic as prices rise. Others agree but question whether a scarcity of reserves and the time and investment required for production of unconventional oil will keep supplies from responding as quickly to price increases as they have done in the past.

In North America alone the potential for unconventional oil development is huge. These unconventional oils include oil shale, heavy oil, and oil sands. While they are more expensive to develop and produce, their economics should improve as technology advances and projects grow in scale. Thus the growing development of these resources will contribute to North American, and hence global, energy security.

The scale of unconventional resources is so large that current high prices arguably will continue to bring forth investment and expand the supply of oil sufficiently to meet future demand. The issues for the future are access to these resources, investment, and technological improvements, including meeting environmental challenges. The proponents of the cyclical theory say unconventional resources undermine the peak oil argument or at least push supply concerns much further into the future.

An advocate of the peak oil theory questioned the assumption that unconventional oil can easily replace conventional, stating that it will take the Saudis only four years to increase their production capacity by

2 million barrels per day, while it will take investments in Canadian oil sands 15 years to reach the same level of growth. It also should be borne in mind that the latter requires nearly three times the investment for each barrel per day of production capacity as the former. Since the Saudi expansion will not fill the expected supply gap by itself, it is difficult to imagine sufficient non-conventional oil supplies coming on line soon enough to make a difference. IEA estimates total non-conventional oil production of only 9 million barrels per day by 2030, resulting from investments of about \$150 billion. According to this analysis, only massive government intervention can make the development of non-conventional oils a near-term reality. Are governments prepared to do this?

A common question in all three perspectives - peak, plateau, and cyclical - is the degree to which investment takes place. Investment is influenced by technical and non-technical factors. The evaluation starts with the technical geological factors - what is the resource, where is it located, how can it be extracted, are there any particular problems that will be encountered, is new technology necessary, and the list goes on. It generally is relatively easy to determine the geological risk, the construction risk, and the financial risk. From a technical perspective, a feasibility analysis can be made that will determine whether it is economically attractive to make the investment.

In many instances, however, it is not the technical factors that will be determinative. The non-technical factors - the risk of investing or the willingness to invest in a particular country - largely will determine the likelihood of investments in the new production needed for future demand. What is the investment environment like in the country? What kind of tax system is in place? Does the country have a strong rule of law, or is it subject to the whims of the prevailing government? Is there contract sanctity? What are the rules for access to the oil or gas resources? Even in the United States, one of the most open economies in the world, the rules of the game and access to resources vary significantly by region, by state, and by who the owner of the resources is.

Regional Strategic Considerations

The focus on global oil markets highlighted the role of the major producing countries - Saudi Arabia and Russia - and the role of two of the largest consuming countries - China and India. Saudi Arabia, a major proponent of the plateau theory, was discussed as part of the oil market session. The second session turned first to examining demand and security of supply from the consuming countries' perspective before reverting back to a discussion of the second largest oil producer and exporter, Russia.

China

The China discussion focused on the sources of its explosive oil demand in 2003-2004 and China's policy responses. Demand surged primarily for two reasons - high economic growth leading to increased need for electric power, which was met in the short-run by using diesel generators, and increased vehicle sales and usage.

Additions to electric power generation capacity declined after the Asian financial crisis of 1998 as China experienced surpluses in many sectors including electric power. China's fiscal responses to the financial crisis eventually led to renewed economic growth. The economy started booming from 2002 onward. The economic boom renewed the demand for electric power; however, the capacity was not there due to the dramatic slowdown in new capacity additions

after 1998. Since it takes several years for new generation capacity to be installed, China turned to a short-term strategy of using diesel generators to fill the gap. This led to large increases in oil demand in 2003 and 2004. Once it became apparent that the economy was recovering, China embarked on rapid construction of new electric power generation. As a result, diesel demand for electric power generation has diminished substantially and is expected to continue to decline.

The second reason stems from increased use of private vehicles. Again as a result of the booming economy since 2002, many Chinese found that private vehicles were affordable. There was a rapid increase in the sales of new vehicles to those with higher incomes, leading to a surge in gasoline demand. With vehicle demand largely satisfied in the higher income areas and with the lower income areas lacking the ability to buy new vehicles, vehicle demand is likely to lessen. In addition, the government has taken steps to slow demand by encouraging mass transit and altering urban growth patterns. It also is altering the demand for oil by requiring better fuel economy in new vehicles. The second primary driver of China's oil demand is thus diminishing significantly. For the first half of 2005, demand increased significantly more slowly than in 2003 and 2004.

China also is addressing its long-term policy options to stem the growth in oil demand and imports. The drivers behind these policy options are the high volatility of the oil market, the negative response in the U.S. to China's attempted foreign acquisitions, and a reminder of the risks associated with an over-dependence on foreign energy supplies. The long-term policy goal is to base economic growth on domestic resources. To implement this goal, the Chinese will seek to enhance conservation and efficiency policies, develop alternative energy sources, build strategic oil reserves, and diversify overseas supplies with a corollary of promoting friendship with oil producers.

On the demand side, the policies include energy efficiency standards and addressing urban sprawl through urban planning. China also may try shifting its economy away from energy intensive industries.

On the supply side, China understands the problem associated with increased oil use. The problem derives from the share of domestic oil production in the overall energy mix falling from 24 percent in 1980 to 14 percent in 2004. At the same time, oil's share in overall energy consumption rose from 21 percent to 23 percent, making China a net oil importer from 1993 on. The resulting policy focus will be on developing China's large coal resources, enhancing oil production, developing more of China's hydro-electric potential, and using more nuclear energy. Coal is the dominant domestic energy source, and China intends to use more for electric power generation and to substitute for hydrocarbon liquids, relying on the latest clean coal technologies.

For the future, China foresees its oil demand growing to about 9 million barrels per day in 2020, with domestic production estimated to be 3.6 to 4.0 million barrels per day, leaving a gap of 5.0 to 5.4 million barrels per day. This demand estimate is about 25% lower than the EIA reference case and 33% lower than the EIA high economic growth case, reflecting China's optimism about the success of its demand reduction policies. Whatever the size of the gap between demand and domestic oil production, China foresees meeting it through imports and the use of alternatives, such as coal liquefaction. Three coal liquefaction projects already have been launched, with ten more on the drawing boards. The economics of these projects is based on \$25 per barrel oil. Whether all these coal liquefaction plants can fill the gap between consumption and oil production is questionable. Thus China's growth to some extent will continue to exert upward pressure on world oil prices.

China's overseas strategy also will continue. This strategy is to diversify its oil suppliers largely through equity investments. China is still evaluating whether this strategy of equity investment makes sense. China recognizes its relatively weak position in the world oil market and therefore has been willing to pay more for its equity investments than the market would dictate. Securing these supplies may not appear to make much sense since China still has to pay market prices for this oil. However, diversification of its sources still appears to be part of the national strategy. The failure of CNOOC to

acquire Unocal may have led the Chinese to look more to their domestic resources, assigning a larger role to coal, rather than to rely on an uncertain foreign market and especially on international equity oil. Additionally, China is trying find pipeline solutions to transporting its foreign oil rather than continuing to rely on uncertain sea lanes. This strategy may have China look closer to home for its oil, for example, to Russia, Kazakhstan, and other Central Asian producers.

In addition, China will develop its strategic stocks as a precaution against future disruptions. Four sites now are under development with others planned for the future.

India

In India, future energy needs will be driven by robust economic growth. India expects that its GDP growth will average 7 to 8 percent per year over the next 20 to 25 years. If this goal is achieved, the economic growth coupled with continuing population growth will present challenges for India to meet its energy needs.

India is looking at various sources of energy for the future. Conventional oil and gas are part of the mix, produced domestically and imported. India also is exploring various alternative fuel options including coal bed methane, underground coal gasification, and bio-fuels. India has reformed its rules for investment in its upstream and downstream energy sectors with the hope of drawing significant foreign direct investment in order to meet its future needs.

In the oil sector, India foresees demand more than doubling from 2002 to 2030, growing from 2.2 million to 5.6 million barrels per day. In the gas sector, growth will be faster, going from 0.76 million barrels of oil equivalent (mmboe) per day to 4.38 mmboe/day. India's strategy to meet this demand has several components. It expects to meet some of this demand through increased domestic production and as a result has reformed and liberalized its leasing policy to attract more foreign participation. It plans aggressive leasing in the future in order to ensure that exploration and develop-

ment take place. Already it has achieved some success as the area of land leased has more than tripled from 2000 to 2005.

India also is aggressively promoting development of its coal bed methane resources through aggressive leasing. There is the potential to produce 0.16 mmmboe/day from the 3,145 mmmboe of potential reserves. In addition, India is exploring the use of underground coal gasification, and several Indian companies are now in the exploratory stage of this development.

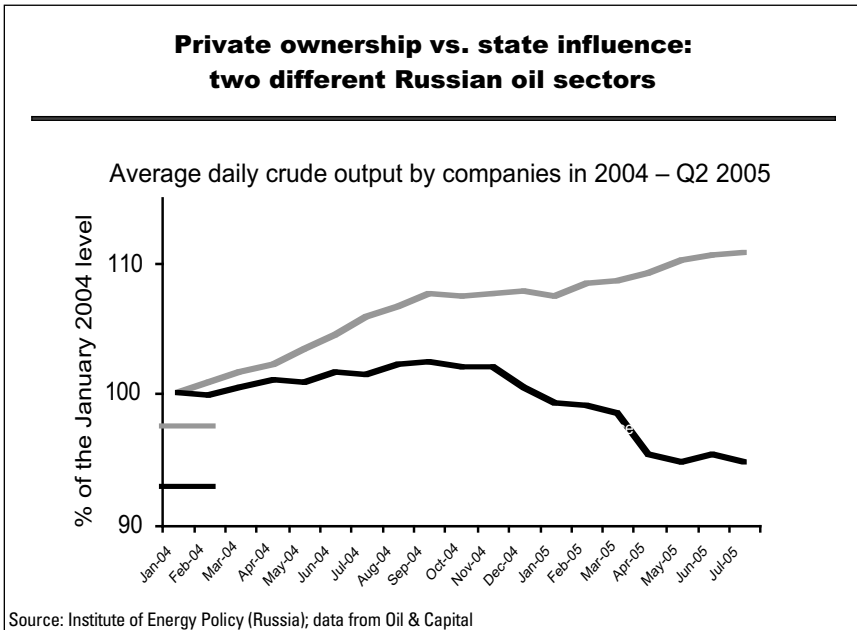
India additionally is accelerating research and development of other options including renewable energy, energy efficiency, and alternative fuels. One area that appears very promising is the development and use of bio-fuels, especially bio-diesel. India sees significant growth for bio-diesel, going from less than 20,000 barrels per day in 2016 to 126,000 barrels per day in 2030 in its normal growth scenario and 360,000 barrels per day in its high growth scenario. The bio-diesel can be produced from oil seeds. India expects substantial benefits from the use of these oil seeds in its energy mix. It provides local solutions for its national security strategy, it can enhance energy security at the village level, the bio-fuels have a relatively short gestation period, the technology is relatively simple, it can provide substantial employment for unskilled and semi-skilled workers, and it is both environmentally friendly and sustainable. If its promise is fulfilled, bio-fuels can supply as much energy at lower cost as a gas pipeline across Iran or domestically produced oil.

While these domestic solutions are being developed, India still has a significant demand for oil and oil products that cannot be met either through current domestic production or presently through the use of alternatives. As a result, India's oil companies have been investing abroad in order to secure access to energy. India terms this "oil diplomacy to enhance oil security." Currently Indian companies have investments in 12 countries with an investment commitment of \$5 billion. Current oil and gas production from these investments is about 100,000 barrels per day of oil equivalent. India has recently accelerated its plans for foreign production, moving its goal of 400,000 barrels per day by 2020 forward ten years to 2010. This dramatic increase in its target will require an aggressive investment strategy.

Russia

Russian oil production increased more than 50 percent since 1998, supplying much of the oil for the robust growth in world demand that has occurred over the last several years. But in September 2004, Russian production growth slowed precipitously, putting additional upward pressure on oil prices. What is the story behind the growth and stagnation of Russian oil production?

The growth in oil production since 1998 mainly was attributable to the Russian private oil sector. These companies invested heavily in their existing West Siberian oil fields using modern production techniques purchased from foreign oil service companies. More recent evidence shows that since January 2004, the crude oil output coming from the Russian private sector increased significantly while oil produced from State companies showed production declines. Russia



Government interference with the state-owned oil sector and a few private companies led to a decline in production in 2004 and the first half of 2005, while production by other private companies rose. Groupings based on the presence or absence of dominant state ownership or of state interference in companies' affairs (e.g. Yukos).

exports more than half of its crude oil production. These exports and the revenues attributable to them are the main source of Russian GDP growth. Thus, what happens in the oil sector not only matters for world oil supply but also for the economic prosperity of Russia.

The recent stagnation in Russian oil production was largely attributable to governmental interference. The initiatives that adversely affected the industry included structural rearrangement of the industry conducted by the Kremlin, tax increases, uncertainty about new export pipelines, and administrative pressure against companies that exceeded the levels of production permitted in their licenses.

The structural rearrangement of the industry was initiated by the government in the summer of 2003 through its actions against Yukos, the largest Russian oil company and the one responsible for about 60 percent of the growth in Russian production. The government charged Yukos with violations of tax laws and its president, Mikhail Khodorkovsky, with tax evasion. Both were found guilty. For Yukos, the government alleged that back taxes exceeding \$25 billion were owed. In payment for these claims, the government seized its largest production company, Yuganskneftegaz, and sold it in a rigged auction in December 2004 to a state-owned company, Rosneft. Yuganskneftegaz produced over 1 million barrels per day when held by Yukos. Its production declined significantly after its sale to Rosneft.

The fifth largest oil company, Sibneft, also was the target of governmental action and recently was sold to Gazprom, the state-owned gas company. TNK-BP, while owned 50-50 by a private Russian oil company and BP, has encountered difficulties through changes in the law providing access to licenses as well as being subject to large back tax claims. Even the state-owned company, Rosneft, has had substantial uncertainty surrounding it. As the government restructured the industry, an attempt was made to merge Rosneft with Gazprom. This ultimately failed, but it was highly diversionary for the company. Once its independence was settled, a higher priority was given to acquiring new assets - Severnaya Nefte in 2003 and Yuganskneftegaz in 2004 - than to developing its existing assets.

Thus the restructuring of the industry by the government along with the “Yukos effect” brought about declines in Russian oil production. It is fair to ask why the government embarked on the restructuring in the first place when the private oil companies were so successful. One reason given for the reassertion of control by the Kremlin is the desire of a small group within the Kremlin to control the large cash flows generated by the oil companies.

The government imposed new oil export taxes on the industry in 2004 and increased them in 2005, with the tax increasing as the price of oil increases. In addition, the Mineral Resource Tax (MRT), a tax imposed on oil production, also increases with the price of oil. The combination of the MRT and the crude oil export tax means that for all export-generated revenues over \$25 per barrel, the state takes at least 94 percent. The result has been a reduction in investment in exploration and production, especially where exports cannot be made efficiently through pipelines.

At one point, more than 1 million barrels per day of oil was exported using rail or barges. The additional cost has been estimated to be \$5-7 per barrel. With high taxes, it may not make economic sense to use these alternatives. A recent analysis indicates that as production costs increase due to using more advanced, expensive technology to extract what is left from existing fields, and as transportation costs increase because of the use of more expensive rail and barge, no profit remains for reinvestment purposes even with oil prices exceeding \$25 per barrel. In addition, there is insufficient pipeline export capacity out of West Siberia, especially since the government rejected the idea promoted by several private Russian oil companies to build a pipeline from West Siberia to the Murmansk area, or at least to the Barents Sea near Murmansk. The government, in effect, has created a situation where only high cost transportation alternatives are available for the marginal barrel produced. Thus, the tax increases and the lack of new export pipeline capacity rendered the exploration and development of expensive oil fields senseless.

The pipeline situation is more problematic than just the rejection of the pipeline from West Siberia to Murmansk. The government, at

the behest of Transneft, the government-owned oil pipeline transportation monopoly, decided to build a pipeline to the Far East instead. The Japanese lobbied for the pipeline to go all the way to the port of Nakhodka, not far from Vladivostok, so that oil could be exported to Japan. The Chinese lobbied for it to go directly to China and link up with the internal Chinese pipeline system at Daqing. After years of pondering, the Russian government finally decided on the route to China. The problem with either route is the high cost of construction and the associated high cost of pipeline transportation. The costs are comparable to the costs of railway transportation of oil and therefore make any attempt to increase West Siberian production subject to the same problem currently faced - namely, no profit generated and therefore no incentive to increase production.

Finally, the government places in each of the licenses it provides for the development of oil fields a maximum level of production. These production levels were determined using oil production technologies of the 1980s. With today's modern technology, it is quite easy to exceed the approved oil production while still maintaining sound oil field management practices. The government has used these limits in the licenses in a selective fashion to bring pressure against companies. These tactics led to a reduction in production as well as increasing the opportunities for corruption.

The companies' reaction to these government policies has been to reduce investment in the oil sector even as earnings increase. In addition, the companies have been taking their money out of the country; capital flight has increased substantially in the last several years.

In mid-2005 Russian oil production has shown an upturn, although the year-on-year growth is still in the 2-3 percent range rather than the 9-11 percent range before the stagnation occurred. It is unclear whether this is a true upturn in production or merely a small revival based on the previous poor results.

There is some hope, however, since the government has proposed to break the link between the MRT indexation and world oil price. This may lower the tax burden on the industry by between \$3.4 bil-

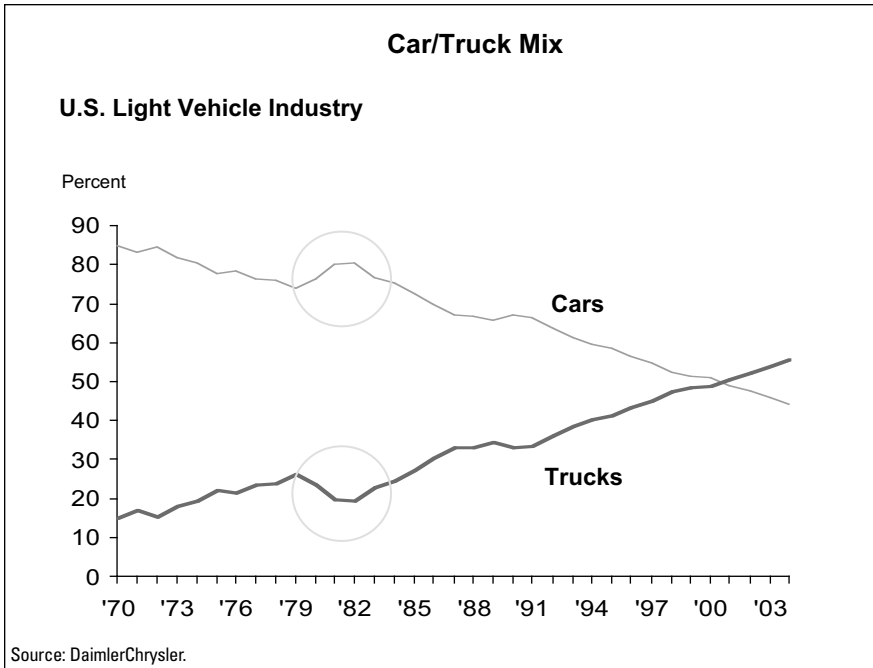
lion to \$4.6 billion. The purpose of the proposal is to create incentives for investment in the oil sector and encourage companies to invest in fields with higher cost production. The proposal came from the Ministry of Economic Development and Trade, known for its reform proposals, and is likely to be opposed by the Ministry of Finance, whose goal is to increase short-term revenues for the government. In addition, there is much discussion within the government of instituting a “differentiated tax” aimed lowering the tax rate on the more geologically challenged fields with high production costs in order to stimulate new investment and production. The interest in this differentiated tax is coming from all Ministries including the Ministry of Finance. These discussions raise some hope that the government at last is aware of the problems it is creating through its tax policies.

For the future, there is significant production potential from new fields. These new provinces could add 800,000 bpd in four years and more than 1.5 million bpd by 2015. Development of these new areas, however, would greatly depend upon fair access to the new resources for foreign capital, meaning that the new mineral leasing law (subsoil law) would have to permit companies owned or controlled by foreign investors to bid on these resources; current drafts of this legislation would not allow for foreign owned entities to bid and own these “strategic” resources. In addition, adequate pipeline solutions would have to occur, allowing for reasonably priced transportation. Finally, a favorable tax regime would have to be put into place. These conditions create a rather high bar for the likelihood new investment and new production.

Transportation Demand

Oil demand is driven by oil consumption by vehicles - transportation use makes up more than two-thirds of all oil consumption in the U.S. and other developed economies. Altering transportation demand can have a large impact on oil demand and perhaps alleviate the pressure on supply and prices. The peak oil or plateau theories may not have such dramatic implications if the profile of future oil demand could be changed significantly. The discussion therefore turned to what is occurring in the vehicle market.

One of the reasons that oil demand in the U.S. has been increasing is the shift within the U.S. light vehicle market from cars to light trucks. (Sport utility vehicles - SUVs - minivans and pickups are categorized as trucks for purposes of fuel economy regulations and recently comprised half of new “car” sales.) Light trucks have lower fuel economy standards than cars, permitting automobile companies to sell more of them without incurring any penalties. As the shift to SUVs took place, the average fuel economy of new vehicles in the U.S. declined. This has been one of the main drivers behind increased U.S. oil consumption, along with the strong economy, which has led to more cars on the road and more miles traveled per vehicle. The discussion focused on what can be done to change the use of gasoline and lower future demand.



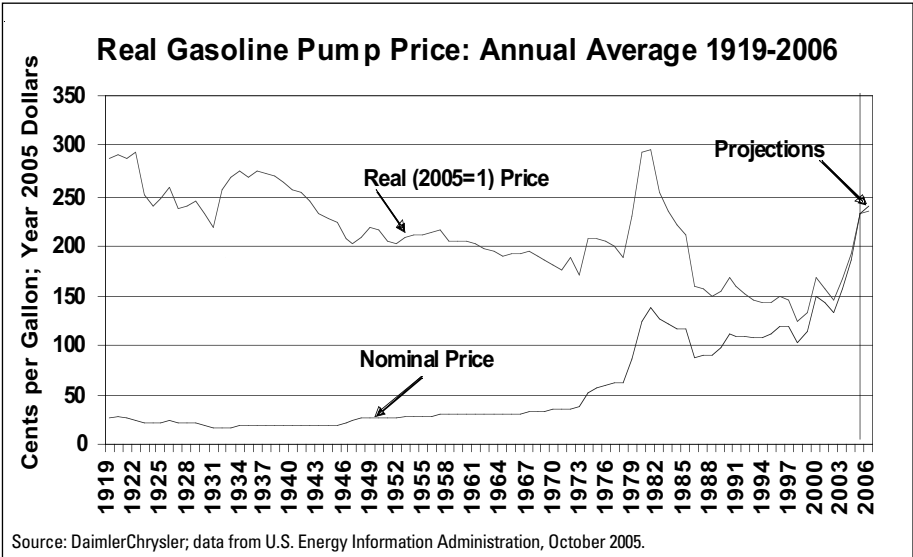
Except during brief periods of rapidly rising gasoline prices, the purchase of light trucks (SUVs, minivans, and pickups) has steadily increased as a share of the U.S. new car market, contributing to a decline in average fuel economy.

One element of the discussion focused on the use of new and improved technologies to enhance fuel economy. The conclusion reached was that automobile manufacturers have introduced a wide spectrum of new innovative technologies into their vehicles in their attempts to improve fuel economy. Not all have been used in all models, however, and some technologies that could be used to improve fuel economy have instead been used to increase the vehicle's power.

More radical changes will be necessary to make large jumps in fuel economy. One technology that could offer large enhancements is the diesel engine, which could improve fuel economy by an average of 30 percent. European cars increasingly are diesels, so that diesels now make up about 47 percent of the European car market. European cars have seen a notable improvement in gas mileage as a result. One U.S. automobile maker indicated that if its U.S. domestic fleet had the same mix of diesels as the European fleet, it could improve its fuel

economy average by three miles per gallon. The conclusion reached was that there is a market in the U.S. for diesel engines, but the uncertainty is how large it is. The major reasons for the lack of diesel penetration in the U.S. are the bad experience drivers had with diesels sold in the 1980s, and stricter emissions requirements than in Europe. A great deal of consumer resistance still exists with diesels despite substantial improvements in diesel technology since the 1980s, and many major environmental organizations oppose relaxing emission standards to facilitate a switch to diesel.

Other fuel systems were considered as ways to enhance the fuel economy of vehicles, including hybrids and fuel cells. Hybrids now are being sold in limited but growing quantities. With the nominal price of gasoline in the U.S. recently at record highs, hybrids have moved from the boutique market to being more main stream. The U.S. domestic auto makers are playing catch-up with hybrids. Ford has a hybrid SUV that it is selling well. Ford intends to expand its production of this vehicle to meet demand. DaimlerChrysler, General Motors and BMW have joined together to develop their own hybrid system. The joint development was justified as being



The steep gasoline price increase since 2003 paralleled the spike during the Iranian revolution and the start of the Iraq-Iran war, but the price in real terms is still below the 1981 peak.

faster and better than individual development due to the high costs associated with this new technology. The goal of these companies is to put their hybrid technologies into their most popular products. For the U.S. companies this means their SUVs, where they note that fuel savings will be greater than in small passenger vehicles.

Fuel cells rely on hydrogen rather than gasoline to power the vehicle. Auto makers are heavily invested in R&D in these systems. The challenge is to lower the costs of powering vehicles using fuel cells to a commercially acceptable level. It was unclear whether this cost would ever be low enough or whether consumers would be willing to pay a premium for the fuel cell given its advantages in lowering emissions and eliminating demand for gasoline. While the auto makers have some fuel cell vehicles on the road to test their technologies, it is not realistic to expect commercially available fuel cell vehicles for at least 10 years or major market penetration for many years after that.

The discussion focused on very recent shifts in the auto market as consumers seem to be buying fewer of the largest SUVs. However, it may be that consumers are merely shifting from the very largest SUVs to smaller SUVs or crossover vehicles in order to improve their gasoline efficiency. With only one or two months of data at the time of the conference, it was too soon to know whether there is permanent shift taking place or merely a short-term response to high gasoline prices.

Any transitions in vehicle technology take a long time due to the large number of cars on the road and the length of time they are driven. Transitions to new fuel systems can take even longer, due to the significant investment in fuel production and distribution infrastructure. It became clear during the discussion that there are few alternatives and all face significant challenges.

Past experience with alternative fuel vehicles (AFVs) shows that they had very limited penetration into the auto market. The reasons included the initial higher cost for the vehicle, concerns about onboard fuel storage, often higher fueling costs or unreliable pricing of fuels, safety or liability concerns leading to higher insurance costs, and a very limited infrastructure available to support the AFVs. In

addition, competition from the gasoline-powered internal combustion engine did not stand still.

In addition to the fuel economy benefits from AFVs and hybrids, there is the potential for significant reductions in emissions. In many metropolitan areas, auto emissions are the most significant air pollutant, and carbon dioxide emissions from autos are a large share of greenhouse gas emissions. Many of the actions taken to reduce petroleum use for energy security reasons could also lead to environmental benefits.

Thus the question was raised whether a wholesale shift to hybrids could change not only the dynamics of the marketplace, but also change the profile in emissions from autos. Some hybrids merely slow the growth of emissions while others actually could reverse the growth of emissions and help stabilize the level of CO₂ in the future. The need to eliminate carbon from both the power and transportation would be the only way to stabilize CO₂ emissions.

With this discussion as background, the alternatives discussed included plug-in hybrids, liquid bio-fuels, and hydrogen fuel cells (already discussed above). From a technological viewpoint all faced challenges. With plug-in hybrids, the vehicle runs on a dual system using an electric motor and a gasoline engine. The electric motor is used in start up and low speeds. In addition to the electric motor there is also a back-up battery system. The vehicle requires heavier batteries and motors since the system runs on the frequent deep discharge of batteries. Thus advances in battery technology would be required in order to provide the kind of batteries that could take the constant deep discharge required before being replaced. It was not clear that these vehicles lowered emissions, because the kind of fuel used to generate electricity was an important component of the analysis. Moreover, there is little interest among vehicle makers for this technology, primarily due to the problems associated with battery technology. Consumer acceptance was unknown.

With liquid bio-fuels, the difference made in the use of these vehicles depended heavily upon the type of bio-fuel used. Ethanol was

probably the preferred alternative due to the minimal changes required in vehicles, but it requires an entirely different distribution system from petroleum fuels. Moreover, producing corn ethanol in large quantities would have an impact on production of food and animal feed. Thus cellulosic biomass resources would have to be developed that could contribute to the production of ethanol. These fuels probably could replace a significant portion of the current gasoline market, but it is improbable that they could fully replace petroleum fuels. There are mandates in current law for the use of ethanol to be added to gasoline as an oxidant in order to lower certain types of emissions. A more radical shift to bio-fuels will depend upon the cost of the bio-fuel versus gasoline and would probably require some initial incentives.

Gas Markets and Security

World natural gas consumption is projected to increase by more than 50 percent between 2002 and 2025, according to the EIA. Regionally, growth will be led by Eastern Europe, the Former Soviet Union, Emerging Asia (includes China, India and most of Asia except Japan, Australia and New Zealand) and North America. Most of the world's reserves are located either in the Middle East (Iran and Qatar are the second and third largest holders of reserves) and the Transitional Economies (nations transitioning away from the centrally planned economies of the Soviet Union - Russia is by far the largest natural gas reserve holder). The consensus view is that the world holds large gas resources; however, most of them are concentrated in areas remote from the major consumers, requiring substantial production and transportation infrastructure to get the gas to consuming markets.

Increasingly, liquefied natural gas (LNG) is becoming a more important part of the world's gas trade as the costs of liquefaction, transportation and regasification fall. As LNG becomes more important, natural gas markets are shifting from regional to global markets. But even as this shift is taking place, regional supplies play important roles in supplying their region while increasingly confronting competition from outside their region. Thus, today, the Pacific Basin leads the world in LNG liquefaction capacity, followed by the Atlantic Basin and then the Middle East. However, the sup-

pliers in the Pacific Basin have to be cognizant of the role of Middle East suppliers in their region. The same is true of Atlantic Basin suppliers, since Middle East suppliers often can compete. For the future, the largest liquefaction capacity will shift to the Atlantic Basin based on current proposals for new capacity, followed by the Pacific Basin and then the Middle East.

Based on its large natural gas resources, Russia is primed to become the dominant natural gas exporter in the global market. It will remain the largest pipeline transporter of gas to Europe and will become increasingly important in pipeline transportation in Asia to China, Japan and South Korea. Starting in the next decade it may play an increasingly important role in the LNG market in both Atlantic and Pacific basins. The Middle East, namely, Iran, Qatar, UAE and eventually Saudi Arabia, will become more important in the LNG market and Iran will become increasingly important in the pipeline transportation market. Europe and Asia will remain major importers and will be joined by the U.S as domestic supplies continue to decline. U.S. imports via pipeline from Canada will be supplemented and eventually surpassed by LNG imports from many sources. Even Europe will become a major importer of LNG in the next decade and may even import more LNG than Northeast Asia as several long pipelines are built in Asia.

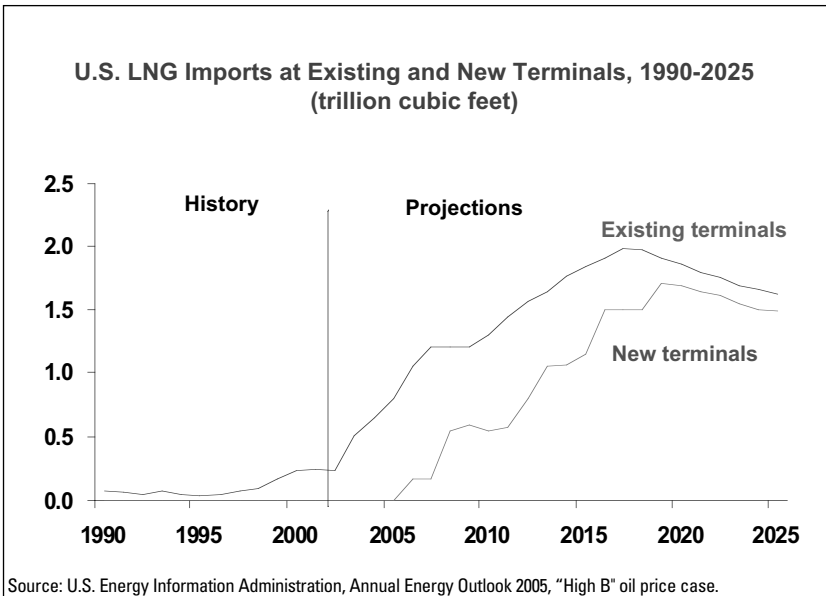
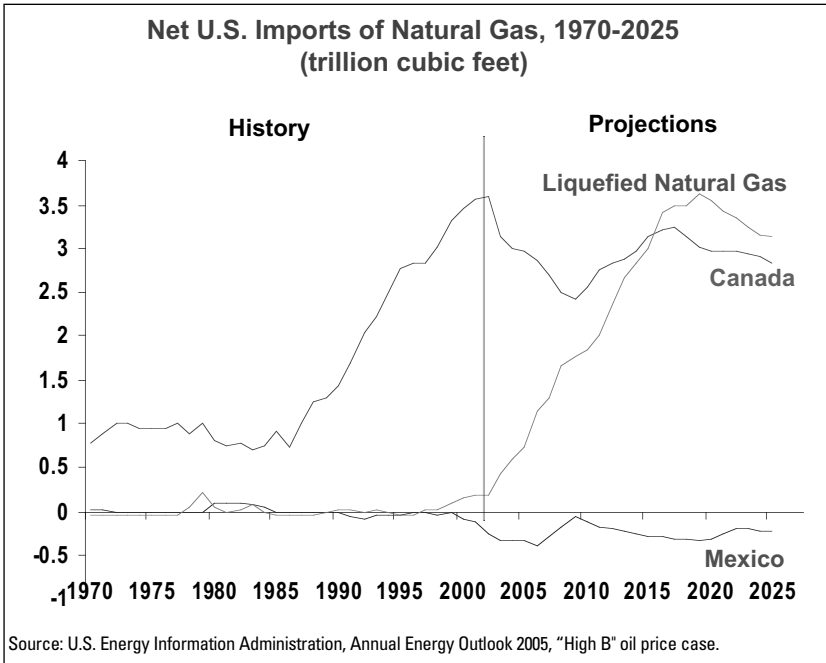
Politics is likely to prevent some trade routes from being developed, for example, building a pipeline across North Korea to supply South Korea. With the supply of gas increasingly coming from Russia and the Middle East, there will be increased dependence upon these regions, raising issues of security of supply. While there have been few political disruptions in the natural gas market to date, this may change in the future and become a greater issue, just as oil security dominates today's discussions.

Moreover, new policy instruments may have to be developed to accommodate differences between oil and natural gas markets. In some instances these policy instruments will be identical, such as the need for supply and demand diversification; however, there will

inevitably be some differences in approach. For example, oil is not traded based on long-term supply contracts while natural gas usually is. OPEC is a dominant factor in the oil market, while no similar organization exists today in the natural gas market. Oil clearly trades in a world market, while to date, natural gas is traded in regional markets. Despite these differences, it would be unrealistic to leave natural gas out of the consideration of policies for the New Energy Security.

In the United States, there is a growing gap between production and consumption. Today, imports comprise 15 percent of the total supply. By 2025, this gap is expected to grow so that imports will make up 20 percent of the total supply. Today nearly 90 percent of these imports are met by pipeline gas from Canada. By 2025, LNG will provide over half. LNG imports will continue at the five regasification facilities available today, and these facilities will continue to be the largest suppliers of LNG through the entire period to 2025. New terminals are expected to start coming on in 2006, with the largest supply coming through the Gulf Coast, the next largest coming from Mexico to the U.S. West Coast, and some into Florida via pipeline from regasification facilities in the Bahamas.

The discussion turned to the example of Japan as a major buyer of LNG. For Japanese energy supply security there are several components to the strategy. Diversifying the sources of supply for LNG is an important element. Japan now has eight countries that supply LNG, with additional sources to be developed in the future. Another is that Japan often is the founding customer for the initiation of a new supply project and relies on export finance assistance in order to finance the project. A third part of the strategy is the development of a buyers' consortium where several buyers aggregate their demand in the early years of the project. This helps in mitigating the gap between supply and demand. Finally, Japan relies on long-term contracts with take-or-pay clauses. By ensuring a stream of revenue to the supplier, these rigid contracts help support a new project, and this in turn helps ensure Japan that the supply will be forthcoming.



The growing gap between U.S. natural gas demand and domestic supply was met in the last 20 years primarily with Canadian imports. As the gap grows in the next 15 years, LNG imports from existing and new terminals will rapidly overtake Canadian imports.

Japan foresees changes in the world's natural gas trade. For the Asia-Pacific region today, the overwhelming gas trade is in LNG shipments - 89 percent of natural gas supply is LNG. Japan sees new sources of supply for its region coming mainly from Russia in the form of LNG from Sakhalin Island and in new pipelines from East Siberia. In addition, Japan and the entire Asia-Pacific region will have to compete for new LNG supplies with North America as it becomes a large LNG consumer.

As the market shifts, there will be new issues and concerns. One will be higher energy prices with different trading centers setting prices. Japan is worried about delays in project initiation and surges in domestic demand due to problems in its energy supply chain - this may lead to a gap between supply and demand.

Increasing demand from North America and from emerging markets will lead to more complexity in the LNG trade. It is possible that with so many new supply projects planned in the next decade the LNG market may be in surplus sometime after 2015. It also is possible that the Japanese buyers' consortium may disintegrate due to market liberalization and differing corporate strategies. This will put new pressure on individual companies within Japan.

As the market shifts and new issues and concerns develop, companies will have to evolve strategies to secure LNG supplies. These strategies will include a mix of the old and the new. There will be an emphasis on maintaining the security of supply based on long-term contracts and supply diversification. There also will have to be increased competitive pricing and contract flexibility in order to maintain the comparative advantage of LNG.

Contract flexibility could include changing the pricing point from a delivery point to the embarkation point to give the purchaser more flexibility, that is, to provide some opportunity to change to spot transactions in the event of a mismatch between supply and demand. In addition, eliminating destination clauses - that is, a contract provision that requires the buyer to take delivery and does not allow the buyer to sell the gas to some other buyer - will give the buyer addi-

tional flexibility. Future contracts either could eliminate destination clauses entirely or split the gas with some portion subject to a destination clause and some free of the destination clause.

Some of the new elements in the strategy will focus on portfolio management of the delivery of LNG. One component will be a focus on transportation through ownership of vessels or some form of participation in transportation services. These strategies will help optimize the cost of transportation and permit greater flexibility to trade LNG. In addition, the strategy also will focus on the upstream where new investments in upstream resources and operations may be necessary.

Conclusion:

The New Energy Security

The nature of security and insecurity is changing. In the past, importing countries were concerned primarily about threats of supply interruptions due to embargoes or political or military disturbances. Suppliers worried about security of demand, fearing short-term price drops and long-term price-induced conservation or fuel switching. Now importing nations face the likelihood that sooner or later, even if producers are cooperative, declining reserves and higher prices may cause economic harm, a central concern about supply security. Many exporting nations already face the reality of declining reserves and, although high prices and improved technology can delay the day of reckoning, can foresee the end of their ability to export meaningful quantities of oil.

The discussions on oil markets, regional supply and demand, transportation demand, and natural gas markets led to some generalizations about policies shaping the search for a New Energy Security. In many respects energy security from consuming and producing countries' perspectives really are two sides of the coin rather than polar opposites. Because consumers depend upon producers for supply and producers depend upon consumers for demand, the policies implemented by either will have a clear impact on the other. Moreover, with IOCs having full equity access to only 6 percent of the world's oil reserves and another 18 percent accessible only through negotiation with the NOCs and the new Russian compa-

nies, working together is really the only option if sufficient supplies are to be made available to meet growing demand. It is likely that only Saudi Aramco can manage to expand its capacity without the assistance of the IOCs, although even Saudi Aramco has turned to IOCs for help in development of its gas resources. Thus, even the richest NOC finds it beneficial to work interdependently with the IOCs to achieve its goals.

The discussion also made it clear that a confluence of factors has placed upward pressure on prices and heightened price volatility. First is the partial collapse of two pillars that sustained the ability of yesterday's world oil markets to respond to supply interruptions. The disappearance of excess capacity eliminated the major source of surge production, and the system of emergency stocks held by IEA countries has been weakened by the emergence of non-member countries that have a significant impact on world oil markets, such as China and India. Both countries, however, are building these strategic stocks and perhaps, as these stocks come into being, the second pillar of the old energy security policy will be strengthened. A third factor contributing to recent high prices has been inadequate investment in refining capacity and other infrastructure in importing countries. Just as the lack of surge production capacity can prevent a rapid response to a crude oil supply interruption, tight refining or transportation capacity can prevent a response to outages or rapid demand increases. Private and public investment decisions can help to strengthen all of these elements of energy security, although they will not be able to do more than smooth the transition if the fears of an early peak in oil reserves prove to be well founded.

By examining the growth of natural gas trade, the increasing dependency of consuming nations on gas imports, and the upward pressure on prices, it is clear that in the future the notion of energy security will increasingly have to encompass natural gas trade in addition to oil trade. Both consuming and producing countries need to evolve policy instruments that will address insecurities in both markets, including investments to expand infrastructure.

The discussion of regional producers and consumers focused attention on the disparate strategies relied upon to enhance energy security. These policies covered both supply and demand options and varied depending upon individual circumstances. Common themes emerged, however. For the consuming countries, dealing with the gap in supplies of oil and gas was paramount. Diversifying the sources of supplies was a common element. Equity investments in upstream resources were important to Chinese and Indian NOCs and as well as to IOCs. Japan has largely abandoned that policy in oil, but pursues it in natural gas.

Building and holding strategic oil stocks, pursuit of alternative fuels, and conservation and energy efficiency policies were common to all consuming countries and will need to be strengthened to avoid painful adjustments to future high or volatile prices. Slowing the growth of demand for hydrocarbon-based fuels from transportation was high on all agendas. The problem of transportation demand was being addressed through R&D into alternatives in the developed consuming countries, while the emerging countries dealt with it in other ways, whether through developing bio-fuels or through government actions that would limit the growth in demand for vehicles. Producing countries were taking steps to ensure that demand for their oil and gas resources remained strong and that trade in these commodities was not interrupted.

The New Energy Security will have to solve the problems inherent in unstable and constrained oil and natural gas markets, in oil markets where excess production and refining capacity has disappeared and is not likely to reappear for some time, and in natural gas markets where LNG trade is changing regional markets to global markets and long-term contracts are slowly giving way to the flexibility of spot markets. At the end of the day, many of the questions posed at the beginning of this discussion remain to be answered. A New Energy Cooperation between consuming and producing countries seems an essential element of progress toward a New Energy Security.

Agenda

“THE NEW ENERGY SECURITY”

Aspen, Colorado
October 14-17, 2005

Forum Co-Chairs: **James R. Schlesinger,**
Senior Advisor, Lehman Brothers, and
former U.S. Secretary of Defense
and Energy

Luis E. Giusti,
Senior Advisor, CSIS, and
former Chairman and CEO of Petrol os
de Venezuela S.A. (PDVSA)

Keynote address: **“Thinking About the Day of Reckoning”**
James R. Schlesinger

Tight Oil Markets and The New Energy Security

Energy security in a global market

J. Robinson West, Chairman, PFC Energy

Scenarios for the future

Andrew Slaughter, Senior Adviser, Shell Oil US

World petroleum reserves

Michael Rodgers, Senior Director, PFC Energy

Crude and product prices

Herman Franssen, President, International Energy Associates

Regional Strategic Considerations

Saudi perspective

Mazen Snobar, President, Aramco Services Company

Chinese perspective

Tian Jun, National Development and Reform Commission and Counselor, Chinese Embassy in Washington

Indian perspective

Jyoti Parikh, Executive Director, Integrated Research for Action and Development (IRADe)

Russian perspective

Vladimir Milov, President, Institute of Energy Policy, and former Deputy Energy Minister

Transportation Demand

DaimlerChrysler view

Reginald Modlin, Director, Environmental and Energy Planning, DaimlerChrysler Corporation

Future technologies

Anthony Eggert, Institute for Transportation Research, University of California at Davis

Gas Markets and Security

World LNG markets

Howard Gruenspecht, Deputy Administrator, US Energy Information Administration

Geopolitics and world gas trade

Peter Hartley, Professor of Economics, Rice University

Supply security - Japanese view

Takashi Tanaka, General Manager, Gas Resources, Tokyo Gas

Conference Summation

Luis E. Giusti

Participants

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Washington DC

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Selected Publications

Program on Energy, the Environment and the Economy

Electricity: Who Will Build New Capacity?

The report of the 2005 Energy Policy Forum, chaired by Cinergy Corp. Chairman and CEO James E. Rogers, examines who will build needed new power generation and transmission facilities in a new regulatory environment. The report is organized around recommendations on market design, energy efficiency, innovation and technology choice, carbon management, and infrastructure security.

2005. 46 pages, ISBN# 89843-440-8 \$12 per copy

A Silent Tsunami: The Urgent Need for Clean Water and Sanitation

Based on a 2005 dialogue co-sponsored by the Aspen Institute and the Nicholas Institute for Environmental Policy Solutions at Duke University, this report provides a series of recommendations for governments, businesses, and other organizations. Co-chairs William K. Reilly and Harriett C. Babbitt highlight the urgency of the challenge and the array of public and private initiatives to tackle it.

2005. 40 pages, ISBN# 0-89843-435-1 \$12 per copy

Conserving Biodiversity

Co-chaired by Bruce Babbitt, former U.S. Secretary of Interior, and José Sarukhán, Professor of Ecology and former President of the National University of Mexico (UNAM), this 2004 dialogue was based on commissioned discussion papers and focused primarily on the policy drivers of ecosystem degradation and biodiversity loss. This report seeks to educate policy makers and opinion leaders on the loss of critical ecosystems and biodiversity and to recommend specific changes in policies that may affect biodiversity, such as trade, aid, and lending policies.

2004. 120 pages, ISBN# 0-89843-423-8 \$16 per copy

A Climate Policy Framework: Balancing Policy and Politics

The Aspen Institute, in association with the Pew Center on Global Climate Change, convened a diverse group of leaders to develop a politically feasible framework for a mandatory U.S. climate change policy. Co-chaired by Eileen Claussen and Robert W. Fri, the group did not discuss whether mandatory action is now warranted. It did, however, reach consensus on several fundamental elements of a national policy, if one is adopted.

2004. 100 pages, ISBN# 0-89843-397-5 \$12 per copy

Tackling the Critical Conundrum: How Do Business, Government and Media Balance Economic Growth and a Healthy Environment?

Former EPA Administrator Christine Todd Whitman and former Undersecretary of State Frank Loy co-chaired a Forum in Aspen on balancing economic growth and a healthy environment. This report includes their conclusions and discussion papers exploring the tradeoffs from the perspectives of business leaders, elected officials, investment firms, journalists, and economists.

2004. 102 pages, ISBN# 0-89843-435-1 \$12 per copy

Fossil Fuels, the Hydrogen Economy, and Energy Policy

The 28th annual Energy Policy Forum considered key variables each of the fossil fuels, including new technologies and the competition offered by alternatives such as renewables and nuclear. It then examined the problems and potential of hydrogen. Based on these discussions, it suggested guidance for the development of near-term government energy policy. Red Cavaney, President and CEO of the American Petroleum Institute, and Susan Tomasky, Executive Vice President and CFO of American Electric Power Company, co-chaired the Forum.

2004. 62 pages, ISBN# 0-89843-422-X \$8 per copy

Electricity Restructuring

The 2003 Energy Policy Forum focused on electricity restructuring. Chaired by former Director of Central Intelligence and Undersecretary of Energy John Deutch, participants discussed the advantages and disadvantages of national rules governing transmission, economic and market power issues affecting ownership, whether the market's choice of fuel is in the national interest, whether natural gas supplies are adequate, and how restructuring will affect the future of nuclear power, renewables, efficiency, and distributed generation.

2003. 55 pages, ISBN# 0-89843-389-4 \$8 per copy

U.S. Policy on Climate Change: What Next?

Following U.S. withdrawal from the Kyoto Protocol, the Aspen Institute invited a distinguished group of scientists, business leaders, and environmental experts to discuss what the U.S. should do next. The non-technical discussion papers provide useful background and innovative policy suggestions. Forum co-chairs Frank Loy, Undersecretary of State under President Clinton, and Bruce Smart, Undersecretary of Commerce under President Reagan, summarize the discussion and the Forum's conclusions in a compelling introductory essay.

2002. 200 pages, ISBN# 0-89843-344-4 \$16 per copy

Dam Removal: A New Option for a New Century

This report offers practical advice to make it easier to integrate the consideration of dam removal into river management decisions, and to evaluate fairly and, if appropriate, to implement dam removal effectively. It is the product of a two-year dialogue among a group of people who represent a wide range of interests and disciplines. The imprimatur of this diverse group, with interests that are often at odds, lends a unique weight to the wide-ranging and practical recommendations.

2002. 68 pages, ISBN# 0-89843-360-6 \$12 per copy

U.S. Policy and the Global Environment: Memos to the President

Prior to the 2000 election the Aspen Institute convened a distinguished group of leaders as a hypothetical committee to advise the new President on global environmental policy. Experts prepared this set of policy memos to tell the President “what he should know” and “what he should do” about climate change, biodiversity, population, oceans, water, food and agriculture, and other problems. A thematic summary of the group’s conclusions, written by co-chairs Donald Kennedy of Stanford University and Roger Sant of the AES Corporation, communicates the urgency of the challenges, their complexity, and the optimism necessary to tackle them.

2000. 220 pages, ISBN# 0-89843-303-7 \$16 per copy

With All Deliberate Speed: Electricity Restructuring in Asia

The 1999 Pacific Rim Energy Workshop was held in Kanagawa, Japan, co-sponsored and hosted by The Asia-Pacific Energy Research Centre (APEREC). Representatives of 17 economies discussed electricity restructuring and fuels trade in the region. This report concludes that the theoretical and observed benefits or

deregulation are quite powerful, but there are concerns about the impacts of making the transition from national monopoly systems to deregulated or privatized systems.

1999. 23 pages, ISBN# 0-89843-278-2

\$8 per copy

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