WORLD ECONOMIC FORUM ENERGY VISION UPDATE

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

The New Energy Security Paradigm

Spring 2006

World Economic Forum
in partnership with
Cambridge Energy Research Associates

About the World Economic Forum

The World Economic Forum is an independent international organization committed to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas.

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Cambridge Energy Research Associates, Inc. (CERA), an IHS company, is a leading advisor to energy companies, governments, financial institutions, technology providers, and consumers. CERA delivers critical knowledge and independent objective analysis on energy markets, geopolitics, industry trends, and strategy. (www.cera.com)

CERA's expertise covers all major energy sectors—oil and refined products, natural gas, coal, and electric power—on a global and regional basis. CERA's team of experts is headed by Daniel Yergin, Chairman, author of *The Prize: The Epic Quest for Oil, Money and Power* for which he won the Pulitzer Prize, and author of *The Commanding Heights: The Battle for the World Economy*. IHS is the leading source for the critical information and data on which the upstream oil and gas industry operates worldwide. (www.ihs.com)

About the Energy Industry Partnership

The Energy Industry Partnership (IP) programme of the World Economic Forum provides the CEOs and senior executives of the world's leading companies as well as select Energy ministers with the opportunity to engage with their peers to define and address critical industry issues throughout the year. Identifying, developing and acting upon these specific industry issues is fundamental to the Forum's drive to deliver sustainable social development founded upon economic progress.

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The Energy Vision Update is published twice a year and provides in-depth analyses of energy issues identified by the Energy Governors' Community of the World Economic Forum.

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Executive Summary

Energy security has changed dramatically since the great oil supply disruptions of the 1970s and is capturing headlines worldwide. After nearly two decades of comfortable supply margins, the global energy system is now stretched to the breaking point. The recent Russian-Ukrainian natural gas dispute and oil disruptions elsewhere highlight the importance of the issue on the geopolitical agenda.

What does energy security mean in a world in which financial markets, energy markets and communications are so closely linked? Historically, energy security focused primarily on concerns about oil disruption in the oil-producing world, with particular focus on the Middle East. That concern has not abated, but has been joined by others. Today, news about any energy disruption – electric power black-outs in Europe or North America, political and social conflict in Latin America, hurricanes in the Gulf of Mexico, terrorist activities in Iraq or threats such as a confrontation over Iran's nuclear programme – moves around the globe with lightning speed. The impact is immediate and felt by companies, suppliers, consumers and market traders – and in the balance of payments, revenues and government expenditures.

The latest technologies have been used to create more complex, integrated systems that have squeezed out inefficiencies and enabled nations around the world to access energy on demand. This has been done in response to market pressures, government policies and technological advance. But this level of integration and complexity has come with a price, demonstrated most recently by the destruction from hurricanes Katrina and Rita in the US Gulf of Mexico. Oil refineries and oil and gas pipelines were inoperable because the power lines that feed critical electricity to them were damaged in the storms. Natural gas flowed in from the Gulf of Mexico but was then trapped at natural gas processing plants that were not able to function. The first integrated energy crisis of the 21st century contributed to changing the way that energy security is viewed.

The integrated energy industry – in which a break at any point in the supply chain can reverberate throughout the system – is not the only change in the definition of energy security. Oil producers view energy security in terms of predictable revenues to feed growing economies. Developing countries seek price stability to maintain fragile economies and avoid balance of payments crises. Climate change concerns influence decisions regarding new investments. No region or energy infrastructure is totally immune from new terrorism risks.

The New Energy Security Paradigm is the first semi-annual Energy Vision Update for members of the World Economic Forum's Energy Industry Partnership (IP). We chose the issue of energy security because it is the central theme for a wide range of concerns for the energy industry. Responses to the Interest Poll sent to IP members over the summer of 2005 identified five areas of concern – all closely aligned with energy security that demand action and on which there is a high level of uncertainty in both the short and long term (see Box 2).

After three decades, it is time to revisit the energy security paradigm of the 1970s. The potential for global terrorism focused on energy supply systems was not a consideration in the mid-1970s; climate change regulations were not on the agenda. When the International Energy Agency (IEA) was established as a result of the 1973/74 oil crisis, the key energy demand centres in the world were all members of the Organization of Economic Cooperation and Development (OECD). Today, China, India, Brazil and other developing countries already account for an increasing share of the demand for energy – and this demand will continue to rise. Global demand for natural gas was less than 40 trillion cubic feet (tcf) in 1974. Today, thanks to the introduction of combined cycle gas turbines into the electric power sector and increased use of natural gas for home heating, natural gas demand globally is nearly 90 tcf.

The five traditional elements of energy security – demand centres, supply sources, geopolitics, market structures and institutions – have all changed over the past 30 years. So has technology. The ten principles listed in Box 1, which resonate for both producers and consumers, can help provide solutions to the long-term concerns about energy security.

In *The New Energy Security Paradigm*, the World Economic Forum and Cambridge Energy Research Associates explore and analyze the changes that have occurred since the oil crises of the 1970s – changes that require a fresh look at this issue. Four critical sets of questions emerge.

Executive Summary

Box 1 Ten Key Principles of Energy Security

- Diversification of energy supply sources is the starting point for energy security.
- There is only one oil market.
- A "security margin" consisting of spare capacity, emergency stocks and redundancy in critical infrastructure is important.
- Relying on flexible markets and avoiding the temptation to micromanage them can facilitate speedy adjustment and minimize long-term damage.
- Understand the importance of mutual interdependence among companies and governments at all levels.
- Foster relationships between suppliers and consumers in recognition of mutual interdependence.
- Create a proactive physical security framework that involves both producers and consumers.
- Provide good quality information to the public before, during and after a problem occurs.
- Invest regularly in technological change within the industry.
- Commit to research, development and innovation for longer-term energy balance and transitions.

Source: Daniel Yergin, "Energy Security and Markets," Energy and Security: *Toward a New Foreign Policy Strategy*, Jan H. Kalicki and David L. Goldwyn, eds. (Woodrow Wilson Press, co-publisher Johns Hopkins University Press, 2005)

These questions will be the focus of the Energy Industry Partnership meetings in the months ahead.

- **Signals that might increase supply.** Government policy clarity sets the framework for energy industry investment. There is currently a lack of government policy clarity on a wide range of issues, including climate change, rent-sharing, stability of contracts, environmental and social impact requirements. Will new national policies or international agreements emerge that reduce the risk of new investments?

- **Signals that might reduce or slow demand growth.** Conservation has moved to the fore in energy policy discussions once again. Historically, price signals have triggered a new round of new energy supplies and energy efficiency gains to bring supply/demand back in balance. What are the possible signals for reducing or modulating energy demand? Will the price signal suffice? Is there a requirement for signals from governments? Will prices spike – or collapse?

- **Integration challenges.** Globalization has enhanced the drive toward integration of multiple systems to squeeze out inefficiencies. In some cases, the integration is physical, with interconnections all along the supply chain. In that case, physical security becomes critical. But integration also creates new vulnerabilities in a broader sense because a break anywhere in the system – whether the links are financial, physical or communication – can cripple large segments of an economy. Exposure to increased rates of natural disasters and potential terrorist attacks underline these vulnerabilities. How can societies take advantage of integration while also protecting against its risks?

- **Institutional and market structural change.** The IEA was created to share the burden of a supply disruption in the Middle East. Will the current wave of energy security concerns foster new arrangements and institutions? Will governments shift away from reliance on energy markets and recapture the "commanding heights"? How can other countries – China, India and Russia – be integrated into the system? What are the opportunities for enhanced cooperation between consumers and producers?

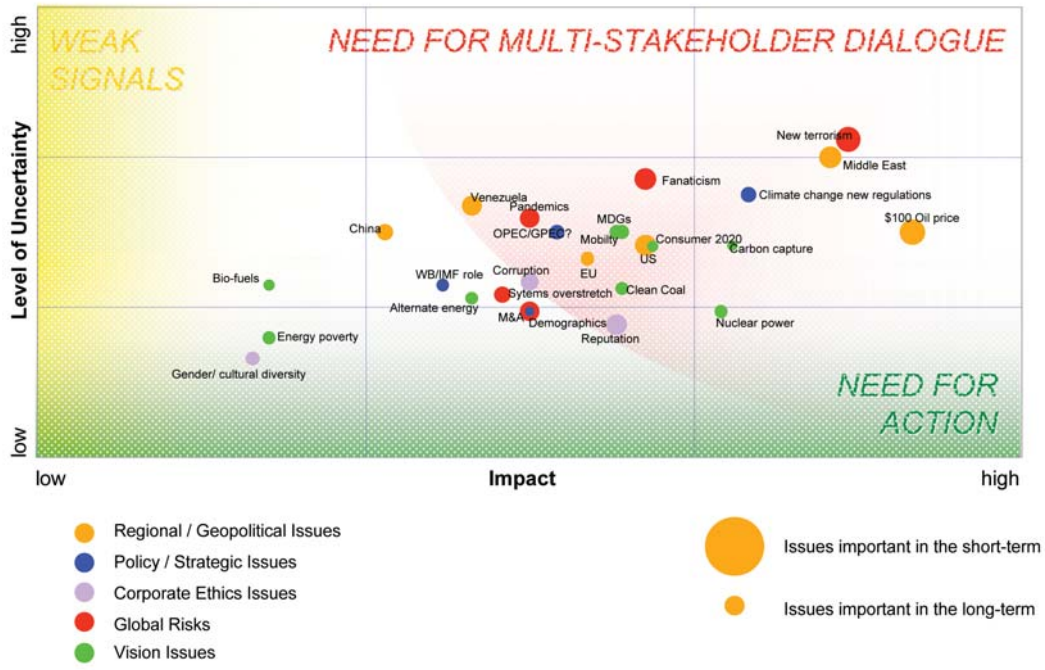
We look forward to meaningful dialogue about the best way forward. We hope that energy suppliers, energy producers, policy-makers and consumers can join together to shape a new energy security paradigm that addresses the realities of the 21st century and respond to all stakeholder needs in a cooperative fashion.

Daniel Yergin, Chairman, Cambridge Energy Research Associates

Christoph Frei, Director, Energy Industry & Strategy, World Economic Forum

Energy Community Survey

Box 2 **Energy Issue Map 2005/06**



Source: World Economic Forum, Energy Industry Partnership Programme 2005

Key Issues for the Energy Industry

The key issues selected and their priority are based on a survey conducted with 60 CEOs of global energy companies, 32 of whom (53%) responded.

The Issue Map Explained

Key issues are positioned according to three parameters:

- The **horizontal axis** indicates how large an impact the issue is expected to have on the energy sector.
- The **vertical axis** indicates the degree of uncertainty surrounding an issue.
- The **size of the bubble** indicates distance in time to when the issue becomes pressing. Immediate concerns are shown by larger bubbles, while small bubbles indicate issues that will become important only in the longer term.

How to Read the Issue Map

- **High impact/low uncertainty** issues require immediate action – by industry associations, political decision-makers, etc.
- **High impact/high uncertainty** issues would benefit from multistakeholder dialogue.
- **Low impact** issues are either considered unimportant or they have not yet registered on CEOs' radar screens. Where the survey reveals sharp differences over the impact of an issue the second interpretation is more likely, in which case the World Economic Forum may seek to raise awareness.
- **Setting the Agenda:** Issues that lay on the upper right corner of the Issue Map define the Agenda of the Energy Governors. This agenda is balanced with respect to short-term and long-term issues.

Most Urgent Issues

CEOs consider energy security, climate change and the longer-term energy supply as the highest-ranking issues. More specifically, in the context of energy security uncertainty over supply from the Middle East ranks as top issue (as already in the previous year survey). New forms of terrorism clearly have gained on the list of concerns and now rank top. On the other end, the urgency of energy security related issues has outranked more society and sustainability related concerns such as energy poverty, diversity or biofuels. Corruption has maintained its position.

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Introduction

Energy security has risen to the top of the political agenda again. It is at the forefront of national debates and G-7 discussions and is slated to be at the top of the list for the G-8 Summit in 2006. It is also of great significance for developing countries, emerging economies, and energy exporters. But what does "energy security" mean in the 21st century? The traditional areas of concern – supply sources, demand centres, geopolitics, market structures and responsiveness of related institutions – form the core of discussions about the best way to ensure that economies have sufficient energy to meet their needs. However, the energy security paradigm has shifted and become larger since the major supply disruptions of the 1970s and even the early 1990s. The risks are different, the considerations for the best response have changed, and the implications for solutions are far more complex. The 1970s model is no longer sufficient and a more expanded concept now seems necessary.

Some issues remain the same. Regional and social turmoil still unsettles key producing areas. However, global terrorism threatens the entire supply system. Iraq's production is more constrained than many anticipated before the Iraq War, and it remains vulnerable to sabotage and terrorism. There is growing concern that rising tensions over Iran's nuclear programme could lead to a new oil disruption.[1]

The risks are hardly limited to the Middle East. In the past few years, political conflicts have disrupted significant amounts of oil supplies far afield from the Persian Gulf – in Nigeria and Venezuela, both major producers. Indeed, the 2002-2003 interruption of exports from Venezuela, considered a most reliable supplier since World War II, removed more oil from the world market than the cessation of Iraqi supplies did during the 2003 war. The hurricanes in the Gulf of Mexico in 2005 mean that consumers in the United States see the new risks in terms of higher and more volatile prices both at the gasoline pump and in their home heating bills. China, with its oil imports rising rapidly and confronting what it sees as its own "energy crisis," is seeking a new definition for its energy security that goes beyond its traditional policy of self-sufficiency. Accelerating oil demand in 2004 and 2005 pushed up prices and strained the global supply system, adding to the vulnerabilities. Concerns persist that if the energy demand "nerve" continues to be hit, a potential slowdown in global economic growth may follow.

The issue of energy security is certainly not restricted to oil. The electric power blackout that struck the US Northeast in August 2003, and the power cuts that occurred in Europe and in Moscow, demonstrated the vulnerability of complex transmission systems. High natural gas prices in the United States are evidence of a tightly-balanced gas market that leaves consumers vulnerable to supply disruptions or weather-driven increases in demand. This tight market is driving the United States toward integration with an emerging global gas market, which, while bringing in needed new supplies, will add to the energy security agenda.

Twin Hurricanes

The theme of integration was driven home during and in the aftermath of the twin hurricanes that ravaged the Gulf of Mexico in 2005. With the overall energy system stretched to its limits, the critical physical connections between gas and power, and oil refineries and power, and between pipeline distribution systems and power, led to the first integrated energy crisis of the 21st century. Indeed, the very concept of "energy security" is taking on wider dimensions. No longer does it mainly encompass just the flow of oil, as central as that is, and as it has been for more than three decades. It now extends to the entire infrastructure of energy supply that supports the global economy – offshore platforms, pipelines, oil tankers, long-distance natural gas pipelines, liquefied natural gas (LNG) tankers as well as refineries, storage, generating facilities, transmission lines and distribution systems. This vast network was designed for major storms, but not storms of the magnitude seen in 2005. The network was also not

[1] See Daniel Yergin, "Energy Security and Markets," Energy and Security: *Toward a New Foreign Policy Strategy*, Jan H. Kalicki and David L. Goldwyn, eds. (Woodrow Wilson Press, co-publisher Johns Hopkins University Press, 2005).

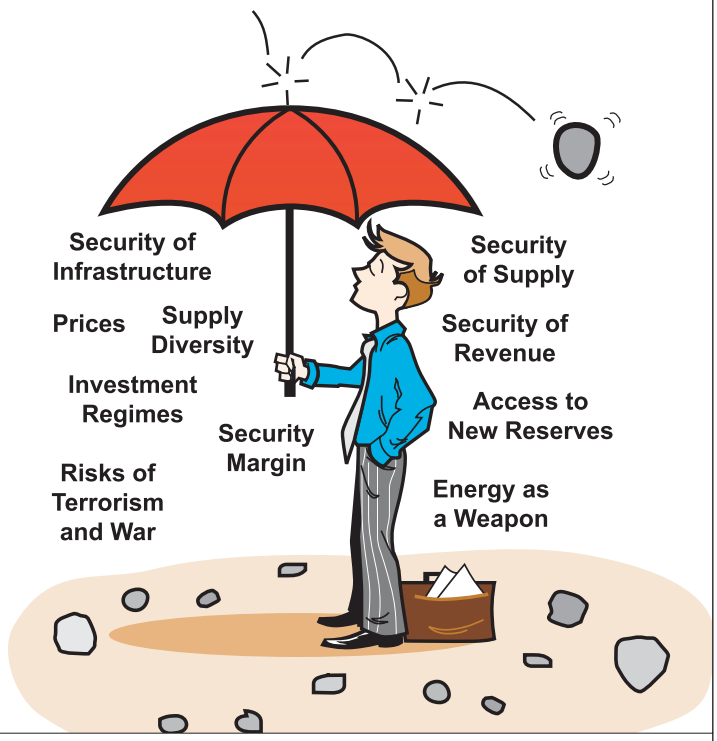
designed with terrorism in mind. But industry structures and operations will now need to be designed and managed with those continuing dangers in view. The result is to create new and complex responsibilities for both industry and government, including communication and coordination between them. There is still much to be learned – and done – in this arena.

Energy Shocks

Yet less visible, and every bit as important as the risks, is a compensating reality. New sources of oil and gas, and technological advances both for energy production and for consumption – and the lessons learned and the institutional development that has come with those lessons – give policymakers the capability to manage "energy shocks" and to weather disasters, whether natural or man-made, that may lie ahead. Relations between producing and consuming countries are generally based much more on interdependence and cooperation than in the past, although new conflicts continue to erupt. Still, these more cooperative relations provide a crucial foundation for handling and minimizing shocks. In the longer term, a renewed commitment to new technologies and energy research and development holds the promise of further diversification, although neither the timing nor the certainty is as sure as some may wish. At the very least, the realities – the huge scale of the energy supply system, the inevitable time lags and the requirements for commercial proof – delay the major impact of alternatives one or two decades. In other words, energy security requires continuing commitment and attention – today and tomorrow.

In this *Energy Vision Update,* Cambridge Energy Research Associates (CERA) and the World Economic Forum seek to respond to the urgent need to establish the foundation for discussions about the new, emerging energy security paradigm, and the implications for oil, gas and power around the world.

Box 3 Energy Security: An Umbrella Term



Source: Cambridge Energy Research Associates

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The Definition of Energy Security

Energy security is an umbrella term that covers many concerns linking energy, economic growth and political power (see Box 3). The energy security perspective varies depending upon one's position in the value chain. Consumers and energy-intensive industries desire reasonably-priced energy on demand and worry about disruptions. Major oil-producing countries consider security of revenue and of demand integral parts of any energy security discussion. Oil and gas companies consider access to new reserves, ability to develop new infrastructure, and stable investment regimes to be critical to ensuring energy security. Developing countries are concerned about the ability to pay for resources to drive their economies and fear balance of payment shocks. Power companies are concerned with the integrity of the entire network. Policymakers focus on the risks of supply disruption and the security of infrastructure due to terrorism, war or natural disaster. They also consider the volumes of security margins – the amount of excess capacity, strategic reserves, and infrastructure redundancy. Throughout the value chain, prices and supply diversity are critical components of energy security. In earlier periods, oil was used as a "weapon," and there is concern that natural gas could also be used to gain political leverage at some time in the future.

The traditional elements of energy security include supply sources, demand centres, geopolitics and market structures (and responsiveness of related institutions). In the energy crises of the 1970s, the primary focus for the Western industrial countries was on oil supply sources and geopolitics. These two elements were the underlying causes of energy security concerns, and the demand centres, market structures and new institutions created the solutions to the two energy crises that occurred. In fact, the creation of the International Energy Agency (IEA) was a direct response to the 1973-74 oil disruption by the then-dominant energy-consuming economies (see box 4).

The implications for addressing energy security concerns loom large. Three oil price spikes over the past 35 years have helped to precipitate global economic slowdowns (see Box 5).

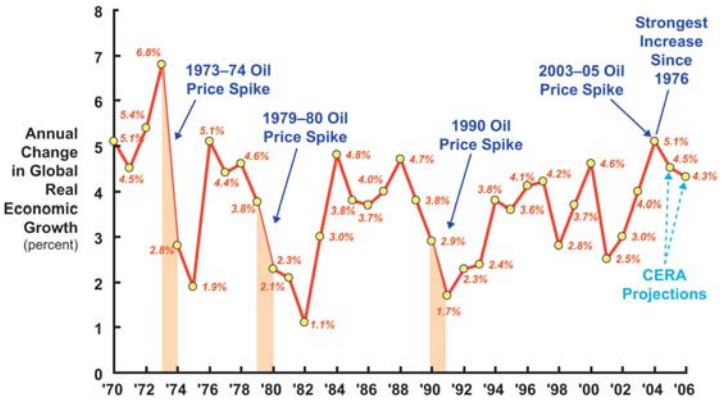
Box 4 The International Energy Agency and Its Role in Energy Security

The IEA was founded during the 1973-74 oil crisis that was precipitated by the 1973 Arab-Israeli War and the oil embargo. The initial purpose of the IEA, established by members of the Organization for Economic Cooperation and Development (OECD), was to coordinate activities during oil supply emergencies. The 26 member countries of the IEA are Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Japan, Korea, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and the United States. Poland and Slovakia have applied for IEA membership, and the European Commission also participates in IEA activities. Notably, China, India and Russia are not currently part of the IEA system.

IEA member countries are required to hold oil stocks that can be shared in case of an oil supply emergency. These stocks fall into three categories: company stocks, government stocks and agency stocks; the total volume of these three categories is approximately 4.1 billion barrels. Company stocks are both mandatory and commercial, and represent about two-thirds of total IEA stocks. Government stocks are financed by national governments and are held exclusively for emergency purposes. Additional agency stocks are maintained by a combination of public and private organizations.

An emergency response team has been activated four times: during the 1991 Gulf War when a supply shortfall of 4.3 million barrels a day (mbd) occurred at one point, during the millennium (Y2K) when there were concerns that computer systems might fail as we moved from 1999 to 2000, during the Venezuelan shutdown at the end of 2002 and the beginning of 2003, and most recently in response to the loss of oil supplies in the Gulf of Mexico due to Hurricane Katrina. The only actual release of emergency stocks occurred twice – during the 1990-91 Gulf crisis and in the immediate aftermath of Hurricane Katrina in late 2005.

Box 5 Oil Price Spikes and Global Economic Growth



Source: International Monetary Fund, Cambridge Energy Research Associates

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Structural and technological responses can reshape the competitive environment for traditional players and stimulate new industries. At the same time, producers need to make decisions based on estimates of demand in the future.

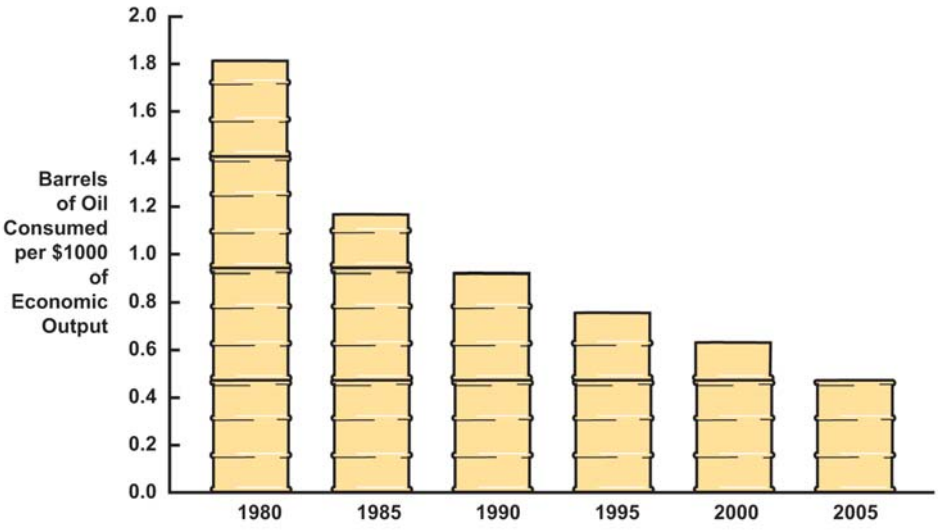
After the second oil price shock of the 1970s, the oil intensity of the global economy declined from 1.8 barrels of oil consumed per US$ 1,000 of economic output, down to less than 1.2 barrels of oil and has continued to fall (see Box 6). Automobile manufacturers that produced smaller, more efficient vehicles quickly gained market share.

Regulatory and institutional responses to energy crises, on the other hand, can "freeze" solutions that are difficult to unravel decades later. In the United States the Securities and Exchange Commission's methodology for calculating oil reserves was, in part, a response to a lack of information on the quantity of US oil reserves available. Yet, three decades later, after extraordinary changes in the technology to explore and develop oil reserves, that methodology – based on 1970s technology – persists.[2]

Over the past 30 years, the characteristics of each of these four energy security elements – supply sources, demand centres, geopolitics and market structures – have changed, and new elements have emerged. The current focus on energy security began with a disruption in Venezuela in 2002 and then the Iraq war in 2003. That focus was much amplified by a demand shock created both by rapid Asian economic growth and by the best global economic performance in a generation. When the anticipated incremental supply from Iraq did not materialize, the global oil supply system was stretched to its limits, its flexibility limited by sophisticated integration that had squeezed out any inefficiencies. The crisis was then compounded by supply disruptions, including the natural disaster caused by hurricanes Katrina and Rita in the Gulf of Mexico.

Any solutions to the current energy crisis – and to long-term concerns about energy security – need to integrate these changes and the new elements. They should also incorporate the ten key principles of energy security (see Box 1).

Box 6 **Oil Intensity of the Global Economy**



Source: Cambridge Energy Research Associates, International Monetary Fund

[2] CERA Reports, *In Search of Reasonable Certainty: Oil and Gas Reserves Disclosure* and *Modernizing Oil and Gas Reserves Disclosures*

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The Evolution of Energy Security

Energy security issues have traditionally focused on crude oil supply disruptions in the Middle East. The instability of the Middle East during the 1970s led to rising prices for more than a decade. After oil prices collapsed in the mid-1980s, followed by the end of the Cold War and the resolution of the 1990-91 crisis, the world passed into a decade of lower oil prices and overconfidence about energy security – and, indeed, security overall. But turmoil in the Middle East – accentuated by demographic pressures, generational change and the rise of extremism; by the threat to political order and infrastructure posed by terrorist organizations; by regional conflict; and by rising demand, market pressure and price spikes – all these have brought the issue centre stage again (see Box 7).

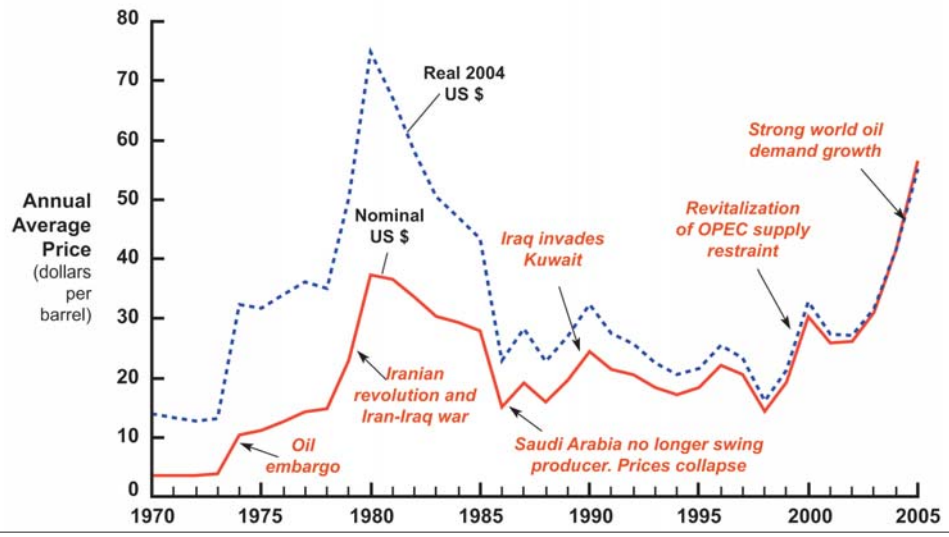
Yet, over the past 30 years, all four elements of traditional energy security discussions have evolved. Oil and natural gas production occurs today in locations not anticipated 30 years ago.

The expansion of the European Union, the break-up of the Soviet Union and the economic explosion in the Asia Pacific region have meant major shifts in demand and supply and in geopolitics. Terrorist acts by small groups that are more concerned about disrupting economies than on controlling oil were not a consideration in the past. Now, every government must factor in the possibility of terrorist acts that could disrupt some part of the supply chain or systems that support the energy supply chain, including telecommunications.

In the 1990s, natural gas became the "fuel of choice" for new power generating plants. Both globalization and the Internet revolution have also created interconnections in the supply chain that squeeze out inefficiencies and yet create new vulnerabilities for disruption.

In this section of the report, we explore the major shifts in the world of energy between 1974 and 2005, beginning with oil – the original focus of energy security.

Box 7 **Crude Oil Prices in Nominal and Real US Dollars, 1970–2005**

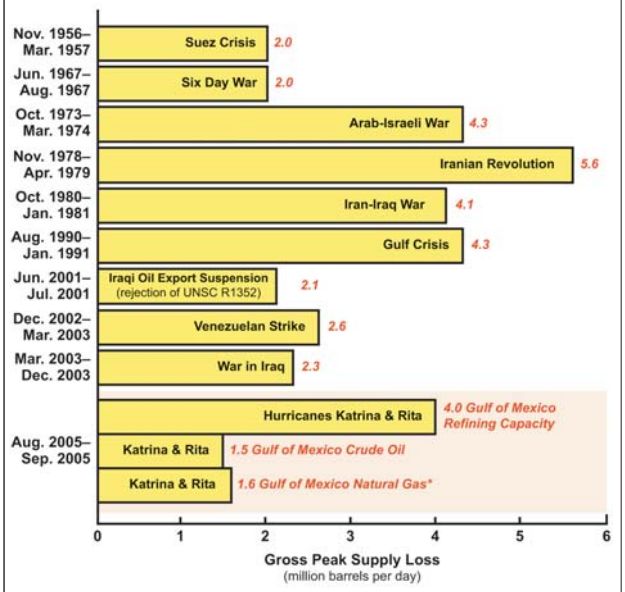


Source: Cambridge Energy Research Associates

Shifts in Global Oil Supply and Demand Patterns

Nine times in the past 50 years global oil markets have experienced supply disruptions of at least 2.0 mbd. The most severe, in terms of gross supply loss at its peak, was during the Iranian Revolution. That disruption lasted around six months, from November 1978 until April 1979, and caused the then-largest crude oil price increase, until the most recent price run-up in late 2005. In comparison, the maximum crude oil disruption from Hurricanes Katrina and Rita reached 1.5 mbd. There was an additional natural gas disruption equal to 1.6 mbd (9.5 billion cubic feet a day) at the peak of the crisis. Gulf of Mexico refining capacity losses rose to 4.0 mbd during the height of the crisis (see Box 8).

Box 8 Global Oil Supply Disruptions

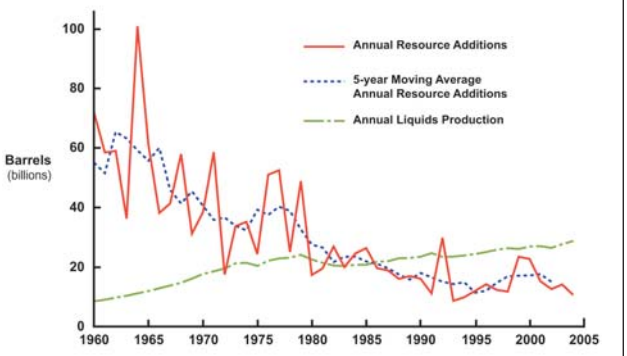


* Natural gas measured in millions of barrels of oil equivalent.

Note: Magnitude of supply shortfall is the peak gross supply loss excluding increases of other oil-producing countries. The IEA calculation uses a trigger of 7% net loss of available IEA supplies. Average daily supply loss over the disruption period is lower than the gross peak supply loss.

Sources: International Energy Agency. US Minerals Management Service, and Cambridge Energy Research Associates

Box 9 Annual Liquids Discovered versus Annual Liquids Production



Source: Cambridge Energy Research Associates, IHS

The recent disruptions have intensified concerns about the declining rate of oil discoveries (see Box 9). Over the past 40 years, the volumes of oil resources classified as discoveries have exhibited a downward trend. However, the traditional way of measuring discovery rates can be misleading and underestimate the total oil resources available for exploitation, or recovery. Discoveries are normally recorded when the initial contact, via wellbore, is made in a field previously unexploited. The Canadian oil sands, for example, were well-known to the indigenous people or First Nations many centuries ago, and were "discovered" by European traders in the 1700s. However, they are not reflected in current discovery statistics because they do not meet the technical definition. Yet, in recent years, technology has made oil sands competitive so that they now represent approximately 174 billion barrels of recoverable oil reserves (according to Canadian government estimates). In addition, recoverable resource estimates continue to be revised – and tend to increase – over time. It should be noted that these revisions are also not reflected in the discovery statistics, as they are not technically discoveries but additions, leading to a sense that oil resources are less than they actually are. The changes in recoverable resource estimates come from three sources.

- **Additions and revisions.** There is an increase in the estimate of recoverable in-place resources as the characteristics of the field become better known.

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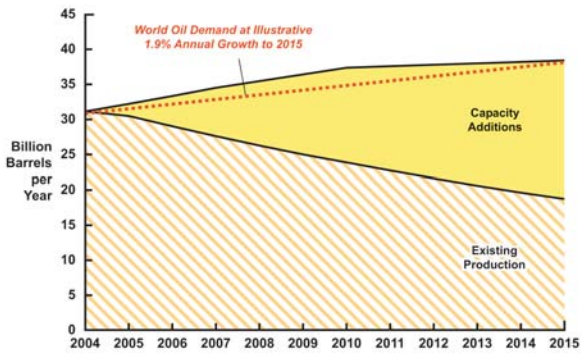
- **Improved technology.** Drilling, seismic, reservoir modeling, and other technologies enable the operator to identify and extract more oil than originally envisioned.
- **Commodity price.** Higher oil prices provide the incentives for new investments in enhanced oil recovery, infill drilling and other development activities that can squeeze out incremental volumes.

Box 10 illustrates the impact of combining these post-discovery activities with new discoveries. CERA estimates that total productive capacity will keep pace with demand until around 2015. But the challenge of delivering enough oil to meet demand should not be minimized.

Box 10 **Capacity Additions – Outpace Expected Demand by Narrow Margin**



Source: Cambridge Energy Research Associates

Oil production from OPEC member states accounted for 54% of global oil production in 1974. It fell to a 30% low in 1985, and currently stands at around 40%. In terms of oil production capacity, 15 countries dominate the future growth in long-term oil supplies (see Box 11).

This growing concentration is occurring at the same time that competition for these resources has become more intense. National oil companies have joined international oil companies in competing for resources to feed economies. Developing the oil reserves will require new infrastructure to refine the oil and deliver products to market.

Changes are under way in oil demand as well. The IEA was established by OECD countries. In 1974, OECD countries accounted for 70% of global oil demand. Today, the OECD countries have been joined by strong growth in China, Brazil, East Asia and South Asia. As a result, OECD countries today represent just 60% of global oil demand.

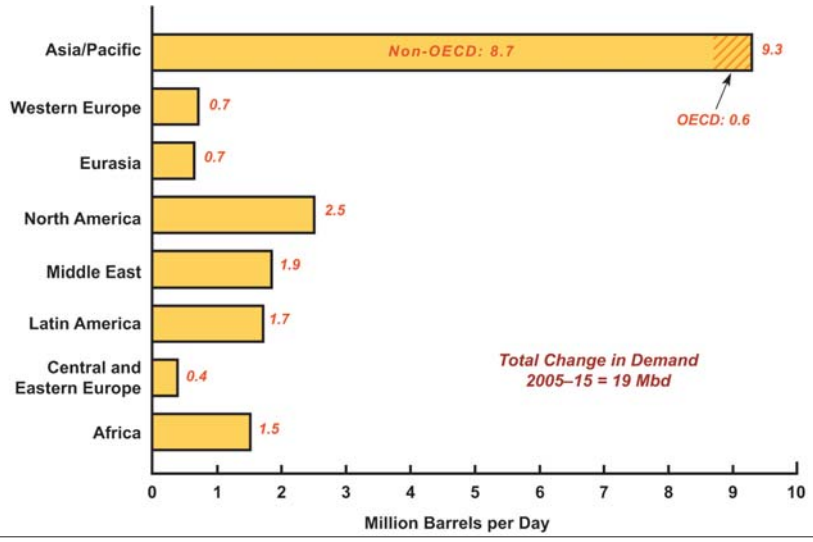
Box 11 **STRUCTURAL CHANGE**

Oil Production Capacity Increases:
15 Countries Dominate Long-term Oil Supply Growth
(million barrels per day of production capacity)

Rank	Country	1995	2005	2015
1	Saudi Arabia*	10.2	11.1	13.2
2	Russia	6.2	9.5	11.3
3	Iran*	3.7	4.2	5.2
4	Iraq*	2.1	2.3	4.0
5	Canada	2.4	3.5	5.3
6	Venezuela*	3.0	2.9	3.4
7	UAE*	2.3	2.9	3.5
8	Kuwait*	1.6	2.5	3.2
9	Nigeria*	2.1	2.9	3.7
10	Kazakhstan	0.4	1.2	3.3
11	Algeria*	1.4	2.2	3.1
12	Libya*	1.5	1.8	2.6
13	Brazil	0.8	1.8	2.7
14	Angola	0.6	1.3	2.5
15	Azerbaijan	0.2	0.4	1.1
Total Top15		35.9	47.0	62.8
Share of World Liquid Capacity		50%	54%	58%

Source: Cambridge Energy Research Associates. *OPEC member

Box 12 **Changes in World Refined Product Demand by Region, 2005 to 2015**



Source: Cambridge Energy Research Associates

Looking ahead, we can anticipate that nearly half of global oil demand growth over the next ten years will occur in the Asia Pacific (see Box 12). Both the supply sources and the demand centres for oil are shifting, with direct implications for energy security issues. Only Japan, for example, of many Asian countries, is included in the IEA agreements. Yet, the oil demand growth will be focused in China and India. Countries in Latin America, the Middle East and Africa are outside the IEA umbrella. All of them will see substantial growth in oil demand over the next decade.

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Box 13 World Natural Gas Production

Country	1973	2004
Canada	75'341	182'564
Mexico	12'428	41'467
United States	615'085	531'951
OECD North America	**702'854**	**755'982**
Austria	2'242	1'963
Belgium	48	-
Czech Republic	474	216
Denmark	-	9'430
Finland	-	-
France	8'046	1'390
Germany	23'124	20'559
Greece	-	23
Hungary	4'879	2'963
Ireland	-	855
Italy	15'407	12'961
Luxembourg	-	-
Netherlands	75'064	85'983
Norway	-	82'340
Poland	6'458	5'957
Portugal	-	-
Slovak Republic	496	165
Spain	1	339
Sweden	-	-
Switzerland	-	-
Turkey	-	688
United Kingdom	29'210	101'182
OECD Europe	**165'449**	**327'014**
Australia	4'048	37'025
Japan	2'595	2'957
Korea	-	
New Zealand	481	4'350
OECD Pacific	**7'124**	**44'332**
OECD Total	**875'427**	**1'127'328**
Argentina	6'629	46'728
Bolivia	2'036	7'638
Brazil	198	11'886
Chile	625	1'113
Colombia	1'903	7'560
Cuba	15	658
Peru	409	1'144
Trinidad and Tobago	1'900	27'943
Venezuela	11'268	25'827
Other	51	501
Latin America	**25'034**	**130'998**
Albania	191	14
Bulgaria	212	320
Romania	30'069	13'102
Croatia	-	1'941
Serbia, Montenegro	-	299
Slovenia	-	5
Former Yugoslavia	1'561	2'245
Non-OECD Europe	**32'033**	**15'681**
Azerbaijan	-	4'870
Belarus	-	244
Georgia	-	19
Kazakhstan	-	21'855
Kyrgyzstan	-	27
Russia	-	620'095
Tajikistan	-	33
Turkmenistan	-	59'296

Country	1973	2004
Ukraine	-	19'977
Uzbekistan	-	59'487
Former USSR	**241'183**	**706'439**
Algeria	4'478	88'337
Angola	67	720
Congo	2	
Cote d'Ivoire	-	1'422
Egypt	89	31'632
Gabon	490	117
Libya	4'185	6'994
Morocco	72	43
Mozambique	-	3
Nigeria	434	21'142
Senegal	-	13
South Africa	-	2'252
Tunisia	125	2'278
Other	1	
Africa	**9'943**	**154'953**
Bahrain	1'645	7'036
Iraq	1'210	1'560
Islamic Republic of Iran	11'884	81'332
Israel	54	351
Jordan	-	261
Kuwait	6'069	10'195
Oman	-	20'589
Qatar	1'580	41'463
Saudi Arabia	1'880	63'999
Syria	-	6'950
UAE	1'284	44'899
Middle East	**25'606**	**278'635**
Bangladesh	639	12'753
Brunei	1'871	12'355
Chinese Taipei	1'505	770
India	721	27'393
Indonesia	381	79'498
Malaysia	118	52'387
Myanmar	107	8'391
Pakistan	3'827	32'579
Philippines	-	2'779
Thailand	-	22'170
Vietnam	-	3'263
Other	2'687	205
Asia	**11'856**	**254'543**
China, People's Republic	**5'380**	**46'475**
Non-OECD	**351'035**	**1'587'724**
World	**1'226'462**	**2'715'052**
World Totals in Other Units	**1'973**	**2'004**
Billion cubic metres	***1'226.5***	***2'794.5***
Trillion cubic feet	***43.3***	***98.6***
Billion cubic feet per day	***118.6***	***270.3***

Source: International Energy Agency and CERA
2004 data are provisional for the OECD and are estimates for the Non-OECD countries.

Box 14

World Natural Gas Consumption

Country	1973	2004
Canada	43'386	89'934
Mexico	12'371	50'454
United States	624'088	631'002
OECD North America	**679'845**	**771'390**
Austria	3'787	8'981
Belgium	8'257	17'063
Czech Republic	1'279	9'600
Denmark	-	5'171
Finland	-	4'860
France	17'136	45'582
Germany	41'301	101'252
Greece	-	2'693
Hungary	5'049	14'464
Ireland	-	4'295
Italy	17'095	80'608
Luxembourg	289	1'361
Netherlands	40'382	51'302
Norway	-	5'545
Poland	8'138	15'668
Portugal	-	3'737
Slovak Republic	2'001	6'719
Spain	1'009	27'012
Sweden	-	979
Switzerland	180	3'311
Turkey	-	22'443
United Kingdom	30'027	102'550
OECD Europe	**175'930**	**535'196**
Australia	3'839	26'370
Japan	6'777	83'548
Korea	-	27'844
New Zealand	481	4'349
OECD Pacific	**11'097**	**142'111**
OECD Total	**866'872**	**1'448'697**
Argentina	8'265	39'500
Bolivia	103	1'171
Brazil	198	19'972
Chile	625	8'368
Colombia	1'903	7'564
Cuba	15	658
Peru	404	1'175
Trinidad and Tobago	1'900	12'749
Venezuela	11'268	25'827
Other	52	1'489
Latin America	**24'733**	**118'473**
Albania	191	14
Bulgaria	212	3'773
Romania	29'868	18'886
Bosnia-Herzegovina	-	621
Croatia	-	2'600
FYROM	-	81
Serbia, Montenegro	-	2'085
Slovenia	-	1'104
Former Yugoslavia	1'551	6'491
Non-OECD Europe	**31'822**	**29'164**
Armenia	-	1'561
Azerbaijan	-	6'001
Belarus	-	20'009
Estonia	-	847
Georgia	-	1'123
Kazakhstan	-	19'198
Kyrgyzstan	-	731
Latvia	-	1'750
Lithuania	-	2'944
Republic of Moldova	-	3'401
Russia	-	427'305

Country	1973	2004
Tajikistan	-	563
Turkmenistan	-	15'205
Ukraine	-	70'116
Uzbekistan	-	55'956
Former USSR	**255'748**	**626'710**
Algeria	1'906	23'689
Angola	67	720
Congo	2	-
Cote d'Ivoire	-	1'422
Egypt	89	30'941
Gabon	-	132
Libya	1'033	5'894
Morocco	72	43
Mozambique	-	3
Nigeria	434	8'221
Senegal	-	13
South Africa	-	2'252
Tunisia	125	3'420
Other	1	-
Africa	**3'729**	**76'750**
Bahrain	1'645	7'036
Iraq	1'210	1'560
Islamic Republic of Iran	3'794	83'929
Israel	54	312
Jordan	-	1'100
Kuwait	6'069	10'195
Oman	-	10'360
Qatar	1'580	17'032
Saudi Arabia	1'880	63'999
Syria	-	6'950
UAE	1'284	38'594
Middle East	**17'516**	**241'067**
Bangladesh	611	12'753
Brunei	357	2'575
Chinese Taipei	1'505	9'788
India	721	30'399
Indonesia	226	40'210
Malaysia	118	27'739
Myanmar	107	1'773
Pakistan	3'827	32'587
Philippines	-	2'779
Singapore	-	7'998
Thailand	-	30'674
Vietnam	-	3'263
Other	178	205
Asia	**7'650**	**202'743**
Hong Kong, China	**-**	**1'515**
China, People's Republic	**5'380**	**45'179**
Non-OECD	**346'578**	**1'341'601**
World	**1'213'450**	**2'790'298**
World Totals in Other Units	**1'973**	**2'004**
Billion cubic metres	***1'213.5***	***2'790.3***
Trillion cubic feet	***42.8***	***98.5***
Billion cubic feet per day	***117.4***	***269.9***

Source: International Energy Agency and CERA
2004 data are provisional for the OECD and are estimates for the Non-OECD countries.

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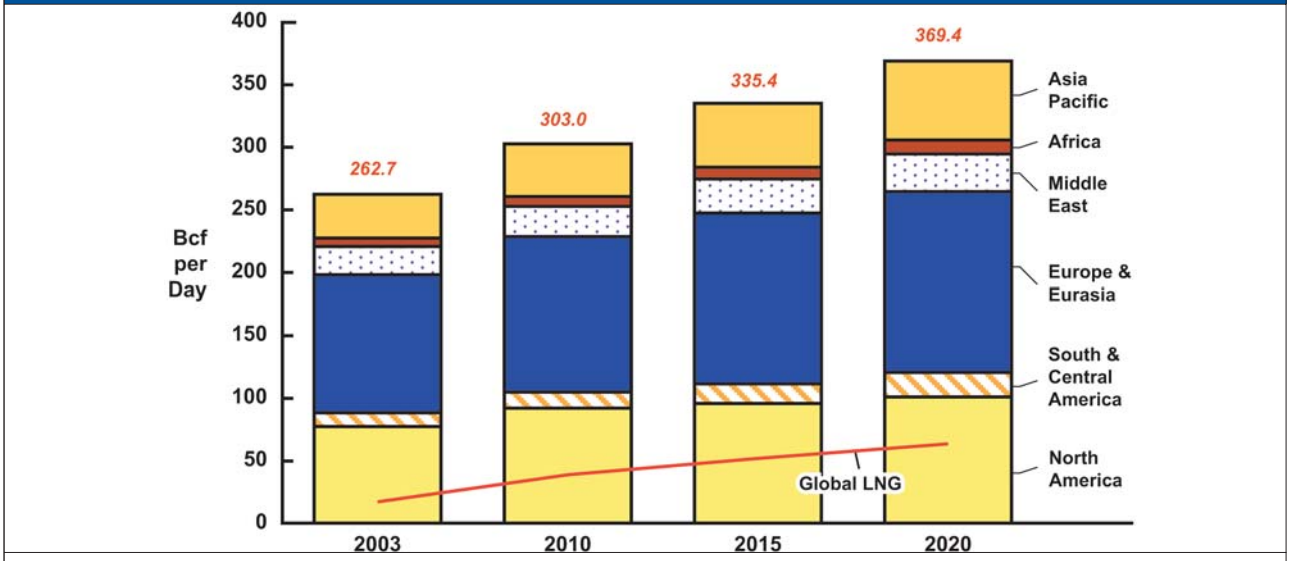
Box 15 **Sizing Up—LNG versus Gas: Global Natural Gas Demand and LNG's Share**



Source: Cambridge Energy Research Associates

Construction of the Baku-Tbilisi-Ceyhan (BTC) pipeline, Rustavi, Republic of Georgia, June 2004

The Dash to Natural Gas and the Effect on Electric Power

The changes are not limited to oil. The natural gas story is even more remarkable. In 1973, total world natural gas production was approximately 43.3 trillion cubic feet.[3] There was minimal natural gas production in Africa, Norway, the Asia Pacific and the Middle East. The Caspian region was largely undeveloped in terms of natural gas. Today, all of these regions are teeming with natural gas exploration and production projects, and demand has more than doubled (see Boxes 13 and 14).

The "dash for gas" is in large part a result of natural gas becoming the "fuel of choice" for new power generation globally. Increasingly, long-distance pipelines crisscross borders, linking economies but also creating vulnerabilities for terrorist activities. In addition, as gas demand centres are decoupled from production sources, the need has increased for LNG that provides more supply flexibility than point-to-point pipelines. CERA anticipates that LNG will have 17% of the global market by 2020, up from 7% in 2003. Over that same period, CERA estimates that total natural gas demand will have also grown from 262.7 bcfd to 369.4 bcfd (see Box 15). The push to be able to deliver natural gas by both pipelines and LNG tankers adds to the complexity of energy security. The high seas will carry more LNG tankers along with oil tankers.

[3] 1,226.6 billion cubic metres or 118.6 billion cubic feet per day.

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Aftermath of Hurricane Denis, Gulf of Mexico, July 2005

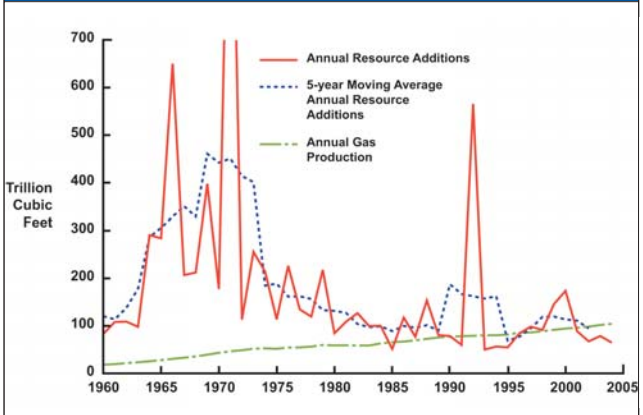
Global natural gas demand more than doubled in the past 30 years, driven largely by new technology. The most remarkable growth, in terms of volumes, has occurred in the Asia-Pacific, the Former Soviet Union (FSU), Europe and the Middle East.

Expectations of strong growth in natural gas demand have led to a push to develop previously discovered natural gas reserves and search for new sources as well. Annual additions to natural gas resources have remained above production rates throughout most of the past 45 years (see Box 16). Also, many of the fields that have been discovered have not been developed because they lack a market. One of the attractions of the growing LNG trade is to enable the development of those fields, often referred to as "stranded gas".

All of the caveats related to oil discovery statistics apply equally to natural gas discoveries. Three reasons account for most changes in resource estimates.

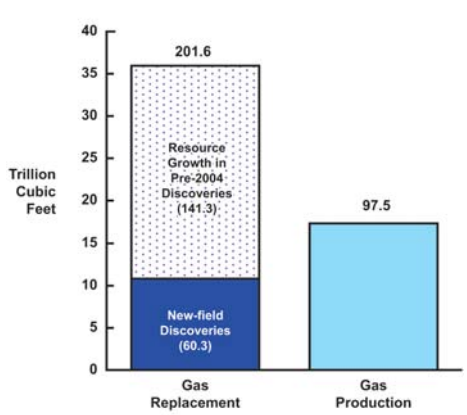
- **Additions and revisions.** There is an increase in in-place resources as the characteristics of the field become better known.
- **Improved technology.** Applying digital and other technology, including the ability to capture natural gas that was previously flared, enables the operator to identify, extract, and deliver more natural gas than original envisaged.
- **Commodity price.** Higher natural gas prices provide the incentives for new investments in, for example, infill drilling that accesses more of the resource.

Box 16 **Annual Gas Discovered versus Annual Gas Production**



Source: Cambridge Energy Research Associates, IHS

Box 17 **Annual Gas Resource Additions in 2004 versus 2004 Annual Production**



Source: Cambridge Energy Research Associates, IHS

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When the resource growth in pre-2004 discoveries are added to new-field discoveries, the annual replacement of natural gas resources was twice the rate of gas production in 2004 (see Box 17).

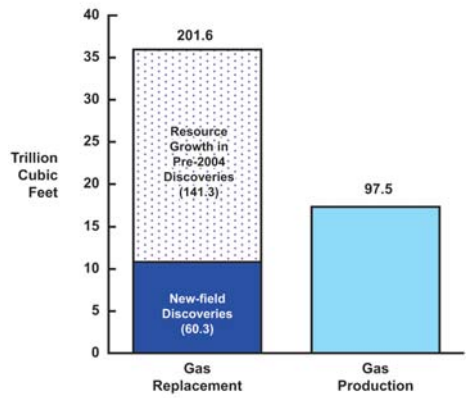
Natural gas demand

The growth of natural gas demand in the United States offers an illustration of the significance of policy changes combined with new technology. In the United States, the 1978 Power plant and Industrial Fuel Use Act (FUA) restricted construction of new power plants that used either oil or natural gas as a primary fuel. This was in response to two perceived energy crises: oil disruptions in the Middle East and reduced supplies of domestic natural gas. Both crises were exacerbated, in large part, by price controls. With the end of natural gas price controls in the mid-1980s, new domestic natural gas exploration and production efforts resulted in stable long-term prices. In addition, the development of combined-cycle gas turbine technology offered a new generation of energy-efficient power production. When the FUA was repealed in 1987, the stage was set for a dramatic increase in natural gas consumption for electric power generation.

In fact, over the past ten years, between 1995 and 2005, the US power sector has added 252 gigawatts of natural gas-fired capacity, outpacing any other form of new electric power.

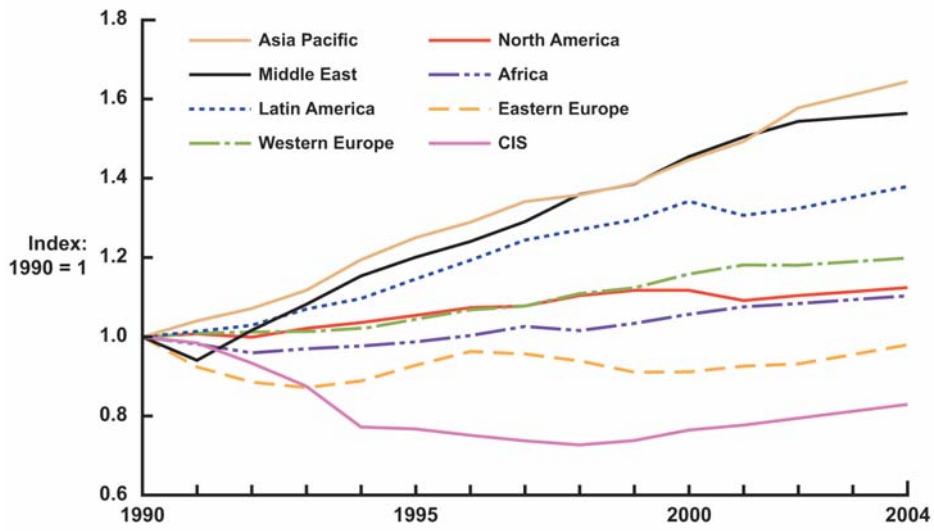
Economic growth and development are driving power demand around the world. This is occurring during a time when power markets reflect many of the same issues as oil and gas markets (see Box 18).

Box 17 **Annual Gas Resource Additions in 2004 versus 2004 Annual Production**



Source: Cambridge Energy Research Associates, IHS

Box 18 **Index of Per Capita Power Consumption by World Region, 1990-2004**



Source: Cambridge Energy Research Associates

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- Markets are shifting between state-ownership or regulatory-controlled markets and deregulated, commercially-based structures. Combined with continued globalization, there is a possibility that the pendulum may swing back toward greater state control for power markets as well as oil and gas markets if markets are perceived to be insufficiently reliable.
- Some government officials are increasingly viewing energy markets – oil, gas, and power – as "the commanding heights" with implications for how control, markets, investments and energy security are perceived. This will have spillover effects on how both governments and corporations respond to any energy crisis.
- Local communities have become more vocal about the impact of any new development on their neighbourhoods, affecting the ability to build new infrastructure in a timely manner.
- Climate change concerns influence the choices that companies make in terms of new energy sources. They also affect the emerging policies of governments that are juggling budgets, economic growth, social and environmental concerns, competitive concerns and interest in developing new technologies.
- The world economy and energy markets are more closely linked than 30 years ago – or even five years ago. The recent supply disruption in 2005 in the Gulf of Mexico was felt in Europe, Latin America, and throughout the Middle East, Asia and Africa. Similarly, financial flows are closely linked and any slowdown in one economy would put all economies at risk. Gas prices in North America, Europe and Asia will to a degree unanticipated just a few years ago increasingly influence each other through LNG.

Oil and gas pipelines: from producers to consumers

Box 19 **Perspective: Geopolitical Transformations and the Shifting Energy Markets**

By Anoush Ehteshami, Head, School of Government and International Affairs, University of Durham, United Kingdom, and Sven Behrendt, Senior Project Manager, Global Risk Network, World Economic Forum

The geopolitical landscape has changed profoundly in the past 15 years. Until the end of the Cold War and the fall of the Berlin wall, international politics was dominated by the struggle of the two super-powers, the US and the USSR, for global dominance. With the end of the East-West conflict and the demise of the Soviet Union, the world anticipated that the West, led by the US, would largely dominate global politics.

More than a decade later, the United States maintains its economic and military superiority. However, it seems that the world is heading towards a fundamental reshuffle of the global balance of power with new powers emerging, their ascendance fuelled by rapid economic growth. Their rise will inevitably contribute to shaping global order: new alliances will emerge that will reflect interests that may be fundamentally different to those that have dominated international politics in the past decades. Managing this global transformation and securing global stability are two of the biggest challenges facing the international political system.

Yet, it is uncertain what form of global order will emerge from this great transformation we are witnessing today. The key drivers of this new order will be the distribution of military power in the global system, converging and diverging political interests, the economic potential of current and emerging powers and cultural influence.

Global Order Pre-1989 [or post-oil shock 1973 and 1979], Today, and Outlook for 2020

Pre-1989 Cold War Period	*Today*	*Towards 2020*
Bipolar World Based on divergent ideologies and military balance of power, bipolar competition for global influence	**Intervening Time** No clear pattern of global order recognizable. Future alliances will be based on military balance of power, political interests, economic potential and cultural influence	**Global alliances determine geopolitical agenda in 2020** Alternative arrangements: 1) “Five on a Dice” 2) Opportunistic Alliances 3) Alliances based on cultural proximity 4) Emerging power alliances

The combination of these drivers and the superiority of each one of them will feature alternative forms of alliances. Assuming that the US retains its military and economic superiority, current and emerging powers – Europe, China, India and Russia – might revolve in shifting alliances around the US like a **“five on a dice”**. If power is fragmented throughout the global system, the geopolitical environment might be determined by **opportunistic ad-hoc alliances** among global powers. In a world that is culturally fragmented, Europe has the potential to become the central hub for global policy coordination and alliance-building, based on the **cultural proximity** of individual European countries to all parts of the world. A fourth scenario assumes that **emerging powers** engage more actively in building new alliances among themselves, based on their growing global ambitions.

No matter how this transformation plays out, it will have tremendous consequences for how global oil and gas supply and demand is structured. Only a few years ago, oil and gas exports originated mainly from the Middle East and were transported to the trans-Atlantic area; today, both supply and demand are much more diversified. Russia, Central Asia, West Africa and parts of Latin America have also become significant hydrocarbons suppliers. The economic rise of countries in Asia, especially India and China, have diversified the demand structure for energy supplies.

This transformation will have a direct impact on both sides of the demand and supply equation. It will increase the bargaining power of the suppliers as they find hungry new customers for their processed and unprocessed hydrocarbon resources. But at the same time, consumers will for the first time in decades, have the opportunity to negotiate alternative deals with a number of suppliers that operate outside of the OPEC-pricing mechanism or be able to exploit upstream and downstream investment opportunities presented by the NOPEC producers. Thus, while the hydrocarbons market as a whole may become more volatile in the coming years as a consequence of geopolitical and economic realities of the post-Cold War globalized international order, new opportunities will also emerge as the structure of the hydrocarbons market itself changes. There is, therefore, a real need to manage the changing energy market as the international balance of power itself shifts.

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Emerging Energy Security Issues

The traditional energy security elements – supply sources, demand centres, geopolitics and market structures – have been joined by additional considerations. These include the interconnectedness of world economies and energy infrastructure systems, climate change concerns, technological innovation and increased pressure from a broader array of stakeholders.

Oil has been a global commodity for many decades, delivered across borders via pipeline, by rail and by tanker trucks and ships. As mentioned above, natural gas is also increasingly becoming a global commodity. International pipelines already transport natural gas from North Africa to Europe, from Russia to Europe, from Canada to the United States, from Bolivia to Brazil and eventually from Russia to Asian markets, while natural gas movements by LNG tankers also continue to grow. These emerging transport links offer opportunities for cooperation during energy emergencies, but also provide additional risks to economies that are so interdependent.

Supply disruptions

During the North American supply disruptions caused by Hurricanes Katrina and Rita, the interconnectedness of the energy infrastructure became crystal clear. Oil product and natural gas pipelines were not able to move product because the electric power that operated compressor stations was shut down. Refineries that depended on power from the grid were not able to resume operations until the electric power lines were reconnected. In some instances, neither telephone land lines nor cell phones were operable because the electronic connections were out of service. The energy industry is integrated and tied to physical and communication infrastructures in ways that influence how energy security concerns, including the risk of terrorism, need to be reassessed.

Geopolitical alliances continue to shift along with supply sources and demand centres. The Russian oil and gas sector is increasingly linked to both Europe in the west and potentially to Asia in the east. The traditional East-West and North-South structures have become far more complex with the development of multiple international trading agreements and the rise of the World Trade Organization. The opening up of Russia, the Caspian Sea region and Eastern Europe is leading to new economic and political connections that need to be integrated into any conversations about energy security (see Box 19) .

Climate change

Climate change concerns also affect the perceptions of energy security. The objective of diversification of oil supplies has been replaced by the desire for diversification of *all* energy sources to meet energy security and environmental and reliability concerns. Although natural gas is referred to as “the fuel of choice,” in fact, the emphasis should be on “choice.” Many more fuel options are available today, compared to the 1970s. Wind power is competitive in some markets and subsidized in others. Photovoltaic cells have experienced an annual average growth rate of 43% over the past five years, resulting in total shipments of 1,195 megawatts in 2004. And nuclear power appears to be experiencing a renaissance. Globally, four gigawatts (GW) of new nuclear plants have come online since January 1, 2005, and an additional 19 GW, representing 24 new nuclear power plants, are currently under construction. A number of US power companies and partners have taken initial steps to develop new nuclear reactors. These would be the first nuclear plant orders in the US for more than 25 years.

Biofuels gaining

The transportation sector, the primary market for oil, is expanding its choices of fuels as well. The growth in hybrid vehicle sales and the push by several major automobile manufacturers to shift to hydrogen, indicate that the transport sector may well join the power sector with a broader selection of fuel options. In many large cities in Asia, Europe and North America, public transport systems are fuelling buses with compressed natural gas and biofuels are gaining in popularity as well. Government incentives and regulations promoting ethanol and biodiesel are being stepped up around the world, as is research into biology and energy.

A renewed interest in energy efficiency supports both energy security and climate change objectives. The

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tightness of energy markets can be relieved by reducing demand – through conservation and energy efficiency, or through the undesirable method of lower economic growth rates – or by increasing supplies. A combination of greater efficiency and additional supplies is required. However, the political will to focus on conservation has been lacking. Price signals may assist with energy efficiency. However, successful efforts will be short-lived unless consumers either believe that higher price levels will be sustained or there is a stronger market/political/knowledge matrix to support conservation.

The strong interest in carbon capture and storage (CCS) technology can also be linked to both energy security and climate change. Although the oil industry has led the way in CCS technology, it is of growing interest to the power sector. Building new coal-fired power plants that are based on integrated gas combined-cycle technology allows the operators to separate, capture and store streams of carbon dioxide. Because coal is both the most carbon-intensive and the most abundant fossil fuel, carbon capture and storage offers an attractive opportunity to keep coal in the fuel mix for energy security without releasing greenhouse gas emissions into the atmosphere (see Box 20).

Box 20 Perspective: Climate Change and Carbon Capture and Storage

By David M. Reiner, Lecturer in Technology Policy, Judge Business School, University of Cambridge, United Kingdom, and Paul Freund, Convening Lead Author, *Special Report on Capture and Storage of CO_2, Intergovernmental Panel on Climate Change* (IPCC), United Kingdom

For many years, it has tacitly been assumed that the ultimate technical solution to climate change lay in replacing fossil fuels with renewable energy, perhaps by nuclear power. More recently, attention has been given to the possibility of continuing to use fossil fuels without damaging the climate by combining known technologies in a new way, in order to capture and store the carbon dioxide (CO_2) from combustion. Most interest has been in applying this approach to the power generation sector, but it could also be used with any large source, such as oil refining or steel-making. If hydrogen is used by vehicles in the future, it could also be possible to capture CO_2 from hydrogen manufacture.

One method of capturing CO_2 is by washing the flue gas stream of a power plant with a re-usable solvent. The CO_2 is recovered from the solvent and pressurised for transmission through pipelines to the storage site. Storage is most likely to make use of natural geological reservoirs, such as disused oil or gas fields, or deep salt-water filled reservoirs. All of these technologies are already in use for other purposes – the technology for capturing CO_2 has a history of over 60 years, while CO_2 has been shipped in pipelines over hundreds of kilometers and pumped into depleted oil reservoirs to enhance recovery for over 30 years.

No single technology can achieve the deep emission reductions needed to stabilise atmospheric concentrations, so many approaches will have to be used. Capture and storage of CO_2 will likely add US$10-$40/MWh to the cost of generating electricity (depending on circumstances) and reduce emissions from a power plant by 80-90%. This cost is similar to or less than the cost of other options for making deep reductions in emissions, such as wind power or nuclear power. Modeling studies have found that overall costs would be reduced by 30% if capture and storage is used.

Large-scale penetration of CO_2 capture and storage technologies will depend on assuring political and social acceptability by demonstrating its safety and improving its economic competitiveness. The public remains largely unaware of this possibility, but environmental groups have begun at least to consider it as a serious option to complement renewable technologies and as a potential alternative to nuclear power. The first step is proving storage, with several such projects having already begun operation; the next stage will be for projects involving capture in power plants with transport and storage, which could be ready by 2010. Improving economic viability will require reducing the costs of capture, providing the incentives for investment and setting a carbon price sufficiently high to make the option attractive.

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Implications

Initially, this report explores the many different meanings of energy security which are dependant on the perspective of involved individuals, organizations and governments. Any resolution to current concerns about energy security will need to reflect the many points of view (see Box 21).

In this final section of the report, we raise a series of questions for discussion at World Economic Forum's Industry Partnership meetings in the months ahead.

- **Signals that might increase supply.** Government policy clarity sets the framework for energy industry investment. There is currently a lack of government policy clarity on a wide range of issues, including climate change, rent-sharing, stability of contracts and environmental and social impact requirements. Will new national or international agreements emerge that reduce the risk of new investments?
- **Signals that might reduce or slow demand growth.** Historically, price signals have triggered a new round of new energy supplies and energy efficiency gains to bring supply/demand back in balance. What are the possible signals for reducing energy demand? Will the price signal suffice? Is there a requirement for signals from governments? Will prices collapse?
- **Integration challenges.** Globalization has enhanced the drive toward integration of multiple systems to squeeze out inefficiencies. In some cases, the integration is physical, with interconnections all along the supply chain. In that case, physical security becomes critical. But integration also creates new vulnerabilities in a broader sense because a break anywhere in the system – whether the links are financial, physical, or communication – can cripple large segments of an economy. Exposure to increased rates of natural disasters and potential terrorist attacks underline these vulnerabilities. How can societies take advantage of integration while also protecting against its risks?
- **Institutional and market structural change.** The IEA was created to share the burden of a supply disruption in the Middle East. Will the current wave of energy security concerns foster new institutions? Will governments shift away from reliance on energy markets and recapture the commanding heights? How can other countries – China, India and Russia – be integrated into the system? What are the opportunities for enhanced cooperation between consumers and producers (see Box 22).

What are the implications of a new energy security paradigm? Are new structures needed? Or would modifications to our current approach that focuses primarily on oil disruptions in the Middle East suffice?

The initial oil crisis of 1973–74 led to the creation of the IEA, and energy efficiency rates responded to the higher oil prices as well. But, from 1979 to1981, oil prices more than doubled as revolution and war in the Middle East disrupted oil production and exports. Prices gradually declined over the next several years before collapsing in 1986. In addition to the creation of the IEA, many national governments established strategic oil reserves as part of the then-new "energy security regime" under the IEA umbrella.

Box 21

A Perspective on Energy Security

By Abdallah S. Jum'ah, President and CEO, Saudi Aramco

Global energy security is viewed by various stakeholders in different ways, depending on their interests and objectives. Notwithstanding these views, however, the key factors impacting the energy security and energy markets can be divided into two broad groups. The first group entails many uni-dimensional national and international decisions and policies of the past that may have unintentionally impacted the supply of energy to various consuming sectors in a variety of ways. In other words, the current situation may be at least partly the result of our own injudicious actions. The second group comprises, by default, the remaining factors, some of which represent non-traditional developments that have taken place over time. Recognizing the nature of the key factors, included in both the groups, would help the international community suitably address them, leading to enhanced energy security. The focus of this discussion is primarily on the first group of factors, which have not only played a major role in shaping the current situation but also have important implications for the future.

While the world energy demand has undoubtedly grown significantly over time, the planet's total endowment of even conventional energy sources is sufficient to meet the current and future demands for a long time to come. However, a mismatch between supplies and demand has developed for a variety of reasons, many of which involve decisions centring on achieving narrow environmental, political, economic and/or financial objectives.

For example, the tightness in oil supply-demand balance is not a function of scarcity of oil resources; it results from a confluence of factors including restrictions on exploration in offshore and environmentally-sensitive onshore areas; investment sanctions on some major producers; taxation policies by national governments, and discriminatory taxes being considered by international institutions; political uncertainty and instability in other producing areas, which the international community could help address; lag in investments and obstacles in permitting of infrastructure facilities, including refining capacity, pipelines, storage, terminals and oil tankers; unrealistically tight and varying refined product specifications; and last but not least, market speculation.

The electric power industry has been impacted by environmental restrictions, permitting issues, exclusion of selective fuels through policy mandates, lagging investments, subsidies to selective consumer groups in developing nations, political agendas and the changing but still uncertain structure of the industry with respect to its final shape. The nuclear industry has faced serious regulatory and public pressures, working against its growth. In the gas sector, overly aggressive expansion without adequate regard for the corresponding expansion of supply, obstacles in the way of pipelines' construction, difficulties in permitting LNG terminals and a lack of timely investments have all contributed to creating the currently tight gas market situation.

Regarding development of solutions to economic, political, environmental and public policy issues, a holistic approach that carefully took into consideration the impacts on the world's energy supply and security requirements would have produced a different picture than the world is faced with today. In the future, greater attention to the issues directly impacting the energy supplies and markets, outlined above, combined with strengthened emphasis on energy efficiency, conservation and demand side management, would be useful.

Alternative sources of energy and technologies will also be needed in the future to complement conventional energy sources, as demand continues to grow. However, it is important to ensure that the development of such alternatives does not involve discriminatory policies against conventional energy sources, on which the world will continue to depend for many decades to come. At the same time, alternatives should be phased-in gradually and timed optimally, as they reach commercial acceptance. The energy issue is so crucial to the world's economic health that overly optimistic expectations and premature introduction could risk jeopardizing the world's energy security.

While sub-optimal decisions have contributed to the creation of many of the energy supply-demand gaps being experienced today, new factors impacting energy security have arisen. They include, but are not limited to, terrorist threats against the supply system; major demand growth in Asia and other developing nations, changing the face of global energy demand and growing environmental concerns and pressures. The response to these developments should entail the establishment of carefully thought out safeguards against terrorist threats; introduction of appropriate enhancements to the existing structure of international energy institutions to effectively involve energy producers and nations with large, rapidly growing demands; and the formulation of pragmatic environmental policies that concurrently address the economic as well as environmental concerns of society.

To avoid committing the mistakes of the past, the structures being established to promote the consumer-producer dialogue should be strengthened, and taken more seriously. The recommendations resulting from such dialogue should be woven into important public policy and even relevant geopolitical decisions to ensure that the impacts on global energy markets and world energy security are minimized, and energy-supply prospects are enhanced. Continuing to separately treat energy security and other international policy matters that eventually impact such security is clearly inappropriate and should be avoided.

Box 22

Perspective: From OPEC to OPIC

By Ged Davis, Managing Director of the Centre for Strategic Insight at the World Economic Forum in Geneva. A former Vice-President at Royal Dutch Shell, he is a current member of the editorial board of Geopolitics of Energy.[4]

Oil cartels were originally conceived of as defensive instruments, created by or on behalf of suppliers in a time of excess capacity, with the aim of stabilizing crude oil prices. The idea was that, by maintaining sufficient spare oil production capacity, you could influence market prices and minimize volatility – of great importance not only to producers but also, it should be noted, to oil consumers (even if they would have preferred that stability to come at a lower cost). Today, however, with producers working pretty much at capacity and talk of US$ 100-a-barrel oil, it's consumers who feel a need to band together for mutual defense.

The Organization of Petroleum Export Countries, established in 1960, wasn't the first cartel. In the 1930s the (somewhat incongruously named) Texas Railroad Commission regulated the state's oil production to keep prices from plummeting. Around the same time, the big international oil companies sought to stabilize prices through the so-called Achnacarry Agreement (named after the Scottish castle where the pact was signed), in which they agreed to collaborate on the management of crude output. Both the Texas Commission and the Achnacarry Agreement became obsolete in the early 1970s, when US oil production was going full tilt and OPEC states had replaced the oil companies as primary custodians of the oil spigot.

Of course, regulation of crude oil prices through the management of production has its limits. We almost forget that, during the 1998 Asian crisis, oil prices plummeted to US$ 10 a barrel because of the abrupt drop in demand. More recently, rising demand in Asia, along with growing concerns about oil supply security, pushed prices above US$ 70 a barrel before falling back to a range of US$ 55 to US$ 65 a barrel.

And OPEC can do little about it. With crude production at capacity in most OPEC countries, the cartel is unable to rein in prices by increasing output. Indeed, despite the roughly 15% growth in projected worldwide production capacity over the next five years, output will only barely keep up with growing demand. Without a cataclysmic economic downturn among oil consuming nations, OPEC – or any other conceivable organization of oil producers – will no longer be able to manage the market.
Which raises a question: As excess capacity gives way to excess demand, will some institution replace OPEC as a controlling mechanism? The IEA currently monitors energy markets, coordinates oil stockpiling, and recommends options to consuming countries. Could the next step be a more active institution to manage the collective concerns of oil importers – an "OPIC" (Organization of Petroleum Importing Countries) instead of an OPEC?

The organization's members would be the largest and fastest growing energy users: the United States, the European Union, Japan, China and India. Its aims – a response to both growing crude oil supply constraints and the consequences of fossil-fuel use, such as global climate change
– would be the management not of oil production but of oil consumption.

Such an organization's programmes and policies would need to cover three time frames. In the long term – say, the next 50 years, during which oil consumption will certainly peak and then drop off as remaining reserves dwindle – it would promote the development of alternative energy sources, such as biofuels, and technologies that that would reduce energy use. In the medium term, roughly the next 20 years, the group would invest in new production facilities to improve international flows of crude oil and natural gas – and work to protect such investments by improving security in oil and natural gas-producing areas. In the short term over the next five years, the organization, its policy options constrained by existing capital stock and prior investments, would work to foster a closer coordination of members' energy policies. It would also encourage an active programme of buying and selling crude from expanded stockpiles in order to maintain prices within an agreed band – even as it acknowledged the historical difficulties in trying to stabilize commodity prices through buffer stocks.

Could such an organization – an OPIC – actually work? Despite an array of conflicting interests, members would share the strong desire to ensure continuity of oil supply at the lowest feasible price. Most would also see the benefits of addressing environmental issues and lessening their collective dependence on oil. There would undoubtedly be a major rift over whether to rely on market mechanisms or the purchase of oil reserves and tied agreements with oil producers to achieve the group's goals – a difference that would test members' policymaking and diplomatic skills. But the alternative to such an organization – an array of regional groups and large states pursuing their own energy interests in a form of energy mercantilism – wouldn't be likely to serve the interests of any of the big oil consumers.

[4] This is an excerpt from an article published in the February 2006 Harvard Business Review. He can be reached at ged.davis@weforum.org

The New Energy Security Paradigm

There are at least eight factors that influence the impact of high oil prices on an economy and on oil demand. Are these factors equally applicable to all energy? (see Box 23).

Energy is the “hinge” of the world economy and its security cannot be taken for granted. The energy security paradigm is evolving into a new form – based on a far more complex integration of economies, energy infrastructure and political alliances. The old energy security structures continue to operate – and operate effectively, as illustrated by the recent effective response to the energy supply disruptions caused by Hurricanes Katrina and Rita in 2005. Tapping into strategic reserves helped smooth the loss of production and sent a “don’t panic” message to the market and consumers. Shipping refined products from the European market to the US market eased market pressures. Frequent communications regarding the critical points of disruptions allowed policymakers and the energy industry to work cooperatively to address problem areas. The flexibility to lift environmental and national shipping rules temporarily enabled the disruption of pipelines and refineries to be compensated for by enabling gasoline to flow quickly to the markets that needed it most.

However, the next crisis no doubt will have different causes. The changes in supply sources, demand centres, geopolitics and market structures with the addition of supply chain integration, new technologies, public scrutiny and climate change will certainly require fresh solutions. The roles of China, India and Russia will weigh on both the supply and demand elements. Summaries of the World Economic Forum's future scenarios for each of these countries follow in this document. For all the reasons discussed in this report, this is an appropriate time to consider how the traditional energy security paradigm might be enhanced to address the new reality and meet the long-term needs of both consumers and producers.

Box 23 **Factors that Influence the Impact of High Oil Prices on the Economy and Oil Demand**
Speed and magnitude of price increase. A severe, volatile increase in oil prices is more harmful than a moderately paced rise that allows markets to adapt.
Duration of price increase. A brief price spike is less disruptive than an enduring shift upward.
Oil intensity. The more oil-intensive an economy, the more damage high prices can inflict.
Fear factor. The degree of anxiety and uncertainty about the future associated with high oil prices has a bearing on economic confidence and financial markets.
Pricing policy. Subsidies or high taxes can mute impact on demand.
Substitutes and adaptation. Availability of alternative fuels or behavioural change influences the nature of adjustment.
Recycling of petro-dollars. How quickly oil exporting countries convert higher revenues into consumption and imports affects the impact on global economic growth.
Financial variables. How high are nominal prices in real terms? What is the value of the dollar, in which crude oil is denominated, in relation to other major currencies?

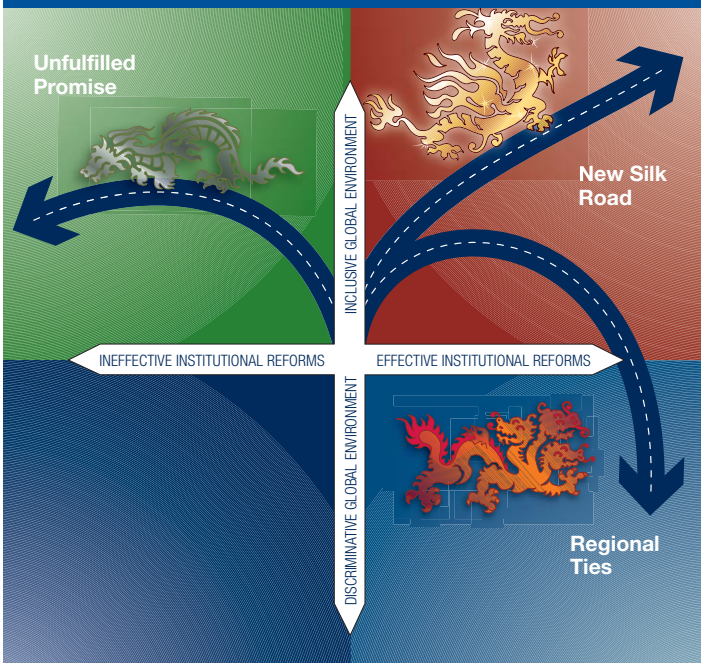
Selected Scenarios from the World Economic Forum's "Scenarios Series", China, India, Russia

China and the World: Scenarios to 2025

China's economic development over the past two decades has surprised both her critics and supporters. Since 1978 when China launched its "Four Modernizations" reform process under the leadership of Deng Xiaoping, growth has averaged 9.5% annually. As a result, China has climbed in world rankings to become the sixth largest economy in nominal Gross Domestic Product.

In the last few years, China has thus become the focus of much attention. Some parts of business, academia, government and civil society are more highly engaged in China than ever before. All need to think about what could happen next. But, China's future is not merely of interest for the experts. China's impact on global growth, resource allocation, trade and investment, as well as geopolitical balance has direct consequences on every part of the planet.

Box 24 **China Scenarios**



The Key Questions for the Scenarios

When looking at the future of China, two core questions stand out. The way in which these questions are answered will largely determine the path of China in the next two decades:

- **Can China implement internal reforms to further its development?**
- **How will China's relationship with the rest of the world affect its development and shape the global context?**

A number of factors will influence how these questions are answered in the next two decades:

- The intent of China's leadership and its ability to ensure implementation of decisions made;
- The choices made in economic policy, including the degree of liberalization and openness;
- The extent to which social stability can be maintained and popular expectations managed;
- The reaction of other global actors to China's rise, and the broader geopolitical situation.

Based on these factors and core questions, three scenarios emerge for "China and the World" over the next 20 years. The three scenarios are supported by detailed macroeconomic modelling.

Selected Scenarios/China

Regional Ties

"Regional Ties" is a story that plays out in a global environment where trade is hindered by protectionism. Hence, China increasingly turns to the Asian region to provide the motor for its trade and investment and to support it on a path of reform and economic development. Chinese leadership and vision facilitate the forging of regional ties that help overcome historical enmities.

Unfulfilled Promise

"Unfulfilled Promise" describes a China where a desire for economic development is not supported by necessary structural reforms. There is continued economic integration globally, but it is tempered by security concerns. In this scenario, China struggles to implement tough reforms, with limited success; this has negative consequences for its economic, social and ecological development. The name reflects the general sentiment among the Chinese people that the promise made to them in terms of inclusive economic development has been largely unfulfilled.

New Silk Road

"New Silk Road" depicts the flourishing economic and cultural rise of China, a feat achieved despite the presence of substantial internal obstacles. The scenario reflects China's peaceful geopolitical integration and its sizeable role in the exchange of goods, services, investments and ideas. This success is driven by strong and inclusive global economic growth, with an emphasis on trade integration and cross-border flows. It is backed up in China by well executed financial, legal and administrative reforms, and the progressive emergence of a middle class and internal market.

Selected Scenarios/China

Box 25	Comparing the Three China Scenarios This table provides a comparison of some of the most important aspects of the scenarios		
	Regional Ties	**Unfulfilled Promise**	**New Silk Road**
Leadership and governance	• Strong one-party leadership • Strategic vision helps to weather the economic crises	• Reactive leadership – lacking in long-term vision • Fear of dissent within the ranks hinders local reform enforcement	• Next generation leadership more open to individual rights and social liberties • Foundations are laid for the separation of judicial, legislative and executive powers
Economic performance	• Global slowdown affects exports to Europe and North America, triggering a focus on domestic and Asian markets	• Growth eventually slows as export growth weakens and domestic market demand does significantly increase	• Balanced growth based on both external and domestic market development • High growth continues
Social development	• China succeeds in maintaining social stability and cohesion despite a depressed global environment • Emphasis is placed on social inclusion and the development of social systems	• Unbalanced development driven by coastal areas • High disparities across regions and classes	• Reforms of state-owned enterprises and accelerated urbanization combined with an insufficient social safety net cause some initial concerns • Inequality is tackled in earnest as of 2015
External relationships	• Successful regional ties fuel growth and prosperity in the region after the Western countries shift attention away from the region	• Aspiration to be a major global player not fulfilled • Lagging reforms affects relations and trade	• China plays an increasingly active role on the world stage and in international organizations

Conclusions

Given the importance of China today, there can be no doubt that the determination of the Chinese leadership to maintain the course of reform will be a decisive factor in the global future. It is equally true that the support of other global players, and their preparedness to welcome China in its gradual rise in greatness, will have a direct impact on how China emerges.

Given the close connection between China and global welfare, these scenarios indicate that outsiders must appreciate the scale of the challenges faced by the government in Beijing, and that those in China need to comprehend the sensitivities of outsiders to its rise.

These scenarios are part of the World Economic Forum's Scenario Series.

Selected Scenarios/India

India and the World: Scenarios to 2025

Few countries can boast the immense diversity of India: among its 1 billion people, there are 18 main languages, 844 dialects and six main religions. The reforms of the mid 1980s and early 1990s sharpened the pace of change and, as globalization has advanced, prompted by rapid technological developments, India has become more significant in international markets. Now many analysts are predicting India's emergence as a global player, set to follow the blazing economic success of another giant, China. It is not difficult to see the rationale behind such optimism. Key trends that could drive and sustain these new dynamics include:

- Favourable demographics;
- A large pool of low cost, skilled labour;
- Entrepreneurial, indigenous companies;
- Continuing economic reforms and global integration;
- A stable political regime and democracy;
- A record of high, sustained growth rates.

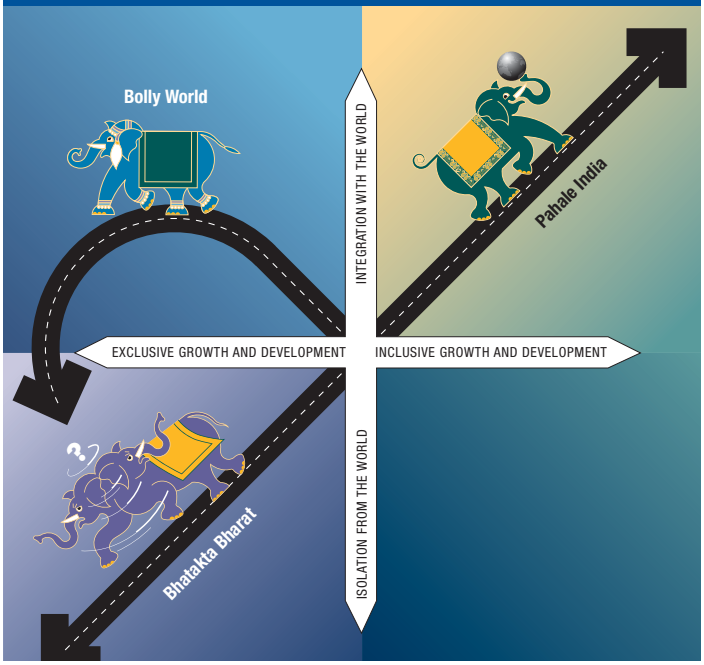
The Key Questions for the Scenarios

However, there are also major challenges that India must address if it is to achieve and maintain this kind of growth and development. The key questions for the scenarios are as follows:

- **Can India engage the whole nation in its quest for sustained security and prosperity?**
- **How will India's relationship with the world impact the Indian Agenda?**

Based on degrees of integration with the world and inclusive growth and development, there emerge three different scenarios for India's future development:

Box 26 **India Scenarios**



Selected Scenarios/India

Bolly World

Bolly World is a story of how initial economic success becomes unsustainable, and domestic social and demographic pressures soon trigger an economic reversal. But need this happen? Could India achieve sustainable economic and social success?

"Bollywood" is the name given India's film industry which is famous for its movies with their spectacular song and dance numbers. The title "Bolly World" portrays a future in which India's leaders are so dazzled by the immediate gains to be made in international markets that they fail to implement much needed domestic reforms.

Pahale India ("India First")

Pahale India describes how a widely shared vision for India's future aligns national aspirations and creates common goals. Everyone puts India first, determined that the entire nation will benefit from India's development. This building of a broad-based economy provides sufficient internal strength to support India's ambitions to become a major world player.
"Pahale India" means "India First" and this is reflected in the scenario in at least three ways: 1) people from across India put the needs of their community and country first; 2) India emerges as a global economic leader; and 3) India's dynamic internal developments make it a source of inspiration for the rest of the world.

Atakta Bharat ("India Getting Stuck")

However, a less benign future is also possible, especially if the international environment proves less supportive of India's aspirations. In Atakta Bharat ("India getting stuck"), the global economy slows, offering few benefits to India, while within India there is little and uneven development.

"Atakta Bharat" describes an India "getting stuck without direction" reflecting the lack of unified action and absence of effective leadership that, in this scenario, create a continuous and cumulative source of problems for India.

Selected Scenarios/India

Box 27 **Comparing the Three India Scenarios**

This table provides a comparison of some of the most important aspects of the scenarios

	Bolly World	Pahale India	Atakta Bharat
Economic performance	• Growth led by a few select sectors, competitive in global economy. Rural development neglected.	• Broad-based, high growth benefits majority and sustains internal economic development, while enhancing global economic integration.	• Low growth, with potential constrained by lacklustre global economy and domestic economic weakness.
Social development	• Unbalanced development driven by a few internationalized sectors and states. High disparity across states and regions.	• Balanced development. Access to opportunities for all, benefiting majority, including women and the poor.	• Rural development neglected. People and communities must help themselves. In best cases this leads to community self organization; in worst cases, corruption and violence
External relationships	• Aspiration to be a major global player; neglects regional relationships	• Proactive economic diplomacy. Respected global player, ensuring peace and prosperity for South Asia and the world	• Reactive foreign relations, shaped by global environment and immediate neighbours • Dissatisfaction with ineffective national and state governance means that people take care of themselves
Leadership and governance	• Oriented towards the self-interest of vocal and privileged minorities. Highly opportunistic; lacking in long-term vision	• Leaders put India first, above personal and sector interests. Aligned, effective and inclusive at all levels.	• Leaders emerge from within communities with varying results

Conclusions

The challenges that India faces and the actions that India needs to take to secure its future seem well known. The question arises: can its leaders and people put this understanding into practice and do what is needed as a nation, in collaboration with the international community.

These scenarios are part of the World Economic Forum's Scenario Series.

Russia and the World: Scenarios to 2025

For decades Russia, as the dominant constituent of the Soviet Union, was indisputably a superpower. The reality today is very different. With a population of 145 million, Russia has approximately as many inhabitants as Pakistan (which, like Russia, possesses nuclear weapons), and an economy about the size of the Netherlands' (population 16 million).

Russia has gone through major changes since the break up of the Soviet Union, with a 30% decrease in Gross Domestic Product from 1992 to 1998, challenges to Moscow's rule in some provinces, and declining birth rates combined with emigration and disease that have shrunk the working-age population. However, at the start of the 21st Century, the indications from Russia are more favourable, not least because it has experienced a strong real GDP growth in the past five years that has created large current account surpluses and reserves. While the upturn is not enough to ensure sustained economic development, it has provided President Vladimir Putin with a window of opportunity, which he has used to introduce a number of reforms, including a flat income tax, a new land and legal code, and legislation on currency liberalization. Indeed, his most significant achievement has been to balance the budget and dramatically reduce IMF borrowing.

It is thus appropriate to ask whether the combination of these different elements will eventually have a negative impact, or if Russia can successfully turn itself around. These scenarios aim to illustrate what could happen to Russia over the next two decades.

The Key Questions for the Scenarios

Among the many challenges confronting Russia, two questions are key to how Russia will look in the next two decades:

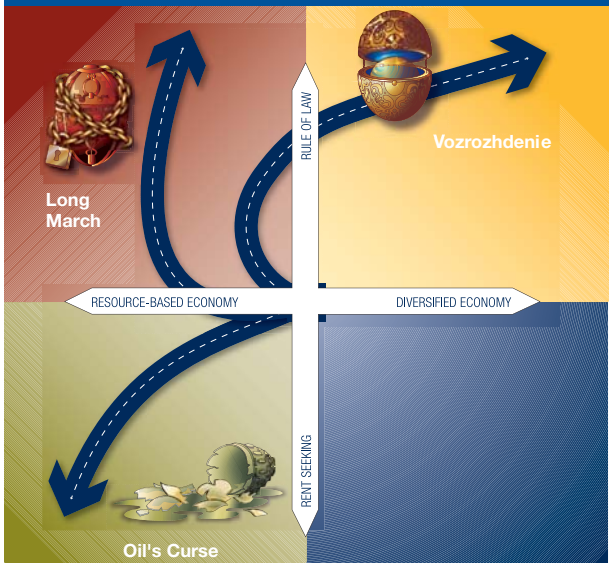
- **Will the country be able to develop legitimate and effective governance, based on the rule of law?**
- **How effectively can it develop a broad-based economy given its extensive energy resources?**

A number of factors will influence the response to in the coming two decades:

- The nature, openness and leadership qualities of the Russian elite, and its interest and ability to impose the rule of law;
- The choice of economic policy, and the extent of the freedom granted to private capital in the energy and non-energy sectors;
- The challenge of maintaining social cohesion given the country's geographic spread and its serious demographic problems; and,
- Russia's relations with the rest of the world.

Different scenario paths for Russia up to 2025 are represented in the next figure, in which the axes reflect different possible outcomes to the key questions:

Box 28 **Russia Scenarios**



Selected Scenarios/Russia

Today, Russia's economy is booming because of high oil prices – but the benefits of this increased economic prosperity are shared only among the elite, while the income gap between regions continues to grow.

Long March

The ***Long March*** scenario covers a situation in which Russia continues to leverage its natural resources, to the detriment of the full development of other sectors. A gradual transition takes place to a system of governance based on the rule of law. In this scenario, Russia is able to achieve relative prosperity, but a far less benign future is also possible.

Oil's Curse

In ***Oil's Curse,*** a political class bent on its own enrichment is in charge, resulting in slow growth, poor levels of investment in infrastructure, capital flight, increased corruption and a decline in the competitiveness of domestic industries.

Renaissance

A radical departure from the past is also possible, in which Russia would gradually achieve real economic and social progress. ***Vozrozhdenie*** *("Renaissance"* in Russian) foresees relatively gradual but wide-reaching governance reforms combined with market reforms leading to strong GDP growth, an increase in real income, and general improvement in the quality of life for the population at large.

Selected Scenarios/Russia

Box 29	Comparing the Three Russia Scenarios This table provides a comparison of some of the most important aspects of the scenarios		
	Long March	**Oil's Curse**	**Vozrozhdenie**
Economic performance	• Strong investment in oil infrastructure, improvements in public infrastructure, limited growth elsewhere	• Strong state regulation and protection of the economy from outside forces lead to slow and fluctuating GDP growth	• Push to diversify the economy away from energy, leads to healthy and stable balanced GDP growth
Social development	• Higher but inefficient social spending stabilizes income gap • Civil society remains embryonic – but pressures for 'independence' grow	• High social tensions due to prevailing corruption and growing inequalities • Quality of life worsens and social services close to collapse	• Social spending and improved efficiency have reduced inequality • Greater involvement of people in political life
External relationships	• Mildly benign attitude towards the West, focus on China & India • Russia has positioned itself as a crucial supplier of energy in a world where security of supply is a major issue	• Relationship with China as key energy partner is booming • Closer relations with EU driven by security of energy supply • US relationship grow distant	• Russia becomes increasingly active on the world stage and in international organizations • Readiness to align with EU and US views
Leadership and governance	• Power maintained by increasingly moderate and pragmatic conservatives • Successful war on corruption legitimizes the central state	• Power maintained and concentrated by small elites at national and regional levels • Dissatisfaction with ineffective governance	• Full development of a more effective and democratic form of governance • Transparency, personal rights and public accountability are greatly improved

Conclusions

The coming years could well be a crossroads for Russia. Will the tendency to authoritarianism persist or will there be a determined effort to promote more open democratic structures? Will the Russian economy be narrowly based on natural resources or much more broadly based. A large part of the answer lies in the hands of the leaders and people of the country itself.

Against the backdrop of some certainties – notably a declining indigenous population – the challenges may appear considerable. However, that is without reckoning with Russian energy and determination which has repeatedly shown itself over the centuries. Likewise, other countries have their role to play, notably to open doors and provide examples that could help Russia move forward.

These scenarios are part of the World Economic Forum's Scenario Series.

For Your Notes

For Your Notes

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The Energy Governors Community of the World Economic Forum consists of 30 top executives of the world's leading energy firms. The community identifies the key issues that are relevant to its industry, discusses them with thought-leaders and translates them into pragmatic actions that are in line with the World Economic Forum's mission statement: Commited to improving the state of the world by engaging leaders in partnerships to shape global, regional and industry agendas.

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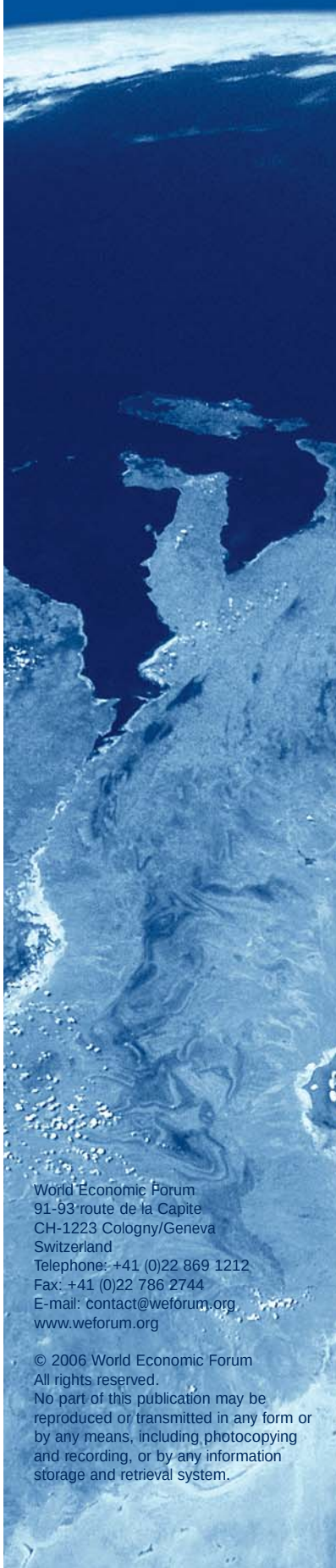

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