



Geopolitics of Energy®

Geopolitics of Energy was founded by the late Melvin A. Conant of Washington, DC in 1979. Since 1993, it has been published under the auspices of the Canadian Energy Research Institute.

Editor-in-Chief

Sulayman Al-Qudsi

Associate Editors

Seyed Jazayeri

Jon Rozhon

Editorial Committee

Alberto Cisneros Lavaller

Napier Collyns

Julian Lee

Michael Lynch

Editorial Board

Peter Adam

Preety Bhandari

Fatih Birol

Ged Davis

Robert Ebel

George Eynon

Fereidun Fesharaki

Herman Franssen

Antoine Half

Paul Horsnell

Tatsu Kambara

Alex Kemp

Walid Khadduri

David Knapp

Edward Morse

Francisco Parra

Robert Priddle

John Roberts

Adnan Shihab-Eldin

Robert Skinner

Subroto

Paul Tempest

R. James Woolsey

Wu Lei

Inside Geopolitics of Energy

- **Not so GECFast. Natural Gas Exporters will Require Discipline, Creativity to Wield Significant Market Power**
By Edward Kott

In his article, Mr. Edward Kott explores the probable success and potential hurdles of the gas producers under the umbrella of the newly-formed Gas Exporting Countries Forum, (GECF), which was established in Doha, Qatar in February 2008. The article draws on the structure and history of OPEC in order to explore the prospects of GECF. Notable differences in international trade of oil relative to natural gas exist: natural gas is not as liquid and is subject to physical market segmentation. The resource endowments of natural gas among GECF countries vary as well with notable differences in the regulatory structures of LNG amongst producers. The author infers that gas producers in non-GECF countries are potentially more responsive to sustained high prices than are oil producers in non-OPEC countries, and the full natural gas resource base at their disposal is very large. Investigating the consumers' side, Mr. Kott suggests that gas consumers in Europe benefit from strong policies, including carbon emission policies; European oil consumers, on the other hand, do not see such benefit. As well, gas consumption peaks in the winter due to heating demand – demand that does not enjoy the flexibility of short-term fuel switching available to the power and industrial sectors. GECF members are acutely aware of this seasonality and may choose to coordinate action to drive up winter prices when consuming countries are less able to conserve gas. The most recent Russia/Ukraine conflict illustrated this dynamic in vivid detail as Eastern Europeans resorted to carting coal and wood to their homes as a stopgap measure. In the end, however, Mr. Kott argues that the success of the GECF will critically depend on its internal harmony as well as its ingenuity in taking advantage of the idiosyncrasies of regional natural gas markets.

- **Scenarios of Russian Energy Future**
By Alexei A. Makarov

The article by Professor Alexei Makarov simulates the likely Russian energy future under three scenarios: the innovative, the favorable and the ecological. Methodologically, it applies modeling structure similar to the US EPA's SGM and IGEM model varieties utilizing alternative financial, energy, and ecology and growth assumptions. Professor Makarov's derived trajectories of GDP growth, energy investment, energy intensity, and infrastructure and technology issues vary appreciably under each scenario. The first scenario assumes new innovative technology and moderate increases in oil prices between \$/bbl 60-70 up to 2015 and \$/bbl 75-85 until 2030, respectively. The Favorable Scenario corresponds with higher world prices for energy and other raw materials and accordingly higher export revenues. The third scenario, the Ecology Scenario, creates lower environmental impact and corresponds with moderate oil prices. In this scenario the economy will grow more slowly because of the additional cost of environmental protection. The extraordinarily high energy intensity of the Russian economy is forecast to decelerate in the ecology and favorable energy scenarios. As well, the power generation will be significantly different. Nuclear and hydro power will be a priority as in other scenarios but the share of natural gas in power stations fuel mix will be higher — up to 74 percent — with actual consumption lower than in traditional scenarios. Cognizant of the fact that the model structure and calibration were benchmarked in 2005 when oil prices were high and the global economy was growing robustly, Professor Makarov indicates that the model forecasts are currently undergoing updates for the period of 2009-2015, which will account for some expected consequences of the world economic crisis.

Not So GECFast

Natural Gas Exporters Will Require Discipline, Creativity to Wield Significant Market Power

by Edward Kott*

The tea leaves of OPEC production cuts and the annual Russia/Ukraine natural gas dispute quickly overshadowed an agreement by 15 natural gas exporting countries to formalize the Gas Exporting Countries Forum (GECF), but the most recent step in the group's evolution has renewed speculation about the potential emergence of an OPEC-style cartel in the natural gas market. GECF members certainly possess sufficient resources to exert influence over gas markets similar to that of their sister organization in the oil world, but the cards are stacked against them. To develop into anything resembling OPEC, the GECF will need to muster a level of ingenuity and discipline that is unlikely for a group of nations with such divergent interests.

Several oil producing countries formed OPEC in 1960 to present a united front in negotiating with international oil companies to set prices and establish royalty regimes. The group enjoyed early success with this objective, but it was largely incapable of truly flexing its muscle for another decade, by which time US production had peaked, surplus capacities evaporated, and OPEC's share of global oil production rose above 50%. The 1973 Arab oil embargo promptly thrust the so-called oil weapon into the spotlight, sending markets into disarray and quadrupling the price of crude within months as non-OPEC producers could not compensate for coordinated production cuts by major petroleum exporters.

In establishing the formal GECF headquarters in Doha, Qatar last month, the gas producers are taking a similar path, initially aiming to coordinate investments, market forecasts, and relations with consumers rather than to establish any sort of a price target. But just as OPEC's influence grew over time, the GECF may develop into a formidable organization a decade or two from now. Through examining the history of OPEC and the economics of dominant firms, we can draw several lessons about the prospects for the GECF. The organization's potential market power will hinge on four key dynamics:

1. GECF's share of the natural gas market: a producer group gains strength as it captures a larger share of the market.
2. The response of non-GECF producers to higher natural gas prices: the organization will be stronger if outside producers are less responsive to changing natural gas prices.
3. The capacity for consumers to move away from natural gas: the GECF will lose strength if consumers can respond to price increases by switching to other fuels or conserving natural gas.
4. The organization's internal harmony and discipline: GECF members will need to overcome divergent interests and challenges to coordinated action in the gas market to realize mutual benefits as a group.

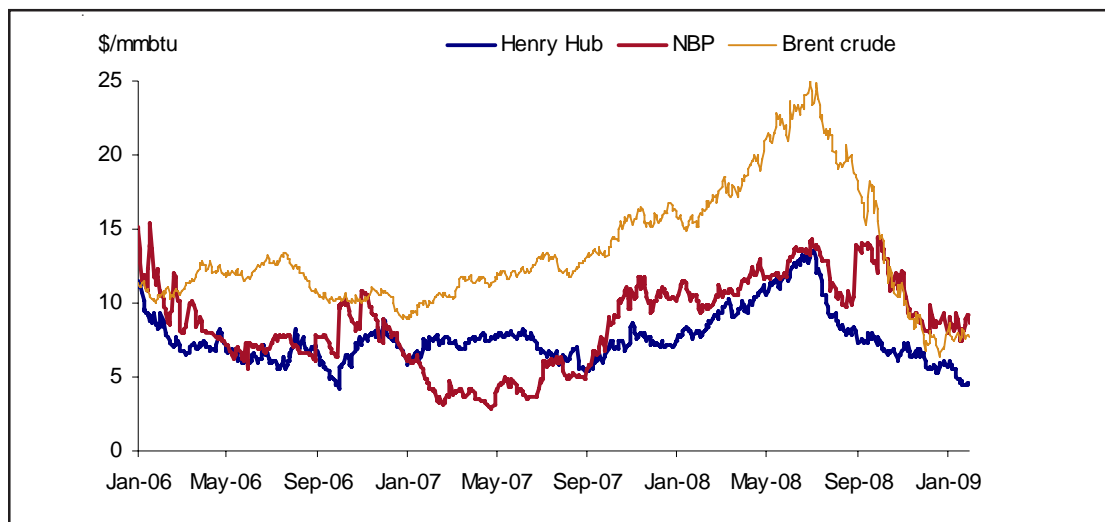
We will address each of these factors in turn but we must first frame the discussion within the context of a crucial difference between natural gas and oil markets. The natural gas trade is not a truly liquid and global market along the lines of the crude market, but rather a jigsaw puzzle of several regional and, for the most part, isolated markets. Crude oil can be shipped via pipelines, tankers, trains, trucks or even horse-drawn carts. Natural gas is far more difficult to transport, so transportation of the commodity carries a higher premium in that market with the vast majority of gas confined to established pipeline networks, as the recurring Russia/Ukraine gas disputes demonstrate again and again. The waterborne LNG market is more flexible and more economic over long distances, but requires hefty investments in liquefaction and

*Edward Kott is a Senior Associate with LCM Commodities in New York. He can be reached at ekott@lcmcommodities.com.

regasification capacity as well as specialized tankers. Because of the necessary investments in transporting natural gas, a greater percentage of gas production has dedicated consumers through long-term purchasing contracts than is typical of the oil market, contracts that GECF members may begin to negotiate in concert.

Divergent pricing mechanisms accentuate the physical segmentation of these markets with gas-on-gas competition setting prices in North America and the UK, indexing to petroleum products the norm in much of Europe and linkages to crude oil driving Asian prices (Fig. 1). LNG has long held the promise of uniting regional markets into a more liquid global market, but in 2007 satisfied just 7.7% of global gas demand and the emergence of a global gas market is unlikely for at least another decade. Although the IEA projects that LNG production will grow to 10.6% of global gas supply by 2015 and as much as 15.9% by 2030, suppliers rely on long-term contracts to secure future cash flows and financing for capital-intensive liquefaction projects. It is estimated that contracts through 2020 currently cover nearly 195 million tons per year, or around 80% of anticipated 2009 LNG supply. Many of these contracts contain diversion clauses that allow for the owners of gas to redirect some cargoes to more valuable markets, and as these contracts expire they will be replaced with shorter and more flexible contracts. However, owners of liquefaction capacity (both companies and governments) will do what they can to maintain the divergent benchmarks. With LNG priced in different markets against local gas, crude, or oil products, control of liquefaction capacity and LNG carries an inherent optionality to fetch the most attractive price as dictated by multiple commodity markets.

Figure 1: Henry Hub (US), NBP (UK) and Brent Crude Prices
January 2006 - January 2009



SOURCE: Bloomberg, LCMC.

Finally, a word of caution in thinking of LNG as a flow such as crude oil that countries will readily increase and decrease as short-term market dynamics dictate. LNG is not in and of itself a commodity but rather a transportation technology. While countries such as Algeria and Libya maintain complete control over their liquefaction capacity through state oil companies, international oil majors, trading companies and utilities actually own significant proportions of liquefaction capacity in countries as diverse as Qatar, Nigeria, Malaysia, Indonesia, Trinidad, and Egypt. Moreover, LNG projects can take on multiple structures; ownership of the gas can change hands at various points along the value chain, complicating any GECF efforts to manipulate LNG flows or movements for the sake of capturing rents. Because of the capital involved in developing liquefaction facilities, state-run companies will hesitate to maintain idle spare capacity and independents will tend to avoid investing in capacity where feedgas is subject to political whims.

Market fragmentation creates obstacles for the GECF in becoming a powerful producer group, but it also provides a number of key opportunities for the GECF. If the group can find the political will to act in concert, GECF members may be able take advantage of isolated markets that cannot transport gas between each other. A harmonious GECF would together have access to

enough markets and sufficient transportation infrastructure to allow for the flexibility that could give rise to creative arbitrage opportunities benefitting the group as a whole. We will discuss the advantages and disadvantages of this market fragmentation in each section below.

Size Matters

GECF members' share of global natural gas production should give pause to any skeptic of the group's chances to coalesce into a powerful organization. OPEC provides a useful benchmark in assessing GECF market share and by several measures, the concentration of global natural gas reserves and production among GECF members rivals, and even exceeds, the concentration of oil reserves and production within OPEC. Even in the absence of any sort of producer group, both the oil and gas markets are remarkably top heavy. According to BP statistics, the top three oil producing countries accounted for 33% of the market in 2007 and the top ten producers supplied 62% of the market; the top three natural gas producers represented 46% of the market, the top ten 65%. Although OPEC no longer supplies more than half of the world's oil, the market still hangs on OPEC's every move as the producer group accounted for 43% of global oil production (including NGLs) over the past two years; GECF members, by comparison, comprised 40% of global natural gas supply.

GECF Reserves and 2007 Production by Country

	Conventional Reserves (tcf)	Share of Global Reserves (%)	2007 Production (bcf/d)	Share of Global Production (%)
Russia	1,577	25.2	58.8	20.6
Iran	982	15.7	10.8	3.8
Qatar	904	14.4	5.8	2.0
UAE	215	3.4	4.8	1.7
Nigeria	187	3.0	3.4	1.2
Venezuela	182	2.9	2.8	1.0
Algeria	159	2.5	8.0	2.8
Indonesia	106	1.7	6.5	2.3
Malaysia	87	1.4	1.5	0.5
Egypt	73	1.2	4.5	1.6
Libya	53	0.8	1.5	0.5
Bolivia	26	0.4	1.3	0.5
Trinidad and Tobago	17	0.3	3.8	1.3
Brunei	12	0.2	1.2	0.4
Equatorial Guinea	3	0.0	0.5	0.2
GECF Total	4,583	73.2	115.0	40.3
Core GECF*	3,463	55.3	75.4	26.4

*Russia, Iran, Qatar.
SOURCE: BP Statistics.

More sophisticated measures of market concentration reveal further similarities between the markets. The Herfindahl-Hirschman Index (HHI) is a commonly-used metric of market concentration calculated by summing the squares of individual market share, resulting in a number between zero and 10,000. An index below 1,000 is generally considered a competitive marketplace and a result above 1,800 is highly concentrated. If each country were considered a single firm, the global oil market would exhibit an HHI of 568 for 2007, but defining OPEC as a single firm raises the index to 2,119. Applying the same metric to global gas supply yields an index of 914 that rises to 2,058 with GECF members as a united entity.

From the market's perspective, the distributions of proved conventional oil and gas reserves are incredibly similar as well. The Gini coefficient is a common measure of inequality that ranges from zero (perfect equality) to 1 (complete concentration of resources); we estimate a Gini coefficient of 0.73 for both the 45 countries with the largest oil reserves and for the 50 countries

with the largest gas reserves. When the producer groups are factored in, the coefficient rises to 0.88 for oil reserves and 0.85 for gas reserves.

In comparing the potential efficacy of the GECF to OPEC, however, a crucial difference is the capacity of unconventional reserves to shift the balance of market power – a topic that we address in the next section.

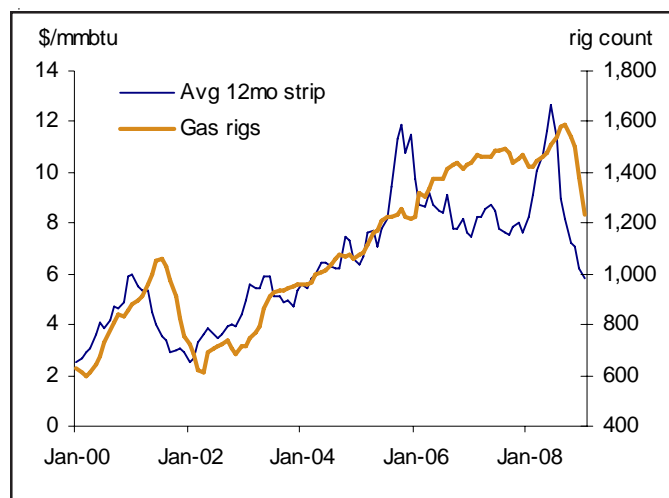
Can Other Producers Respond?

Of course, the GECF, like OPEC, cannot act in a vacuum as producers outside of these organizations are prone to respond to price movements, a dynamic generally referred to as the elasticity of fringe supply. Organizations such as the GECF and OPEC grow stronger as fringe producers become less responsive to changes in price. Fringe gas producers have far greater potential to respond to higher prices than do fringe oil producers, a factor that will limit GECF influence in some markets in the near term and in the global market over the long run.

The US natural gas market offers a vivid example of the potential for production to respond to higher prices outside of GECF countries as booming domestic production has more than made up for lower imports via pipeline and LNG. Even without the recent collapse in demand due to a deteriorating economy, the growth in domestic production would have kept the US in a comfortable supply situation despite a particularly disruptive hurricane season. The development of unconventional resources – shale, tight sands and coal bed methane – has been at the heart of this supply growth, as higher prices prompted E&P companies to boost drilling activity in general and in these unconventional plays in particular (Fig 2).

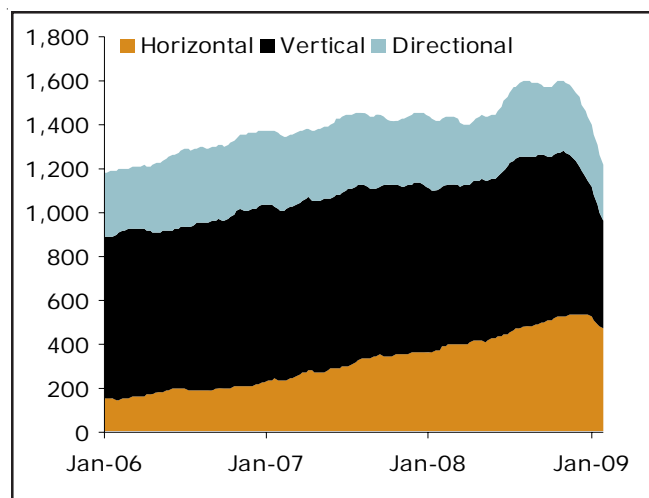
Although higher prices sparked this interest, the newfound focus on unconventional plays spurred companies to enhance technologies, such as horizontal drilling and fracturing, that have unlocked the vast resources and have ultimately reduced the costs of production. Furthermore, the fleet of rigs capable of drilling horizontally has tripled in size over the past three years, easing an infrastructure bottleneck that would otherwise have inflated the costs of unconventional production (Fig 3).

Figure 2: NYMEX Henry Hub 12 Month Strip and US Natural Gas-directed Rigs
(January 2000 - January 2009)



SOURCE: Bloomberg, Baker Hughes, LCMC.

Figure 3: US Natural Gas-directed Rigs by Type
(January 2000 - January 2009)



SOURCE: Smith International, LCMC.

Although the boom in unconventional gas production has been most pronounced in the US, its potential is enormous and by no means confined to North America. The IEA believes that extra-heavy crude oil and tar sands can boost global oil reserves by somewhere in the range of 30% to 60%; by contrast, the IEA estimates that recoverable gas reserves in the types of unconventional formations that have driven US production growth total to be approximately 31,770 tcf, a full 225% of conventional gas reserves. Moreover, much of this gas resides in non-GECF countries with approximately one-quarter to be found in North America and significant amounts likely to exist in South America, Asia, Australia, and Europe.

With more than half of US production now coming from shale, tight sands, and coal bed methane, the label of “unconventional” gas no longer fits. Indeed, many producers are now diverting resources from some conventional regions to these more promising plays that frequently have better economics. Although forward prices above \$7/mmbtu sparked the rush into shale plays, it is now clear that production in many of these areas can be profitable at significantly lower gas prices. To the delight of GECF members, however, European and Asian consumers have been unable to benefit directly from growing North American production due to the fragmentation of the global gas market (although it has freed up some incremental LNG supply). But because gas prices in Europe and Asia are linked to petroleum products and crude prices, respectively, producers in these markets share the impetus to exploit unconventional gas reserves, particularly with OPEC willing to defend prices in the \$45-50 range (\$7.72-\$8.58/mmbtu).

The technological advances that have allowed North American producers to develop unconventional gas can certainly be exported to other parts of the world, but it will be some time before other markets will be capable of experiencing a similar boom. The growth in US gas supply took nearly all observers by surprise because it was not until the market reached a sort of tipping point that allowed production growth in these plays to accelerate – the point at which the market had achieved a critical mass of geological and technical knowledge, available horizontal-drilling rigs, experience working in the basins, and pipeline capacity to move gas from these areas. Until other markets go through these same developments and companies make the same infrastructure investments, unconventional production in other areas will continue to be more costly.

To a certain extent, exporting countries can prevent or delay such developments with the real or perceived threat of flooding a market with low-cost gas that would dissuade companies from making the necessary investments that pave the way for production growth. But once these investments are made, producers can be responsive as natural gas investment and production cycles are shorter than those in the oil industry. Furthermore, European producers are growing increasingly optimistic about the potential for shale plays in that market and the recurring disruptions of Russian gas supply could accelerate the development of these resources.

In sum, gas producers in non-GECF countries are potentially more responsive to sustained high prices than are oil producers in non-OPEC countries, and the full natural gas resource base at their disposal is incredibly large. But overall, the GECF stands to benefit from the fragmentation of natural gas markets as production advances will alter fundamentals one market at a time.

Will Consumers Pass on Gas?

Both in the long term and more immediately, one of the GECF's greatest obstacles will be consumers' abilities to reduce natural gas use through fuel switching and conservation, but demand patterns present opportunities for producers as well. While oil demand is driven by the transportation sector, and alternative fuels are currently unable to displace petroleum products in vast quantities, opportunities for fuel switching abound in the natural gas market, particularly in the power and industrial sectors.

If short-term gas prices rise, power markets can shift toward other fuels as they become relatively more competitive. As natural gas is used primarily for peak power generation in most parts of the world, competition will come primarily from fuel oil when it offers attractive economics. But in the long term, higher gas prices or the perception of higher prices in the future will create the incentive for consuming countries to invest in more efficient gas-fired generation or capacity fueled by coal, nuclear, and renewable energy in an attempt to secure less expensive – and more reliable – sources of electricity. Europe, in particular, relies on a large percentage of generating capacity that is growing obsolete and that requires replacement within the next two decades. Increasing trepidation over the reliability of Russian gas supply could kick start the turnover of Europe's generating fleet, bringing a new and far more efficient generation of gas plants – and perhaps nuclear units – into service.

Natural gas consumers do not hold all the cards, however, as short-term demand elasticity is far from constant because of the seasonality of natural gas demand. Gas consumption peaks in the winter due to heating demand – demand that does not enjoy the flexibility of short-term fuel switching available to the power and industrial sectors. GECF members are acutely aware of this seasonality and may choose to coordinate action to drive up winter prices when

consuming countries are less able to conserve gas. The most recent Russia/Ukraine conflict illustrated this dynamic in vivid detail as Eastern Europeans resorted to carting coal and wood to their homes as a stopgap measure. Although Russia entered the standoff from a position of weakness, its disadvantage stemmed primarily from the global economic downturn, which reduced industrial demand for gas in consuming countries and made Russia loathe to forgo short-term export revenue. Nevertheless, the disruption occurred in the dead of winter and could have been devastating under normal economic circumstances.

Consuming countries are not powerless to respond to GECF attempts to take advantage of seasonal dynamics and some of these actions are already underway. The two most direct methods are by locking in gas prices through long-term contracts and expanding the use of gas storage to balance seasonal changes in demand. Japanese utilities, which depend entirely on LNG imports to satisfy gas demand, typically utilize long-term contracts and advance purchases to ensure their ability to meet peak demand without depending too heavily on the spot LNG market. Negotiating the terms of these contracts (typically linked to crude oil) may become more difficult if GECF members begin to collude.

Europe, jaded and frightened by the recurring disruptions of Russian supply (which meets nearly one-quarter of European demand) has embarked on an effort to expand storage capacity and integrate its pipeline network further to improve the market's flexibility in transporting gas between regions. The European gas market, roughly the same size as that of the US but with just half the storage capacity, could see storage capacity grow by 60 bcm (2.1 tcf) by 2015. The latest spat between Russia and Ukraine has added urgency to these efforts but increasing storage capacity significantly will likely take many years.

Moreover, governments' responses to higher gas prices will serve as an indication of their dedication to curbing carbon emissions; policies aimed at fostering development of renewable electricity and nuclear capacity would mitigate dependence on natural gas while providing more climate-friendly alternatives to coal. Indeed, the IEA has lobbied the German government to reconsider its policy of phasing out nuclear plants by 2020 because doing so will boost carbon emissions and increase reliance on Russian gas. Meanwhile, maintaining strict carbon caps will make gas demand less elastic because the simplest way to meet short-term emission constraints is to displace coal-fired power generation with gas-fired generation. In effect, strict short-term carbon caps will support gas demand despite GECF efforts to drive up prices, allowing the producer group to capture higher rents on its exports.

If the GECF successfully boosts gas prices, the organization's actions would reverberate through carbon markets as well because the price of carbon allowances must rise to a level that encourages switching away from coal. In essence, the price of carbon must fill the gap between the costs of coal-fired power generation and less carbon-intensive gas- or oil-fired units; as the price of gas rises, so too must the price of carbon allowances. The EU Emission Trading Scheme is the world's most robust carbon market and its allowances often track oil prices because petroleum product indexing drives the price of contracted gas. GECF efforts to establish more attractive pricing mechanisms, therefore, would be bullish for carbon.

Looking at supply and demand fundamentals overall, the GECF and OPEC command similar shares of their respective markets, but the GECF faces the considerable disadvantages of greater elasticity of demand and more responsive fringe supply. The natural gas producer group, however, can take advantage of the fragmentation of natural gas markets as well as the seasonal nature of gas demand to augment its market power. To assess the potential for the GECF to develop into a formidable group, we must detail the interests and tools of the major players, which fall into four groups: core GECF, peripheral GECF/free riders, transit countries, and unwitting accomplices.

Core GECF

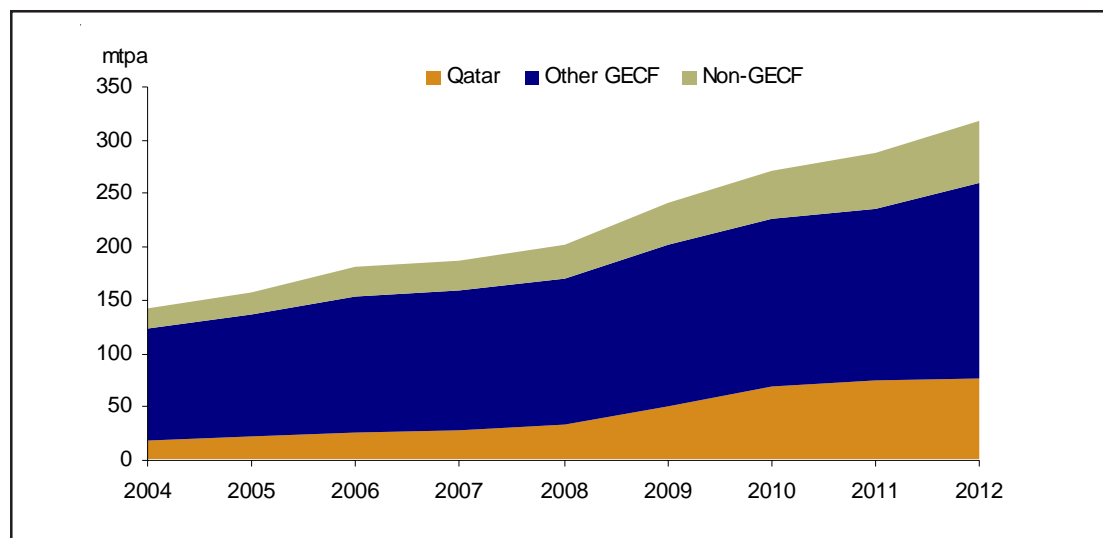
With 55% of the world's conventional gas reserves, Russia, Iran and Qatar form the gas troika at the heart of the GECF, and the producer group's effectiveness hinges on the threesome's ability to act in concert. The three countries occupy dissimilar positions within the global gas market and can complement each other well in coordinated action. These countries' divergent interests, however, decrease the likelihood that they can form a harmonious core similar to the Gulf Cooperation Council members of OPEC.

Russia, home to one-quarter of the world's conventional reserves and supplier of one-quarter of Europe's natural gas, has demonstrated repeatedly its willingness to wield market power for financial and geopolitical goals. Gazprom, the state champion, dominates Russian natural gas production and controls the country's pipeline system, which also serves as a conduit into Europe for Central Asian gas. Although the government helped Gazprom elbow its way into a controlling stake of Russia's first LNG export terminal as part of the Sakhalin II project, the gas giant is overwhelmingly dependent on pipelines – particularly through Ukraine – to access its main export markets in Europe. The recurring standoff with Ukraine has demonstrated that this dependence has simultaneously prompted Russia to wield the “gas weapon” aggressively and limited its capacity to dictate terms to its consumers. Russia's main interests lie in building pipelines that bypass Ukraine, preventing pipeline routes from Central Asia that bypass the Russian grid, and limiting the expansion of connections between other exporters and Russia's established European markets or potential Asian markets.

Iran, like Russia, uses its resource base aggressively in pursuit of financial or geopolitical aims, yet has been unable to utilize its natural gas reserves in the international arena. Iran may be the world's fourth-largest natural gas producer (11 bcf/d), but its net exports represent less than one percent of internationally-traded natural gas. Bottled up by US and European sanctions, Iran has limited connections with other markets, exporting gas to Turkey and Armenia and importing gas from Turkmenistan. Iran is geographically well-situated to export gas via LNG to markets in the east and west or to Europe through pipelines, but Iranian unwillingness to negotiate attractive financial and operational terms with outside investors, exacerbated by international financial restrictions, have scared off companies with access to the capital and technology required by these major infrastructure projects. Iran's primary goals will be to cement partnerships that will open up export avenues for its vast natural gas reserves; although Iran has often found a political and economic ally in Russia, Moscow will do what it can to limit Iranian pipeline access into Europe.

Qatar, meanwhile, enjoys access to the world's most flexible export infrastructure as well as cozy relations with the US. With six new LNG megatransit lines slated to come online by 2012, Qatar's liquefaction capacity will more than double to 77 mtpa, a full one-quarter of global capacity (Fig. 4). Virtually all of Qatar's gas reserves reside in the offshore North Field, conjoined with Iran's South Pars field to form the world's largest proven natural gas field. Approximately 70% of the field's reserves lie beneath Qatari territorial waters, and Iran has occasionally fomented minor spats regarding production from the field. Commercially, Qatar Petroleum has worked harmoniously with US, European, and Asian companies to develop and market the country's natural gas resources.

Figure 4: Estimated Global Liquefaction Capacity, 2004 - 2012



SOURCE: LCMC.

Qatar, like Saudi Arabia in the oil market, prioritizes maintaining unfettered access to export markets while preventing fuel switching away from its product and the entry of competing supply. Finally, many analysts have speculated that Qatar is well-suited to assume the role of swing producer in the gas market – this is unlikely. Building liquefaction capacity is so capital intensive that Qatar would not want to maintain the levels of spare capacity necessary to be a swing producer; the opportunity cost of bringing inexpensive Qatari gas to market would be too great.

Peripheral Producers and Transit Countries

Although peripheral GECF countries cannot shake global markets, they will be able to influence regional markets, particularly in cooperation with the three core countries. The North African GECF members are well-placed to influence European prices while Malaysia and Indonesia have a strong LNG presence in the Pacific basin. Any Russian action to boost European natural gas prices will be more effective (and more subtle) if done together with Algeria, Egypt and Libya, which supply Europe through pipelines and LNG that can reach the continent in as little as two to eight days. Similarly, Malaysia and Indonesia sit within a two-week voyage of the major Asian consuming centers and would be likely to coordinate any action with Qatar. But like Qatar, major LNG exporters will be reluctant to maintain idle capacity and are more likely to cooperate in finding alternate destinations for their LNG and to avoid any oversupply situations in the Pacific basin. Nigeria's location and liquefaction capacity position the country to influence Atlantic basin markets, but changes in Nigerian supply are far more likely to come from upstream disruptions due to internal strife rather than a concerted effort to support prices.

Although Kazakhstan and Norway have observer status in the GECF, they and other key exporting countries will benefit from GECF efforts to support prices as free riders without obligations to restrict production, investment or trade. The biggest winners could be non-GECF LNG exporters, such as Australia, Oman and Yemen as well as the Central Asian countries that would like to increase exports to Europe and Asia via pipeline. Central Asian countries have already enjoyed the benefits of Russia protecting its turf. Last summer, Russia – which acts as a transit country for Central Asian gas – agreed to pay higher prices for imported Caspian gas to weaken the negotiating positions of Europe, Ukraine, and China and mollify Caspian urgency for alternative export routes.

This month's flare up of the Russia/Ukraine conflict highlighted the importance of transit countries in the natural gas trade. Ukraine is clearly the most important transit country in the world, owing to from its Soviet-era legacy pipeline and storage network; approximately 20% of gas consumed in Europe passes through Ukraine's pipeline system, roughly equivalent to the proportion of global oil supply that passes through the Strait of Hormuz. Russia serves as a key transit country in its own right and other countries, such as Turkey and Pakistan, may increase in prominence over the next decade. But as LNG captures a greater share of the gas market, consumers diversify their supply sources and exporters diversify their transit routes, transit countries' influence will wane; GECF members will coordinate efforts to expedite this process when possible.

Unwitting Accomplices Across the Ocean

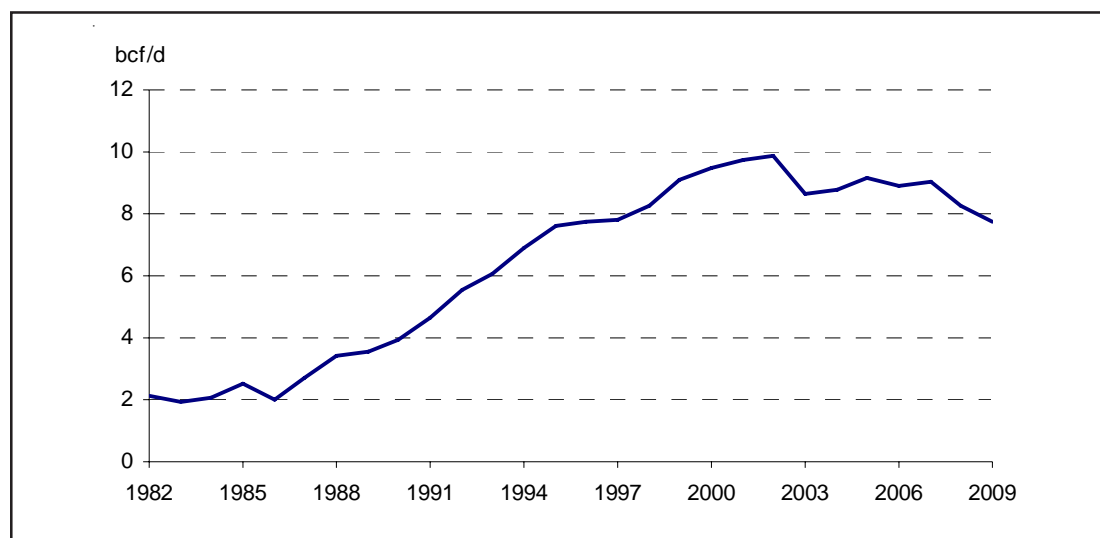
With incredible growth in unconventional gas production, the North American gas market has become virtually isolated from other markets with gas prices far below oil-indexed levels elsewhere in the consuming world and LNG meeting demand only on the very margins. Simple economics would dictate that companies invest in liquefaction capacity to bring North American gas to premium markets, but policy stands in the way as the US Natural Gas Act prohibits the exportation of domestic gas without government authorization. The Department of Energy typically grants carte blanche authorization for exportation to countries that maintain a free trade agreement with the US (Canada and Mexico), but only the small liquefaction facility in Kenai, Alaska has received permission to export gas to other markets. Kenai's initial authorization lasted for 30 years but allowed for only contracted sales to a specified buyer; the facility's recent reauthorization carries more flexible export terms, but in doing so is limited to a two-year timeframe.

Late in the summer, two LNG import terminals, Freeport LNG and Sabine Pass, applied for authorization to re-export imported LNG. Higher prices elsewhere in the world had diverted cargoes from US shores since late 2007, keeping newly-commissioned US regasification capacity idle. In essence, the facilities are angling to become global storage hubs for LNG. These precedent-setting applications to DOE and FERC are still pending, but the permitting would be of a very limited scope, covering small quantities over a short time horizon – a maximum total of 88 bcf

over two years. One prerequisite for granting this authorization would be that the re-exportation does not work against the public interest, usually interpreted as not diverting gas needed by the domestic market. We therefore believe that the US government will only grant (and renew every two years) such authorization as long as the quantities involved remain meager.

Historically an energy exporter, Canada does not fully share the US anxiety regarding shipping its resources beyond its borders and the country is likely to approve its first liquefaction project, Kitimat LNG. The facility will export gas from the large shale plays in British Columbia but at just 650 mmcf/d, the export capacity is not enough to truly align the North American market with other markets and more than 90% of Canadian exports will continue to flow through pipelines to the US. Furthermore, exports to the US have entered a period of decline as falling gas production in Alberta has coincided with rising consumption, much of which results from growing oil sands production (Fig 5). With US production growth increasingly having to pick up the slack for declining pipeline imports, US authorities are less likely to allow widespread re-exportation of LNG.

Figure 5: Annual Canadian Net Exports to the US, 1982-2009



SOURCE: EIA, LCMC estimates.

A Formidable GECF

In the end, the success of the GECF will depend on its internal harmony as well as its ingenuity in taking advantage of the idiosyncrasies of regional natural gas markets. Initially, GECF members are more likely to coordinate long-term activities, such as investment decisions and contract negotiations, but if these countries build trust over the next several years, the organization will hold the potential to manipulate short-term markets in a manner that rivals OPEC's. The tools at its disposal include cooperation in negotiating with consumers and foreign production companies, coordinated long-term capacity investments, and short-term capacity management.

GECF members have explicitly announced intentions to coordinate investments and relations with consumers but for the most part have been more sheepish about the prospects of short-term market management. Although internal discussions about restricting long-term investments are more likely to lead to disputes than to cooperation, the group can benefit relatively quickly from a united front in negotiations with consumers and foreign producing companies, just as OPEC did nearly half a century ago. GECF bargaining power will be augmented by the declining influence of Japan as an LNG importing country; a decade ago, Japan purchased nearly half of the world's LNG and Japanese utilities negotiated supply agreements in unison. With the growth in regasification capacity elsewhere, Japan now purchases less than one-third of the world's LNG and its utilities have recently forgone cooperation in negotiating supply contracts. As LNG import markets continue to become more diverse, the producer group's bargaining power will grow.

Over the next several years, we expect the exporting countries to seek more favorable contract terms when indexing gas prices to oil or petroleum products and to demand greater benefits from the flexibility of diversion clauses in LNG supply contracts, an issue that Trinidad's

government recently raised with shareholders of its Atlantic LNG project. Furthermore, those GECF countries with access to capital may follow Qatar Petroleum's lead by investing in regasification capacity in consuming countries, giving them more direct access to export markets. A GECF presence in regasification projects could further encourage cooperation as state-run companies mimic international oil companies by swapping access to regasification capacity, in effect assuring reliable transit routes for their gas.

A decade from now, LNG will account for a greater share of global gas supply and many of the long-term supply contracts will be expiring, bringing unprecedented flexibility to the market just as potential export destinations will be more diverse. Although exporting countries will face a very high opportunity cost in the prospect of maintaining spare liquefaction capacity, there are other avenues through which the group may influence short-term market dynamics. The producer group's greatest opportunity may lie in linking this flexibility to the inability and political unwillingness to export gas from North American markets. The US is often considered the swing consumer in the LNG market, soaking up any excess cargoes when global demand slackens but the GECF would be wise to focus on the US market more explicitly.

Although it will be difficult for the GECF to unilaterally boost North American prices, it can certainly limit supplies to other markets by directing cargoes toward the US even if the market offers less attractive economics. Dumping LNG into the US would preclude the unattractive prospect of maintaining idle liquefaction capacity while shifting the short-term fundamentals of the larger export markets of Europe and Asia, particularly during periods of peak winter demand. Indeed, there have already been occasional rumblings in the market that LNG cargoes have arrived in the US despite slightly less competitive netbacks as exporters become wary of saturating other markets.

The GECF can utilize gas swaps to the benefit of members, most notably Russia, that lack access to waterborne export routes or others that are more distant from premium markets. The LNG market is notoriously opaque, lending the advantage of information asymmetry to the GECF; the small number of tankers relative to the oil market should aid the group in coordinating activities as well as ensuring compliance, which will be difficult without the threat of spare capacity hanging over many of the smaller producers.

For the next several years, however, these kinds of market interventions will be but a pipe dream for the GECF, and the divergent interests of the key producers are likely to derail such coordination. In the meantime, consuming countries facing higher prices may introduce innovations of their own. It was the Suez Canal crisis of 1956, after all, that presaged a more liquid global oil market and prompted the development of the supertankers that have become commonplace. Creating an equally liquid natural gas market, however, will be more difficult because the regulatory, commercial, and infrastructural obstacles are more daunting. European and Asian consumers, therefore, should hope that internal harmony proves elusive for the GECF. As the GECF inches ever closer to short-term supply management, governments of consuming countries are likely to act along a new dimension of the geopolitics of energy, seeking ways to develop rifts within the new producer group to preempt such coordination.

Scenarios of Russian Energy Future

by Alexei A. Makarov*

Since 2007, the new Energy Strategy up to the year 2030 is being developed as per the Innovation Scenario produced by the Ministry of Economic Development, Russian Federation (MED). Moderate increase of world oil prices is envisioned in this scenario after the slight decline in 2007-2008. In 2015, the oil price is expected to reach 60-70 \$/bbl and 75-85 \$/bbl by the year 2030. New innovative technology is expected to become the main source of growth in certain sectors of the traditional economy such as energy, transportation, and agriculture as well as in some high-tech branches. The MED calculates that the annual Russian GDP growth rate in 2011-2015 will average at 6.2 percent a year with acceleration to 6.6 percent in 2016-2030. GDP will more than quadruple from 2005 to 2030.

The Energy Strategy shall not ignore some major uncertainties related to world energy developments – a long-term probability of high energy prices and coordinated measures of major industrialized countries to reduce emissions of greenhouse gases to prevent climate change. Based on the MED's Innovation Scenario, ERIRAS has developed two additional scenarios, which were calculated using ERIRAS' Sectoral Macroeconomic Model. This model has a similar purpose and structure as a regional block of the US EPA's SGM and IGEM models¹ with the added feature of financial assumptions about development of particular sectors and the economy as a whole.

The Favorable Scenario corresponds with higher world prices for energy and other raw materials.² Higher export revenues would allow for transformation of Russia into a world leader in the production and export of high-tech processed materials for wide usage [*this concept is described in more detail in source 8*]. Low cost hydro power from mainly Siberian sources will facilitate production of high quality materials with higher added value.

The Ecology Scenario creates lower environmental impact and corresponds with moderate oil prices. In this scenario the economy will grow more slowly because of additional cost of environmental protection. Model calculations describe the Favorable Scenario's GDP growth rates as being 0.3-0.4 percentage points higher than those in the Innovation Scenario. The same calculation in the Ecology Scenario provide 0.3-0.4 percentage point lower figures. As a result, the GDP growth rate sensitivity to oil price change plays a less significant role than infrastructural and technology issues.

The main problems facing the Russian energy sector are the result of the extraordinary high energy intensity of the national economy. In 1990, the Russian GDP energy intensity was almost 6 times higher than the world average. By 1996-1998 this gap increased to 7 times. As the economy started to grow toward the end of the 1990s, GDP energy intensity started to decline. The high rate of decline could be compared only to previous Chinese performance. In 10 years Russia has reduced the difference by one third but now the gap is still about 3.5 times the world average and 9 times the US and EU performance data. So, the reduction of GDP energy intensity continues to be the main priority of the Russian Energy Strategy.

However, according to the Innovative and Favorable Scenarios, the reduction of GDP energy intensity will slow down as compared to record breaking rates of the past decade because of the following two reasons: First, from one quarter to one third of the actual reduction has resulted from the growth of energy export prices. With the moderate increase of energy costs of actual material exports GDP input has more than doubled thanks to galloping world prices. Second,

*Professor Alexei A. Makarov is President, ERIRAS and an Acting Member of the Russian Academy of Science. Since 1984, he has headed the Energy Research Institute of the Russian Academy of Sciences, the leading authority on Russian energy policy. Professor Makarov has authored numerous works related to energy development, energy economics, and systems studies. His most recent book is entitled **Russian Power to the Year 2030: An Outline of a Desirable Future**, ERIRAS, Moscow, 2007.

the restoration of the economy after the post-Soviet crisis was completed and transition to a more capital intensive phase would necessarily be more energy intensive. As a result, we expect that energy consumption will increase by 65 to 76 percent from 2005 to 2030 (see Table 1).

Table 1: Scenario Assumptions

	Favourable			Ecology		
	2005	2015	2030	2005	2015	2030
Population (million people)	143	140	142	143	140	142
GDP Growth Rate (percent/year)	6.4	6.9	4.9	6.4	6.5	4.5
Personal Consumption (2005 = 100)	100	186	435	100	184	410
Per Capita Energy Consumption (tce)	6.65	8.2	11	6.65	7.9	9

The Ecology Scenario is not feasible if the rates of GDP energy intensity reduction can not be sustained at the levels achieved in 1998-2007. It will require introducing a number of regulations and economic incentives including equalizing domestic natural gas prices³ with export prices and introducing greenhouse gases emission payments.⁴ Under active implementation of the above measures, the energy consumption in the Ecology Scenario will increase only by 35 percent or only by half of that in the more conservative scenarios.

Russia owns one fifth of the world reserves of organic fuel, but over the last two decades the annual reserves additions were significantly lagging behind production.

Table 2: Russian Energy Scenarios

	2005	2010	2015			2020			2030		
			1	2	3	1	2	3	1	2	3
Demand (mln tce)	949	1062-1055	1180	1195	1115	1315	1355	1175	1585	1680	1270
Natural Gas	495	561-555	607	618	590	650	670	610	695	730	610
Petroleum	181	207-209	245	245	235	270	275	245	325	345	270
Solids	167	180-178	205	210	165	235	250	155	300	320	135
Non-Fuel	106	115-113	125	122	125	160	160	165	270	285	255
Energy Exports (mln tce)	865	926-935	1000	1060	1015	1035	1125	1055	1025	1090	1075
CIS	117	170	170	170	170	170	170	170	130	130	135
Europe	613	641-647	675	710	680	650	730	655	650	695	690
Asia	75	115-118	155	180	165	215	225	230	245	265	250
Supply (mln tce)	1733	1890-1898	2080	2155	2030	2250	2360	2135	2525	2645	2270
Natural Gas (bln m ³)	641	700-707	800	830	790	880	895	850	940	970	870
Petroleum (mln t)	470	507-510	530	560	530	535	595	535	560	600	560
Coal (mln t)	299	343-335	385	387	330	440	450	320	525	545	300
Hydro (bln kWh)	175	183	200	200	202	245	255	247	330	390	325
Nuclear (bln kWh)	149	172-168	225	225	225	330	330	330	600	600	580
Renewable (mln tce)	2	4-5	9	9	15	15	15	28	35	35	70
Energy Imports (mln tce)	80	99	100	105	115	100	120	125	90	130	130
1 = Innovation Scenario 2 = Favourable Scenario 3 = Ecology Scenario											

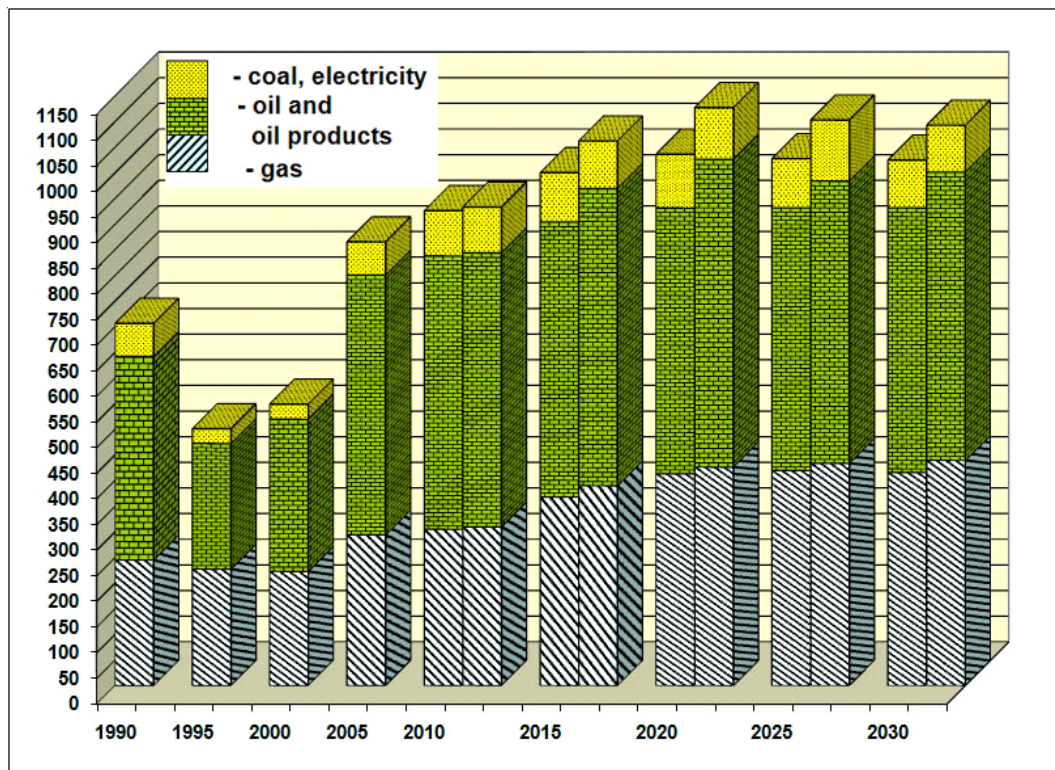
If the exploration and upgrade from probable to proven reserves would be accelerated (the Energy Strategy assumes some complex measures to make it happen), commercial primary energy production in the Innovation and Favorable Scenarios should increase by 45 to 55 percent from 2005 to 2030 (see Table 2). Energy supply structure will change in a favorable direction – share of coal, nuclear and renewable energy will increase by half thus replacing petroleum, which will drop from a 39 to 32 percent share. However, the share of natural gas will stay at its current level of 42-43 percent. This means that Russia would not be able to further diversify energy supply structure, and natural gas would continue to play a dominant role.

One of the main goals of the Energy Strategy is to define an efficient natural gas production strategy in terms of depletion of old reserves and new gas fields development. We expect Russian annual gas production to peak in 2030-2050 at 950 bln m3 with a following acceleration of conventional gas production decline partly compensated with development of huge hydrates deposits.

Another important goal is to assure an efficient development of the national electric power sector. With expected growth of the economy and energy consumption as forecasted in the Energy Strategy, power station capacity in the Innovation and Favorable Scenarios should increase by 2.1 to 2.3 times from 2005 to 2030, with tripled growth of transmission lines. Power generation would increase by 2.4 times but the introduction of new technologies would slow down its demand on primary resources. Total use of primary resources in power generation would grow only by 1.9 to 2 times and organic fuel consumption by 1.7 to 1.85 times. Natural gas usage will increase only by 42 to 50 percent thus decreasing its share in the power sector fuel mix from 68.6 percent in 2005 to approximately 57 percent in 2030.

Commercially sustainable energy exports under accepted price assumptions shall increase 20 to 30 percent by the year 2020 and then will start a slow decline mainly due to decline of oil exports (see Figure 1). Dependency of the Russian economy of energy exports will also gradually decline. Diversification of export routes with a growing share of exports to the Asia-Pacific region from 8.7 percent in 2005 to 23-24 percent in 2030 shall reduce an absolute dominance of the European market in the Russian export shipments.

Figure 1: Russian Energy Exports
(mln tce)



The above scenarios shall significantly increase the environmental impact of the Russian energy sector. By 2020, greenhouse gases emission shall exceed 1990 levels taken as a base in the Kyoto process and, in 2030 levels will exceed that threshold by anywhere between 11 and 17 percent. This presents a threat to sustainable development in Russia.

In the Ecology Scenario the results are much more favorable. First, power generation will be significantly different. Nuclear and hydro power will be prioritized as in other scenarios. Instead of coal stations modern steam-gas technology will be used. This will significantly reduce total primary energy consumption as compared to traditional scenarios. Renewable energy also will be fast growing, especially biomass usage. Share of natural gas in power station fuel mix will be up to 74 percent higher but its actual consumption will be lower than in traditional scenarios.

Declining gas consumption in the power sector shall allow natural gas production to stabilize without reduction in gas exports. After 2015, coal production also could start declining. As the result, greenhouse gas emission by energy sector shall stabilize in 2015 – 2020 at 80 to 82 percent of 1990 levels and then shall further decline to 78 to 80 percent by 2030. This will require an increase of investments into energy conservation, which will lead to technological modernization of both energy production and energy consumption. Energy investments will grow more slowly because of lower demand on gas and coal and lower capital needs of gas feeds as compared to coal supplies.

The Russian energy sector creates a heavy load onto a national economy well exceeding comparable figures for other countries with the notable likely exception of Saudi Arabia. The International Energy Agency reports that a 1.5 percent of GDP world investment in the energy sector has taken place over the last 20 years. The agency forecasts 1.3 to 1.5 percent GDP investments up to the year 2030. This will create a huge 20 trillion+ dollar capital pool but the overall level of economic load would not change over current levels and may even decline.

In sharp contrast, according to traditional scenarios, Russia shall invest between 6 and 8 percent GDP annually against the 4 percent which was spent in the last five years. Such a load will bring the economy to its limits. It is still not clear if Russian would be able to bring this to acceptable levels in the Ecology Scenario. Based on our previous studies, we can conclude that at the price of a slower GDP increase and personal consumption growth the Russian economy may get additional incentives for innovative development because of wide technological renewal of overall energy sector and slower growth of traditional heavy industries – oil, gas and, especially, the coal industry.

The world economic crisis has caused significant changes in Russian economic and energy prospects. Existing forecasts are being corrected towards lower figures, which shall promise some lowering of the environment impact of energy development. Rational combination of economic growth with energy sector development and environment protection plus creation of organizational approaches to its realization, constitute the main content of the Russian Energy Strategy.

Endotes

¹<http://www.economics.harvard.edu/faculty/jorgenson/files>

²Price of Urals Russian export blend will increase in this scenario to \$90/bbl in 2015, \$95/bbl in 2020, and \$110/bbl in 2030.

³All these years natural gas secured more than half of national energy supply at prices several times lower than comparable prices of oil products and even coal.

⁴Preliminary estimates show that even such a moderate price as 10-15 Euro per ton of !•2 can significantly improve commercial attractiveness of many energy conservation measures and non-fuel energy sources.

Sources

1. World Energy Outlook 2007. - International Energy Agency, Paris, 2007.
2. International Energy Outlook 2008. DOE/EIA-0484(2008). - U.S. Department of Energy, Washington, 2008.
3. Energy Policy Scenarios 2050. - World Energy Council, Rome, 2007.
4. D. Yergin. Oil at the Break Point: Prepared Testimony before the US Congress Joint Economic Committee. Special Report. - Washington, DC, June 25, 2008.
5. Energy Technology Perspectives. - International Energy Agency, Paris, 2006.
6. Simulation Models for Development of the Energy Strategy and Monitoring of Its Implementation. – Russian Energy: Development Strategy, Ministry of Energy, Russian Federation, 2003. – P. 677-750.
7. D.V. Shapot, A.M. Lukatski, V.A. Malakhov, A.A. Makarov. Analytical Tools for Qualitative Studies of Energy and Economy Relations. – Economics and Mathematic Methods, V.38, 2002, #1.
8. A.A. Makarov. Russian Power to the Year 2030: Outline of Desirable Future. - ERIRAS, Moscow, 2007.

Publication Date: March 2, 2009

Submit manuscripts and Letters to the Editor to Sulayman Al-Qudsi, Editor-in-Chief, *Geopolitics of Energy*, in-care-of the address below or via email at sal-qudsi@ceri.ca. Manuscripts dealing with energy and geopolitics, generally between 2,000 and 4,000 words in length, will be considered for publication. Unsolicited manuscripts will undergo peer review by members of the editorial board.

Available by subscription for \$500 (US) per year; \$250 (US) per year for universities. For Canadian residents—\$600 (Cdn) per year; \$300 (Cdn) per year for universities—plus GST.

Publisher: Canadian Energy Research Institute, #150, 3512 - 33 Street NW, Calgary, Alberta, Canada T2L 2A6 Telephone: (403) 282-1231; Fax: (403) 284-4181; Email: ceri@ceri.ca.

Reproduction without permission is prohibited.

