The Impact of Nationalization and Insecure Property Rights on Oil and Gas Developments in Russia's Asia Pacific

Judith Thornton

University of Washington

GIARI Occasional Paper

November 2009

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The Importance of Energy

The dependence of the Russian economy on oil and gas is well-known. Conditions in world markets for oil and gas have long played a determining role in Russia's economic growth and level of income. Writing in a series of articles, Clifford Gaddy and Barry Ickes detail the historical importance of oil and gas to the Russian economy, documenting how volatility of revenues from oil created volatility in Soviet and Russian economic performance and contributed to the collapse of the Soviet Union.[1] They argue that, in recent years, the Putin government has succeeded in centralizing and managing resource revenues using a strategy based on insecure property rights. Although this strategy stabilized the economy and centralized resource rents, it did little to foster diversification. Moreover, this strategy creates opaque, inefficient institutions for administering the larger economy.[2] They characterize Putin's control of property rights as a protection racket, since the agent receiving payment for protection is also the source of threat.

Insecure property rights impede structural change, diversification, and the productivity improvements that Russia urgently needs. They generate ubiquitous corruption. Nevertheless, in a period of rising resource revenues between 2000 and 2007, these structures provided the federal government with stability and control.

In September 2009, President Dmitry Medvedev raised resource dependence and corruption as the central issues for Russia's development strategy.[3] His essay published in *Gazeta.ru* and posted on the presidential web site begins: "In a few months Russia will enter a new decade of the twenty-first century. …First, let's answer a simple but very serious question. Should a primitive economy based on raw materials and endemic corruption accompany us into the future?

"The global economic crisis has shown that our affairs are far from being in the best state. Twenty years of tumultuous change has not spared our country from its humiliating dependence on raw materials. Our current economy still reflects the major flaw of the Soviet system: it largely ignores individual needs….

"To sum up, an inefficient economy, semi-Soviet social sphere, fragile democracy, negative demographic trends, and unstable Caucasus represent very big problems, even for a country such as Russia."

Thus, President Medvedev addresses the Kremlin elite with the same questions posed by Western observers: Do the federal institutions developed for centralizing resource rents block the Russian government's ability to modernize its economy? Do they impede modernization built on a healthy, well-trained population, which can take

initiative in an environment that provides them with rule of law and safeguards them from hold-up by criminals or bureaucrats?

Until Russia diversifies its economy, future public and private investment in Russian energy will depend on uncertain future conditions in energy markets. Private investment will depend, as well, on the overall Russian environment for investment. In the short-run, both high levels of market uncertainty and Russia's insecure environment for property rights impede investment and growth of energy production.

Gaddy and Ickes refer to the political economy of Russian resource dependence as "Russia's addiction to oil." Measured in constant dollars of 2006, energy revenues peaked in the early 1980's at more than $350 billion, or about 40 percent of GDP. Then, they plunged in 1986, threatening the ability of the Russian government to earn foreign exchange and import foodstuffs. Writing in *Collapse of an Empire*, Yegor Gaidar details how falling foreign exchange revenues in 1989 contributed to the growing crisis and ultimate collapse of the Soviet economy.[4]

It was only after 2000 that burgeoning demand for oil in developing countries contributed to rising oil prices and a recovery of Russian oil production. World price of oil rose from $13 per barrel in 1999 ($17 per barrel in constant 2008 prices) to $97 per barrel in 2008.[5] Between 2000 and 2004, production of private oil firms expanded rapidly. Then, after the expropriation of Yukos and its sale to Rosneft, growth slowed and stagnated again. Still, in 2007, production of oil, oil products, and natural gas were estimated to account for more than one-fourth of GDP, 60 percent of the value of exports, and almost half of government budget revenue.[6]

The Political Economy of Resource Dependence

Does Russia suffer from a "resource curse?" Other things equal, natural wealth tends to be positively related to per capita income. Still, availability of resources may have negative consequences for other sources of growth. For example, a resource exporter will import other products, such as manufactured goods for domestic consumption and investment. When manufactured products enjoy rapid technological progress, then a resource exporter may lose out on this source of modernization.

There are political reasons, as well, why resource abundance does not always lead to development. If the government is the resource owner, then government use of resource revenues will determine whether rents are spent in support of growth—for example, for infrastructure, health, and education—or if the revenue is distributed to favored groups in society. When the government becomes a source of rent-seeking, then interest groups will tend to compete for control of the power to capture and redistribute rents. When this occurs, government policies are likely to be detrimental to efficiency and economic growth.

Since the onset of reform, Russian institutions for managing resource wealth have been subject to conflicting forces. In the natural gas industry, many of the inefficient and opaque institutions of the Soviet command system were perpetuated in Gazprom. As in the former Soviet system, the domestic prices of natural gas remained low and financial flows were opaque, affording resource managers numerous opportunities for private benefits.

In the oil industry, oligarchic ownership emerged. Between 1992-1995, insider privatization of vertically-integrated production and refining networks created a dozen independent oil companies. As oil prices rose after 2000, these independent oil companies committed substantial investment to the rehabilitation of their mature oil fields and the development of new fields, mostly in the West Siberian basin, generating a rapid growth in the volume of oil production. However, aware that their property rights were hostage to the whims of the Kremlin, private investment by oligarchs focused on short-term gains that could be realized by oil-field re-engineering, well repairs, and well stimulation. As the sum of the tax on mineral extraction and export taxes rose and the federal government's marginal taxes on each barrel of export approached 90 percent, oil production stagnated again.

Since 2004, with the rise of national oil companies in Russia, a new, but familiar, model is emerging. In 2003, Rosneft took control of Yukos. Then, Gazprom purchased Sibneft. Next, government forced Royal Dutch Shell and its partners to sell a controlling stake in Sakhalin-2 to Gazprom and forced TNK-BP to give up its giant Kovykta gas field in East Siberia. By 2008, the share of state-owned companies in oil production had grown from about 27 percent to almost 40 percent of oil output.

Anders Aslund refers to Putin's model as "state capitalism, noting that Putin's peculiar form of state capitalism involves a heavy dose of implicit taxes and subsidies."[7] It is a world in which Putin requires Roman Abramovitz to subsidize remote Chukhotka, forces Oleg Deripaska to pay wages to unemployed workers at Pikalevo, and compels the largest industrial firms to construct infrastructure for the Olympics in Sochi.

The consequences of Russian nationalization are best described by a simple model of hold-up, or risk of expropriation. The risk of expropriation reflects the uncertain rights to future income faced by a multinational investor. At each point in time, the host country weighs the gain from expropriating the current investment against the loss of future streams of investment and management know-how. In a basic model, a multinational firm (M) is considering an investment in a host country (HC), which is capital constrained. (For example, we might apply our model to Exxon's investment in oil and gas on Sakhalin Island.)

If M invests $K \geq 0$ in an initial period 0 and takes action a in period t, then the project generates a net revenue of

- $R_t = R(K, a_t)$.
- There are two possible actions in any period, engage in the efficient rate of production, ā, or shift resources out of HC, ă.
- $R(K, \bar{a}) > R(K, \breve{a})$, $K>0$
- Note that the action, a_t, also changes profits realized elsewhere, denoted by $r(a_t)$.
- This first-best allocation of K and ā generates a surplus
- $$\frac{\delta}{1-\delta}[R(K^{FB}, \bar{a}) + r(\bar{a})] - K^{FB} > 0$$

where δ is the risk-free discount at which M discounts future income. The parties can't commit on how to share the returns once investment costs are sunk. HC is tempted to expropriate the "quasi-rents" by imposing additional taxes, import or export duties, or unnecessary "costs."

The timing of agreement implies that there is an agreement on an implicit contract specifying K, a_t, and tax, T_t. Then, M invests K, chooses action, a_t, after which the return $R(K,a_t)$ is realized. At this point, HC chooses the tax, T_t. With this agreement, the expected returns are:

- $U_M = -K + \sum_{t=1}^{\infty} \delta^t T_t \; [R(K, a_t) + r(a_t) - T_t]$
- $U_H = \sum_{t=1}^{\infty} \delta^t T_t$

For this agreement to persist, it must meet participation and incentive conditions. The host country must be better off imposing a tax, T in every period rather than expropriating the entire return R(K, $\bar{a}$) in one period and R(K, $\breve{a}$) thereafter. M prefers to take action $\bar{a}$ a pay tax, T, rather than choosing $\breve{a}$ and paying T= R(K, $\breve{a}$) if R(K, ā) + r (ā) - T > r(ă) . The project must be sufficiently profitable for M to cover its initial capital outlay. However, if K has been sunk, the maximum per period return M can get is given by R(K, ā) – R(K, $\breve{a}$). Otherwise the host country cannot be prevented from expropriating M. After the fact, the host country will expropriate whenever the gains from current expropriation exceed the loss of expected future revenues from investment and technology. Note that M can reduce the benefits to the host country of expropriation if the initial capital stock is financed by debt attached to project assets.

Russian policies as to whether to nationalize its energy production seem to be in flux, given that Russia badly needs both foreign direct investment and technology. A new Energy Strategy of Russia to 2030, published by the Ministry of Industry and Energy, sees the Russian government playing a key role until 2014, as a source of investment

funds and credits. After that, the financing of investment and infrastructure, totaling more than two trillion dollars, is to come from energy companies themselves and from financial markets, with the government playing a regulatory role.[8] Will this investment be forthcoming? At the moment, the investment for private FDI into oil and gas is limited.

The target figures for domestic energy production and consumption in Russia's Energy Strategy posit modest change, with relatively little reduction in Russia's high energy to output ratios. The largest shift in this forecast is a planned rise in the state's export of energy to the Pacific. The shares of oil exports to China and Asia will increase from the current 6 percent to 20-25 percent, natural gas, from almost none to 20 percent of export.[9]

Russian Energy in the World Economy

To achieve the planned increases in energy exports, Russia must develop new Asian sources of supply. However, its eastward expansion of production is constrained by location, logistics, and the immense investment costs of bringing Asian energy to market. Russia's ability to attract this investment, in turn, will depend on the constraints that the government places on foreign business and on Russia's protection of property rights.

Russia's resource stocks are vast. Today, Russia and the CIS together provide 15 percent of world oil output, compared with the Middle East share of 29 percent. In 2008, Russia's oil production of 9.9 million bpd was second only to Saudia Arabia's.[10] In

2009, Russian oil production ranks first. On the other hand, Russia's share of proved oil reserves (6.3%) is dwarfed by OPEC reserves—76 percent of the total.

Russia's endowment of natural gas is still larger. It has 23.4 percent of world reserves and provides 19.6 percent of production.

[Insert Figure 1: World Share of Oil Production]

[Insert Figure 2: World Share of Gas Production]

[Insert Figure 3: Crude Oil Output by Region 1990 and 2007]

[Insert Figure 4: Natural Gas Output by Region 1990 and 2007]

The regional structure of Russia's resource wealth has been remarkably constant over the past twenty years. The West Siberian Basin is Russia's major energy producing region, accounting for 71 percent of oil output and 92 percent of gas output. It is a low-lying, flood-prone marsh. A line of low hills divides the region. South of the divide, in the Khanty-Mansiisk Autonomous Okrug are found the major oil resources, extracted by vertically-integrated majors such as Surgutneftegaz, Rosneft', and LUKoil. North of the divide, is the Yamal-Nenets Okrug, where the bulk of natural gas is extracted.[11]

Initial Conditions and Recent Developments in the Oil Industry

Russia entered the transition era with a large energy infrastructure in both Khanti-Mansiisk and Yamal-Nenetz. However, the Russian oil industry suffered from low technology and the short-run orientation of past extraction. James Smith estimates that Russian producers lost approximately 40 percent of the total economic value of resource stocks compared with similar fields in the West.[12] Moreover, the low quality

of infrastructure resulted in physical losses of product and immense environmental damage. In an interview conducted by editors of Petroleum Economist in 1996, senior executives of Rosneftegazstroy, Russia's larges oil and gas contractor commented:

> "…the majority of the pipeline construction projects, except for the trunk ones, did not comply with, or meet, world standards… The inappropriate use of corrosion inhibitors and electrochemical protection units has resulted in high corrosion rates in pipelines… The lack of on-line pipeline diagnostics has meant it has been difficult to detect damage and to prevent leakage of gas, oil and oil products.
>
> "As a result, the number of registered accidents at pipelines runs to thousands a year. The number of 'insignificant' leaks exceeded 40,000/year…
>
> "Instead of the design service life of 15 to 20 years, many in-field pipelines become unserviceable, due to internal corrosion and erosion, within as little as two to five years.[13]

In September 1999, this author talked with the head of an environmental-remediation firm who reported that, in Komi, en route to inspect a major oil spill, he counted 16 other pipeline leaks in the space of 30 kilometers.[14]

Thus, at the start of transition, the Russian oil industry had much to gain from access to state-of-the-art foreign equipment and practices. There were large potential gains to be reaped from both oil field re-engineering of existing fields and new field development.

Early in transition, Western oil majors and oil service firms entered into a number of attempted joint projects in Russia, but the uncertain status of control of resources, a chaotic business environment, and difficulties in gaining access to transmission infrastructure rendered these early efforts unprofitable—sometimes, spectacularly unprofitable.

Multinational energy companies attempt to maintain a presence in any country, like Russia, that is both a major producer and a major market for energy. Nevertheless, international energy executives found the Russian environment uniquely difficult. In industrialized countries, they argued, the oil producer finds strong physical and institutional infrastructure, a strong network of suppliers and services, developed financial markets, and an effective legal framework. But there are also many competitors.

In developing countries, there is little local infrastructure or industrial support, a weak capital market, and an incomplete legal framework. But, in these markets, policy makers are eager to establish state-of-the-art industry and willing to construct physical and institutional infrastructure to foster development. While developing countries are likely to impose domestic price controls and high taxes, the formation of strong relationships can create a relatively stable business environment for the firm and provide some barriers to competition.

The Russian environment represents a third case in which there is a large and politically powerful domestic oil and gas industry that has incentives to block foreign competition. Initially, a body of legislation informed by international practice promised

to provide a predictable framework for energy development. However, as a system of crony capitalism emerged, both formal administrative practices and informal practices contradicted formal laws, creating an environment in which corrupt practices and hold-up problems were common. Since 2003, as the Russian government extended government control over "strategic" firms, the constraints on foreign participation in the energy sector loomed large.

In the 1990's, the one apparent exception to Russia's difficult environment for energy development was Sakhalin Island. Western multinationals were willing to undertake investment in Sakhalin's off-shore resources because it appeared that Russian firms lacked the technology or investment funds to develop them. On Sakhalin, producers expected to have direct access to the Pacific market without facing potential hold-up by Transneft' or Gazprom. They expected production-sharing legislation to guarantee access to the world market and to establish a secure framework of taxation, eliminating some of the opportunities for creeping expropriation. On Sakhalin, multinationals formed strong, cooperative relationships with the regional government administration, in a region that faced high levels of unemployment and which valued both the infrastructure investments provided by the multinationals and the strict framework for environmental protection that they established.

Elsewhere, in other, traditional oil-producing regions of Russia, the collapse of production to half of former levels between 1986 and 1997 was followed by a rapid recovery in the period 2000 to 2004. After the ruble devaluation in August 1998, Russia's nine largest vertically-integrated private oil firms undertook substantial oil-field

re-engineering to bring idle wells back into production.[15] They undertook new field development, accessing smaller reserves in established fields.[16] Between 1998 and 2005, the Russian oil majors increased their production from 279.3 million tons to 448.6 million tons.[17] Since then, crude oil production has been approximately constant at about 488 million tons, as new production at Sakhalin-1 offset modest declines in older fields. Although the quantity of oil produced and exported showed modest growth after 2005, the value of exports surged in response to rising oil prices that went from $156 per ton to $684.3 per ton between 2001 and 2008.[18] Then, the collapse of oil prices in late 2008, led to a collapse of federal budget revenue and capital flight. Yet, as oil prices have risen again in 2009, Russian oil exports have grown rapidly again.

[Insert Figure 5: Crude Oil Production 1985-2008]

[Insert Figure 6: Export of Crude Oil and Oil Products 1992-2008]

Looking ahead, changes in oil production and export will depend crucially on world prices and domestic export tariffs, but, with national oil companies playing the lead role, the regional structure of production is likely to show only a modest shift toward East Siberia and the Russian Far East (RFE). Much of the expansion of oil output will continue to come from legacy fields in West Siberia and new resources in the Timan-Pechora Basin, the Caspian. If the government is serious about implementing an ambitious new Energy Strategy, which promises to increase Asia's share in oil exports to 20-25 percent, they will have to commit or attract a huge volume of investment. Each of the proposed new projects—further development of fields on Sakhalin, Rosneft's Vankor field in northern Krasnoyarsk, and development of reserves in the Evenki

Autonomous Okrug, northern Irkutsk, and southern Sakha—will require major up-front commitments.

In 2009, construction of the first leg of Transneft's East Siberian-Pacific Ocean pipeline network is underway. Now, industry observers ask what potential fields will provide oil to fill the pipeline and when. We discuss these individual projects, below.

[Insert Figure 7:

Initial Conditions and Recent Developments in the Gas Industry

Russia's initial conditions in the natural gas industry were more favorable than in the oil industry, and, yet, natural gas production contributed little to recent growth of energy production. In 1990, Russia had the world's largest gas production and transport industry, largely centered in four giant fields—Medvezh'ye, Urengoy, and Yamburg, and, recently, Zapolyarnoye—located in Yamal-Nenetz district in West Siberia.[19] However, as output from Gazprom's super-giant fields declined during the 1990's, so did Gazprom's production.

Initial arrangements for ownership and control of the gas industry created opportunities for rent-seeking instead of growth. In an inflationary era, domestic gas prices were below variable costs. Moreover, since Gazprom had no control over pricing and was not allowed to cut off non-paying customers, huge payment arrears accumulated in the domestic gas and electric power industries. In 1996, 57 percent of gas payments were settled by mutual offsets or barter.[20] Gradually, beginning in 1999,

non-paying companies were disconnected and Gazprom took over indebted municipal gas distribution systems.

Nevertheless, in the 1990s Gazprom's finances remained opaque and the state monopoly provided a major channel for income and asset stripping. In 2001, Rem Vyakhirev was replaced by Alexey Miller, Deputy Ministry of Energy, and by 2005, the former managers had been replaced by managers with close ties to President Putin. Nevertheless, sales through trading intermediaries still create opportunities for rent-extraction.

Even now, domestic gas prices are regulated to just cover variable costs. In January 2005, average domestic price was just $38 mcm compared with an average contract price of $155 in Western Europe. With price controls, Gazprom provides annual allocations of gas to domestic customers at regulated prices, with residential customers enjoying lower prices. Industrial customers then bid for additional gas at higher prices, accessing supplies from independent producers. Today, a growing percentage of gas supply—currently about 16 percent--is provided by independent producers. These companies are generally vertically-integrated oil majors—LUKoil, Surgutneftegaz, and TNK/BP—which produce associated gas. This gas may be sold in the domestic economy, but Gazprom retains a monopoly on export, selling to Europe through a wholly-owned subsidiary, Gazexport.

During the 1990's Gasprom established joint venture marketing companies throughout Europe, holding 30-50 percent of the equity in each. Today, Gazprom seeks to maintain a monopoly of export delivery, limiting access of Central Asian producers to

non-Gazprom transit. However, Gazprom's attempted monopoly is a source of conflict in Russia's negotiations of WTO membership with the European Union. The EU wishes to eliminate Russian gas export tariffs, domestic price controls, and restrictions on gas transit for Central Asian gas. It seeks non-discriminatory transit tariffs for gas deliveries, the right of foreign investors to access Gazprom's network, and private rights to construct their own pipelines. These issues remain unresolved.

The financial significance of gas export sales is substantial. In 2003, European sales accounted for 30 percent of gas volume but 65 percent of total revenue. European gas revenues are estimated to have increased from $16.6 billion in 2000 to $43 billion in 2006, and to $66.4 billion in 2008.[21] However, unlike oil exports, gas exports were down substantially in 2009.

In the past decade, Gazprom has directed relatively little of its revenue to expansion of its upstream reserves and production. Instead, it maintained deliveries by purchasing gas from other Russian producers and from Central Asian producers, using its European revenues to acquire downstream distribution systems. In the future, Gazprom will have to turn to new fields to offset the steady decline of production from its mature fields. There are large reserves in the Yamal Peninsula, the giant Shtokman field in the Barents Sea, off-shore Sakhalin, Kovykta, and other, smaller fields in Krasnoyarsk, Irkutsk, and Sakha. Yet, the cost of production and transportation of natural gas from each of these sources is considerable, and Gazprom is ill-equipped to carry out these projects. Its domestic costs are far higher than costs of independent producers, such as Novatek. Hermitage Capital reports that Gazprom's construction

costs for the Blue Stream pipeline were three times higher per kilometer than construction on the Turkish side of the border.[22] Still, in the current environment, Russia's national energy companies, Rosneft' and Gazprom, are slated to play a crucial role in the supply of Russian energy to China and all of Asia. The form of Western participation in these efforts is still unclear.

[Insert Figure 8: Production and Export of Natural Gas]

[Insert Figure 9: Major Russian Gas Basins]

[Insert Figure 10: Value of Energy Exports]

Expansion of Energy Production in Asian Russia; the Case of Sakhalin

The substantial transfer of effective ownership from private firms to government control since 2003 provides a cautionary example for Western multinationals. Surging prices for oil and gas between 2002 and 2008 created incentives for the Russian federal government to recapture control rights to natural resource stocks. This re-nationalization of resource ownership takes many different forms. It involved the expropriation of Yukos and the sale of Yuganskneftegaz to Rosneft for $9.35 billion, the purchase of Sibneft by Gazprom, the sale of 50%-plus one share in Sahkalin-2 to Gazprom, the sale of TNK-BP's interests in the Kovykta gas field to Gazprom, and the transfer of development rights to several off-shore fields on Sakhalin to state-owned Rosneft' and Gazprom. Two projects, Sakhalin-1 and Sakhalin-2, originally developed by Western multinationals, now face uncertain prospects with substantially changed rules of the game. Most of the rights to additional fields on Sakhalin have been assigned to state-owned Rosneft'. In the case of Sakhalin-3, Rosneft' is conducting exploration on

the Veninskii block of Sakhalin-3 with China's Sinopec. Gazprom is engaged in preliminary exploration of the Kirinsky block of Sakhalin-3.

After the fact, did Western multinationals misjudge the risks of investment in Russia? In the 1990's investment on Sakhalin seemed to benefit all parties. Sakhalin's location on Russia's periphery, only 60 kilometers from Japan, gave it strategic importance to Moscow. Moreover, the island faced high unemployment and a fall of population from 715,000 to 526,000. In the mid-1990's energy prices were low, domestic energy companies had few resources for investment, and Sakhalin's remoteness from Moscow weakened the interest of competing domestic oil companies to undertake development there. There were technological reasons, as well, for the Russian government to involve Western companies with experience in offshore development in difficult environments such as Alaska and the North Sea. Russian domestic firms had little such experience.

Western companies went ahead with two projects after Russia put in place a Law on Production Sharing, signed in 1995. The Russian Production Sharing Law granted an investor exclusive rights to prospect for and extract mineral raw materials from a designated site.[23] Licenses were issued jointly by the Federal Agency for State Mineral Resource Management and the territorial administration. However, international contracts were subject to parliamentary approval, and there were strict domestic content conditions. The Law provided that investors and the Russian government would share the output produced by a project after investors had covered the up-front investment costs of the project. During the initial investment period, investors

committed to make specific payments to the regional government and to undertake substantial investment in regional infrastructure.

The Production Sharing Law explicitly exempted the investors, their contractors, and subcontractors from taxes, fees, excises, and other obligatory payments except for profits tax, royalty payments, bonuses, exploration payments, land use payments, and insurance coverage of Russian employees. However, the Russian side reserved the right to make unilateral changes in arrangements in response to changes in world markets. There were few safeguards for the foreign investor in the event of a dispute.

A number of enabling laws and regulations followed, which capped the number of sites that could be developed under production-sharing rules. Gradually, increasing constraints were placed on production-sharing contracts until, by 2005, production sharing arrangements were no longer available.

Sakhalin-2 was the first firm to undertake production. Since 1999, it has been producing and exporting oil on a seasonal basis from one of its fields, Piltun-Astokskoye, using an offshore platform. By 2006, the Western partners in Sakhalin-2, Shell, Mitsui, and Mitsubishi had much to celebrate. Revenues to the Russian government exceeded $460 million in bonus payments, royalties, and taxes. With full production, the Russian government would receive $300 million per year in royalties, which would rise to $2 billion after cost recovery. Russian contractors had received $8.3 billion in contracts and 12,000 workers were employed.

However, a major ownership change was in the offing. Just as Gazprom and Shell entered into negotiations to swap some Gazprom assets for a 25% stake in the

project, Shell announced that estimated capital investment cost would rise to nearly $20 billion. Following a period of intense pressure on the international partners, an agreement was reached in 2007 for Gazprom to acquire a 50% + 1 share of the consortium for a total of $7.45 billion. Thus, today, the shareholder structure of Sakhalin Energy is Gazprom 50% + 1 share; Shell, 27.5% + 1 share; Mitsui, 12.5%; and Diamond Gas Sakhalin, founded by Mitsubishi, 10%. In return for government approval of a revised budget of $19.4 billion to 2014, the shareholders agreed to make a special payment of $1 billion per year to the Russian government, beginning in 2010, with the exact dividend depending on the price of oil.[24]

Investment in Sakhalin-2 continued on schedule in spite of the ownership change. Phase 2 of its project involved installation of two further platforms, 300 km of offshore pipelines connecting all three platforms to shore, more than 800 km of onshore oil and gas pipelines, an onshore processing facility, an oil export terminal, and the construction of Russia's first liquefied natural gas plant. In 2008, the project began producing and exporting oil from a second platform at Piltun-Astokskoye. In January 2009, it produced first gas from its Lunskoye platform, 15 kilometers off the northeast coast of Sakhalin. Gas is routed to an Onshore Processing Facility from which it goes to Sakhalin Energy's liquefied natural gas (LNG) plant in ice-free Aniva Bay at Prigorodnoye in the south of Sakhalin Island.

The LNG plan consists of two complexes capable of producing 9.6 million tons of LNG per year.[25] Most of that gas is contracted to various Japanese electric power and energy companies. Plans call for delivery of about 8 million tons per year to Japan and

1.5 million tons to KOGAS in South Korea. Within Russia, Gazprom's ownership gave the project considerable protection from the multiple bureaucracies that earlier created hold-up problems on every margin for the international investors. With its widespread participation in oil and gas markets and its ownership of infrastructure for liquefaction and re-gasification of natural gas in the Pacific market, it appears that Shell has been able to manage costs and prices to integrate Sakhalin's supply into the international LNG market. However, as Pacific LNG supplies have increased rapidly, leading to falling prices, the project now faces price pressures.

In contrast to Sakhalin-2, the prospects for Sakhalin-1, which brings together Exxon (30%), Japanese-owned Sodeco (30%), Indian state-owned ONGC Videsh (20%), Rosneft-Sakhalinmorneftegas (11.5%), and Rosneft-Astra (8.5%), seem less certain. Sakhalin-1 controls three fields, Chayvo, Odoptu, and Arktun-Dagi with total recoverable reserves of 307 million tons (2.3 billion barrels) of oil and 485 bcm of gas. After 10 years in development, first production flowed from the Chayvo field in October 2005 and, with completion of on-shore processing facilities, production reached 250,000 barrels of oil a day in February 2007 (12 million tons per year), although production is currently reported to be 200,000 barrels per day. This first phase of development used a revolutionary, onshore drilling rig with numerous extended-reach wells and an offshore drilling and production platform. "Standing 230 feet tall (70 meters), the Chayvo land-based drilling rig, Yastreb (Hawk), is the largest and most powerful land rig in the industry, designed to withstand earthquakes and severe Arctic temperatures. Yastreb drills down and then horizontally under the sea floor a total distance of more than 11

kilometers, making these extended-reach wells the longest in the world, minimizing marine impacts."[26]

When it began production, Sakhalin-1 had access to existing oil and gas pipelines. An oil pipeline ran to the Komsomol'sk refinery and to an export node at DeKastri on the mainland and a gas pipeline extended to Komsomol'sk. In 2006, the project constructed a new 600 mm oil pipeline paralleling the first. A new gas pipeline was under construction by a Russian consortium that included Rosneft and the Khabarovsk regional administration. Initially, a contract was signed to deliver about 2 bcm of gas per year to the region, with the prospect of increasing to about 3 bcm within five years.[27]

In 2005, production of natural gas and oil began simultaneously. In the first year, 1.5 bcm of gas was delivered to Khabarovskenergo and Khabarovskraygaz in Khabarovosk region. However, delivery prices of gas at $45 per mcm were reported to be below variable costs, thus constituting an in-kind tax of the project.

Sakhalin-1 has the capacity to produce considerably more natural gas. In 2006, it signed an agreement with China to supply 8 bcm of gas per year to China. Under its Production Sharing agreement it has the right to export all of its gas to the international market. However, the Russian government blocked project plans to construct a pipeline, and, in 2007, Gazprom purchased the existing pipeline between Sakhalin and Khabarovsk.

Under the current gasification program for the Far East, natural gas is to be directed primarily to domestic use. Gazprom plans to construct an LNG plant in Vladivostok from which Gazprom might export to the international market. According

to recent statements by Gazprom executives, pipeline deliveries to China will come from elsewhere.

At the moment, it appears that the partners of Sakhalin-1 are unlikely to pursue development of the project's remaining fields, Odoptu and Arktun-Dagi. The main sticking points are resource prices. Gas prices on offer from Gazprom appear to be a fraction of the prices that were agreed with China. In the case of sales of crude, terms of access for delivery to the world market and transfer prices also have to be negotiated for delivery of oil to Rosneft' as sole owner of the Khabarovsk refinery.

Gazprom currently holds a monopoly of international deliveries of natural gas from the Far East. Construction of a further extension of that gas pipeline from Khabarovsk to Vladivostok began in August 2009. Gazprom announced that it would commit $1.6 billion during 2009 toward construction of the Khabarovsk-Vladivostok leg of the pipeline and promised a total of $3.2 billion to gas investments in the Russian Far East during 2010. Assuming that construction costs of Gazprom pipelines run approximately three times higher than similar Canadian or European pipelines of a given size and distance, a 1200 mm trunk line running 1350 km would cost $4.5 billion, compared with about $1.6 billion for a similar pipeline in Canada.[28] However, at an inauguration ceremony for the Sakhalin-Vladivostok pipeline in Khabarovsk, Energy Minister Sergei Shmatko estimated that the total pipeline cost would be $11 billion, or an amazing $6 million per kilometer. The initial capacity of the pipeline is 6 bcm per year, with plans to increase the capacity later to 30 bcm, a goal that would require additional supplies from Gazprom's Kirinsky field or other sources.

What are potential sources of supply of gas to Vladivostok in the long-run? The new strategic industries law passed in May 2008 limits the share of ownership that may be held by international investors. Thus, national energy companies Rosneft' and Gazprom and their subsidiaries will play the lead role in developing Siberian oil and gas. On Sakhalin, current interest of both companies is focused on blocks of the Sakhalin-3 field. The four blocks, together are estimated to contain 5.1 bb of oil and 1.3 tcm of gas. The Veninsky block will be developed by a Rosneft-Sinopec (China) consortium, while Gazprom is to develop the Kirensky block. Other long-run plans include a gas pipeline running from the Chayanda gas field in Yakutia on a route to parallel the East Siberia-Pacific Ocean oil pipeline.

[Insert Table: Sakhalin Fields]

[Insert Figure 11: Russian Far East Production of Oil and Gas Condensate]

[Insert Figure 12: Russian Far East Production of Natural Gas]

Expansion of Energy Production in Yakutia and East Siberia; the Case of Oil

Traditionally, only small amounts of oil were produced in East Siberia--in Sakha, Irkutsk, Evenki Autonomous Okrug, and Taymyr Okrug. However, the construction of the East Siberia-Pacific Ocean (ESPO) pipeline will allow Siberian oil to reach Pacific markets, including China, at substantially lower cost. The total ESPO system is to be a 4,700 km pipeline system. State-owned Transneft' is constructing the pipeline in two phases. The first phase of the pipeline consists of a 2,757km section from Taishet in Irkutsk Oblast to Skovorodino in Amur Oblast, along with a subsequent branch to Daqing, China. This construction work began in 2006 and completion of the first Russian section

is scheduled for the end of 2009. On this section, the pipeline consists of 1,220 mm diameter pipe with a capacity of 80 million tons of crude oil per year. The branch to China is expected to have a capacity of 30 million tons per year and is scheduled for completion in 2010. Transneft' estimates that construction cost of this first phase will total about $14 billion. From Amur, crude oil will be transported by rail to the Pacific. The second phase of the ESPO pipeline will involve the construction of a 1,963 km section from Skovorodino to a Pacific Ocean terminal at Kozmino. Capacity of the phase two section has been estimated at 30 million tons of crude oil a year and completion is planned for 2014.[29]

[Insert Figure 13: ESPO and Other Planned Pipelines]

With extension of the ESPO pipeline, several prospective East Siberian fields are candidates for rapid development. Matthew Sagers singles out the Talakan, Verkhnechonskoye, and Vankor fields as major suppliers to ESPO.[30] Talakan, in Sakha was acquired in 2004 from Yukos by Surgutneftegaz (one of Russia's most opaque and politically-connected companies). In northern Irkutsk, oil production began at Verkhnechonskoye in 2005 under the operating partner and majority owner, TNK-BP, which holds 62.71 percent of shares. Rosneft (25.94%) and East Siberian Gas Company (11.29%) hold minority shares. Verkhnechonskoye contains between 4 and 5 billion barrels of oil equivalent, with about 1 billion barrels recoverable. In 2009, the field produced just 20,000 bpd, with production expected to rise gradually to 150,000 bpd.

A TNK-BP publication describes production conditions in remote northern fields: "What is it like to work at Verkhnechonskoye? The field lies in permafrost where the ice

penetrates deep into the ground and never melts. On only about 60 days a year does the temperature venture above zero. In winter it may average well below minus 30 degrees Celsius. Transportation is mainly by helicopters, which according to safety rules are only allowed to fly in daylight, which itself is in extremely short supply so far north. It's a land of solitude – the density of population is less than one person per square kilometer."[31]

Vankor, in northern Krasnoyarsk, is the largest of these oil fields. In 2009, Rosneft' completed an investment program totaling about $6.6 billion to place Vankor into operation. With reserves of 520 million tons of oil and 95 bcm of gas, Vankor will produce 2 million tons of oil in 2009. Rosneft said production in 2009 was 18,000 tons a day, increasing to 30,000 tons in 2010. In the future, it is to produce about 25.5 million tons of oil per year (510,000 bpd), or about one-fourth of Rosneft's total oil output.[32] Although development costs are almost 50 percent higher in East Siberia than in West Siberia, Vankor and other fields in the far north enjoy a preferential resource extraction tax rate. Now, the Russian government has promised that new projects in East Siberia will enjoy a zero customs duty on export as well—a substantial concession.

Initially, oil is flowing south to feed into the Transneft' West Siberian pipeline network, but, ultimately, Vankor's oil is to flow into the ESPO pipeline for delivery to China and the Pacific. China has agreed to lend $15 billion to Rosneft and another $10 billion to Transneft' in exchange for delivery of 300 million tons of oil over 20 years, a large part of which is to come from Vankor.

Russia has long provided China with crude oil and products. In 2007, Russia sent 12.97 million tons of crude and 3.3 million tons of refined products to China by rail.[33] With construction of a spur from the ESPO pipeline to Daqing, oil deliveries from Russia to China are likely to grow rapidly. However, the prospects of natural gas deliveries by pipeline between Russia and China appear to be less certain.

Expansion of Energy Production in Yakutia and East Siberia; the Case of Gas

Based on its reserves, Russia has great potential to supply natural gas to the Pacific market. However, that potential continues to be limited by government policies, giving Gazprom a monopoly over gas exports to the world market, which it has exercised to eliminate international producers. Thus, Gazprom blocked Sakhalin-1 and TNK-BP's Kovykta field from delivering pipeline gas to China. Then, using TNK-BP's low production as an excuse, the government withdrew the Kovyka license. Using environmental regulation as an excuse, the government forced the transfer of a controlling share in Sakhalin-2 from a Shell-led consortium to Gazprom.

Supply of LNG to the Pacific market is beginning. Currently, two LNG trains owned by Sakhalin-2 have the capacity to deliver up to 9.6 million tons of LNG per year to Asian customers, with most of it contracted to customers in Japan. In September 2009, Gazpromexport announced that they were talking to Japan about co-funding the Sakhalin-Vladivostok pipeline and a proposed LNG plant located in Vladivostok. According to *Kommersant*, Japan was discussing a loan of $2 billion on condition that the money would be spent on Japanese pipe. However, the major source of uncertainty

regarding Russia's supply of gas to the international market is the 2007 Order of the Industry and Energy Ministry, which established the Eastern Gas Program.

The Eastern Gas Program, recently amended by a new Energy Program to 2030, envisions investment of 2.4 trillion rubles ($80 billion) in eastern gas development. More than half of the funds would be spent on gas production and processing, one-third on gas transmission and storage. Work would focus on four gas-producing areas—Sakhalin, Sakha, Irkutsk, and Krasnoyarsk. The key principles of that program were: a) priority of domestic customers for the use of natural gas; b) pricing of natural gas based on competition with alternative fuels without direct administrative price regulation; and c) an export policy based on a single exporter, Gazprom. Gazprom was named coordinator of the program. According to Gazprom, the Eastern Gas Program would provide capacity to produce up to 55.7 bcm of gas from eastern fields by 2020. About 30 bcm of this output would be directed to Pacific export and the remainder would serve domestic consumption.

In 2007, Gazprom held 45 license areas in Siberia, the RFE, and the Barents Sea. In 2008, they received licenses for development of the Kirinsky deposit on Sakhalin and the Chayanda field in Sakha. They hoped to receive concessionary tax arrangements for Chayanda. However, in late 2009, Gazprom reduced its forecast rates of gas production at Chayanda and asked the federal agency for subsoil resources to provide a list of alternative fields.

The Eastern Gas Program gives priority to completion of the Sakhalin-Vladivostok pipeline and its later extension by a Sakha-Khabarovsk-Vladivostok pipeline. In addition,

in 2009, Gazprom is to continue development of several small sources of gas on the west coast of Kamchatka and to construct a pipeline and distribution system for the city of Petropavlosk.[34]

There is significant uncertainty, as well, regarding further development of the giant Kovykta field in Irkutsk, with 1.9 mcm of gas reserves. The Eastern Gas Program blocked the original license-holders of the Kovykta field from constructing a pipeline to deliver gas to China, forcing transfer of the field from TNK-BP to Gazprom. In 2009, *Kommersant* reported that declining gas revenues would mean the postponement of Kovykta development by Gazprom until 2017. Sources at TNK-BP suggested that rights to develop Kovykta might instead be transferred to Rosneftegaz, the state holding company, which owns 75.16 percent of Rosneft'.

Russian Access to Energy Markets in the Asia Pacific

Even with its planned rapid increases in deliveries of oil and natural gas to the Pacific, Russian supplies will constitute a relatively small share of Asian energy markets. Japan, which pays relatively high prices for energy, is likely to be Russia's largest customer for LNG. However, Japanese GDP has experienced relatively low growth for the past several years and its economy enjoys high levels of energy efficiency, so its total demand for energy is likely to show relatively little growth. In contrast, both the PRC and South Korea are enjoying high rates of economic growth. Looking at the size of the two energy markets, South Korea's total energy demand is only 12 percent of

China's. However, current consumption of LNG in South Korea is approximately half of China's consumption. So, both could be significant markets. Still, China is the energy user that would enjoy the greatest gains in efficiency and environmental improvement from a shift to natural gas, whether as LNG or as pipeline gas.

[Insert Figure 14: South Korean Shares of Primary Energy 2008]

China's rapid economic growth has generated rapid increases in Chinese demands for all forms of energy and raw materials, but some underlying sources of China's rapidly-expanding energy demand reflect substantial inefficiencies in that economy. During the past decade, China's energy intensity, measured in tons of oil equivalent per million dollars of GDP has been falling rapidly, and, yet, an international comparison for 2007 shows the following energy intensities: OECD Asia (Japan, Australia, New Zealand), 160 tons of oil-equivalent per million dollars; Developing Asia, 189.6; China, 274.4; Russia 383.7.[35] Thus, China's energy intensity is 70 percent higher than OECD Asia's, while Russia's energy use per dollar of GDP is 2.4 times larger.

[Insert Figure 15: Chinese Shares of Primary Energy 2008]

China's high demand for energy reflects growing industrial use and, surprisingly, use in heavy industries, such as steel production. To the economist, the growth of Chinese production in capital-intensive heavy industry appears to be inconsistent with the country's labor-intensive factor proportions and low wages. This industrial structure seems to reflect several sources of inefficiency—the artificially low prices of energy imposed by the government, the extraordinarily high share of saving and investment in Chinese GDP, much of which reflects governmental and state bank financing of high

rates of investment in infrastructure and industrial capacity, and the desire of policy makers in separate regions to create their own bases in heavy industry. If this rapid expansion of capacity in heavy industry is excessive, then much of it will prove relatively unprofitable in the future. That said, once created, the costs of industrial capacity are sunk costs, which implies that Chinese industrial producers are likely to bring products to market as long as their sales cover their variable costs; so Chinese demand for industrial inputs will remain strong in spite of an inefficient structure of industrial production. Looking ahead, China's access to Russian oil is fostered by China's willingness to extend loans of $25 billion to Rosneft' and Transneft' in exchange for guaranteed deliveries of oil.

In the cases of oil and LNG, Russia will face relatively competitive markets, which will determine long-run prices. It is only in the case of pipeline gas that Russia and China will interact as bilateral monopolists. Currently, Gazprom and China are reportedly far apart on an agreement for a delivered price of natural gas, with China holding out for approximately half of the Gazprom-offered price. In the meantime, Exxon, which was blocked by Russia from delivering pipeline gas to China, has now entered into an agreement with Petro China to export 2.25 million tons of LNG per year to China from Australia's Gorgon gas field. The Exxon-Petro China agreement, which is valued at $41 billion, will begin deliveries in 2015. Chevron, another partner in the Gorgon field is negotiating with China's CNOOC to supply a similar quantity. Thus, the bottom line for Russian energy supply is that the access of demanders to competitive alternatives will impose market constraints on Russian market power.

Energy Policy and Potential Russian Energy Supplies to the Pacific

What do recent developments in Russia's energy sector tell us about the future role of Russia as an energy supplier to the Asia Pacific? In the past decade, the government's desire to regain control of its energy wealth has been achieved through the use of governmental measures that have created a highly uncertain business environment. Domestically, the exercise of tax and regulatory authority has been used to transfer assets from private to state control in the cases of Yukos, Kovykta, and Sakhalin-2. In other cases, such as Sibneft, Surgutneftegaz, and Gazprombank, opaque governmental actions have transferred assets to the control of Kremlin insiders. Foreign investors, such as the investors in Sakhalin-1, have seen the value of their investments partially confiscated through changes in the rules of the game.

In East Siberia and the Russian Far East, state-owned Rosneft' and Gazprom appear to be engaged in complicated negotiations with the center as to the control rights that each will acquire to develop valuable oil and gas fields.[36] These negotiations will determine the implicit governmental subsidies, costs, and economic obligations that the national energy companies will enjoy and, thus, will determine the division of rents. While it is unclear how the national champions will resolve their potential competition with each other, it is clear that future arrangements are likely to be monopolistic and that the property rights of private owners, such as TNK-BP, will depend on their ability to manage relationships with Kremlin insiders.

So, the political economy of energy development in Russia confirms the arguments of Aslund, Ickes, and Gaddy. In energy, the economic arrangements seem to be evolving in the form of centralized monopoly structures, which can serve to capture and redistribute wealth but are inimical to efficient production and development.[37] The exercise of Putin's energy policy provides ample support for the Ickes-Gaddy hypothesis that the Kremlin's strategy to centralize resource rents is based on insecure property rights.[38] These administrative institutions prolong some of the worst features of the command system, impeding structural change, diversification, and the productivity improvements that Russia urgently needs.

In the short run, the implication of Russia's weak institutional environment is that engagement of multinational companies and foreign investors in Russia will depend on their ability to address these institutional risks. Investors will seek investment insurance from their governments, hold collateral, or find ways to share risks. Foreign multinationals will alter contract governance or they will simply direct their investment to less risky alternatives. National energy companies, Gazprom and Rosneft', will try to develop Siberian resources independently, operating as general contractors and employing energy service companies.

What policies should the governments of energy importers pursue? For more than two decades, policy-makers in the Asia Pacific have argued for the value of an Asia Pacific Energy Charter modeled on the European Energy Charter. Although Russia never became a signatory to the European Energy Charter, its policies have generally conformed to Charter rules. With the production and trade of oil and LNG in the Pacific

expanding rapidly, it is likely that an emerging network of energy contracts will evolve into a similar, consistent international framework. However, in the near term, it is unlikely that Russian institutions will evolve in a manner that allows Russia to participate in this framework.

We began this survey with President Dmitry Medvedev's recent essay, "Go, Russia!" In that essay, Medvedev asks how long the Kremlin can continue to pursue a form of state capitalism in its strategic industries that deprives it of many of the benefits of international investment, technology, and know-how. Medvedev is frank about the problems that Russia faces.[39] He identifies three major institutional ills:

1. Economic backwardness and the habit of relying on the export of raw materials;
2. Centuries of corruption… Until today this corrosion has been due to the excessive government presence in many significant aspects of economic and other social activities.
3. Paternalistic attitudes are widespread in our society, such as the conviction that all problems should be resolved by the government.

Medvedev proposes to address these weaknesses with a program of technological modernization and innovation, but more importantly, he recognizes that economic modernization will require fundamental institutional changes—democracy, civil rights, rule of law, and independent courts. "We need to eliminate attempts to influence judicial decisions for whatever reasons. Ultimately, the judicial system itself has to understand the difference between what it means to act in the public interest or in the selfish interests of a corrupt bureaucrat or businessman. We need to cultivate a taste

for the rule of law, for abiding by the law, respect for the rights of others, including such important rights as that of property ownership. It is the job of the courts with broad public support to cleanse the country of corruption."

All this is heady stuff coming from the President of Russia—particularly when we consider that President Medvedev was Chairman of the Board of Gazprom during an era of exceptional corruption in that company. The words of his speech might have been ghost-written by Boris Nemtsov, co-founder of the liberal opposition party, *Solidarnost'*. Many Western observers will agree with both Medvedev's diagnosis and his proposed remedies. If the Russian government hopes to keep its skilled people and enjoy the benefits of a modern, efficient economy, it will need to create rule of law, restore federalism, and direct its government spending to the welfare of its population and the creation of modern, market-supporting institutional and physical infrastructure. Russia's debility reflects not the existence of resource rents but the manner in which Kremlin elites capture and use these rents.

Russia's difficulty in expanding economic cooperation in Asia is simply an example of Russia's awkward engagement in the international community in general. Russia's current difficulty in using its energy wealth to modernize is simply an example of the Kremlin's lack of incentives to establish efficient, market-supporting institutions. Perhaps Medvedev's recent essay will motivate government authorities to reform Russia's underlying economic institutions. However, the example of Gorbachev's attempted administrative reforms in the former Soviet Union provides a counter-

example. Until market-supporting institutions improve, investors will continue to approach the Russian environment with skepticism.

Notes

[1] Clifford Gaddy and Barry Ickes, "Addiction and Withdrawal: Resource Rents and the Collapse of the Soviet Economy," Pennsylvania State University, *Economics Working Paper,* December 2006.
[2] Clifford Gaddy and Barry Ickes, "Resource Rents and the Russian Economy," *Eurasian Geography and Economics*, 2005, Vol. 46, No. 8, pp. 559-583.
[3] Dmitry Medvedev, "Go, Russia," *President of Russia Web Site,* http://eng.kremlin.ru/speeches/2009/09/10/1534_type104017_221527.shtml
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[9] "Energy Strategy 2030," *Izvestia*, August 27, 2009, http://www.izvestia.ru.
[10] Data in this section from British Petroleum, *BP Statistical Review of World Energy 2009,* http://www.bp.com/statisticalreview.
[11] Matthew Sagers, "The Regional Dimension of Russian Oil Production: Is a Sustained Recovery in Prospect?" *Eurasian Geography and Economics,* 2006, Vol. 47, No. 5, p. 518.
[12] James Smith, "Cost of Lost Production in Russian Oil Fields," *Energy Journal*, Vol. 16, No. 2, pp. 25-28.
[13] "Seeking Western Involvement for Rebuilding and New Developments," *Petroleum Economist,* January 1996, pp. 10-14.
[14] Interview, Sakhalin Island, September, 1999.
[15] Rudiger Ahrend and William Tompson, "Realising the Oil Supply Potential of the CIS: the Impact of Institutions and Policies," *OECD Economics Department Working Paper 484* (2006), p. 22.
[16] Matthew Sagers, "The Regional Dimension of Russian Oil Production: Is a Sustained Recovery in Prospect?" *Eurasian Geography and Economics,* 2006, Vol. 47, No. 5, p. 511. Sagers lists the nine vertically integrated companies in 2003 as: Rosneft', LUKoil, Yukos (now Rosneft'), Surgutneftegaz, Sibneft' (now Gazprom Neft') TNK-BP, Slavneft', Bashneft' and Tatneft.
[17] *Op. cit.*, p. 512.

[18] Institute for Economies in Transition, *Russian Economy in 2008; Trends and Outlooks.* Moscow, p. 301. http://www.iet.ru/ru/ob-institute.html.

[19] Matthew Sagers, "Developments in Russian Gas Production Since 1998: Russia's Evolving Gas Supply Strategy" *Eurasian Geography and Economics,* 2007, Vol. 48, No. 6, p. 652.

[20] Stern, *Ibid.*, 54

[21]Institute for Economies in Transition. *Russian Economy in 2008; Trends and Outlooks.* Moscow, Vol. 30, p. 301, http://www.iet.ru/ru/ob-institute.html.

[22] Anders Aslund, "Gazprom's New Weakness Offers Opportunity," *Moscow Times,* May 27, 2009 (cited in David Johnson).

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[28] At current prices, a benchmark estimate of pipeline construction in a remote region takes the form: PS * KM * $1000. That is, "pipeline size" in mm times "kilometers" times $1,000 per kilometer.

[29]Transneft'. Novosti Podvodnyi perekhod cherez peky Amur nefteprovodnoi sistemy Skovorodino—granitsa KNR nachalos' proizvodstvo burovykh rabot, http://www.transneft.ru.

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[32] Nina Poussenkova, "The Wild, Wild East; East Siberia and the Far East, A New Petroleum Frontier?" *Moscow Carnegie Center Working Paper* 2007, No. 4.

[33] Matthew Sagers and Clifton Pannell, "The Clean Energy Dilemma in Asia: Observations on Russia and China," *Eurasian Geography and Economics*, 2008, Vo. 49, No. 4, p. 311.

[34] Gazprom, "Meeting on Gasification and Gas Supply to Eastern Siberia and the Far East," *News*, http://www.gazprom.com/press/news/2009/august/article66878/.

[35] Matthew Sagers and Clifton Pannell, "The Clean Energy Dilemma in Asia: Observations on Russia and China," *Eurasian Geography and Economics*, 2008, Vo. 49, No. 4, pp. 391–409.

[36] Nina Poussenkova, "The Wild, Wild East; East Siberia and the Far East, A New Petroleum Frontier?" *Moscow Carnegie Center Working Paper* 2007, No. 4.

[37] Any Myers Jaffe, "The International Oil Companies," *James A Baker III Institute for Public Policy Working Paper,* 2007; Nina Poussenkova, "The Wild, Wild East; East Siberia and the Far East, A New Petroleum Frontier?" *Moscow Carnegie Center Working Paper,* 2007, No. 4.

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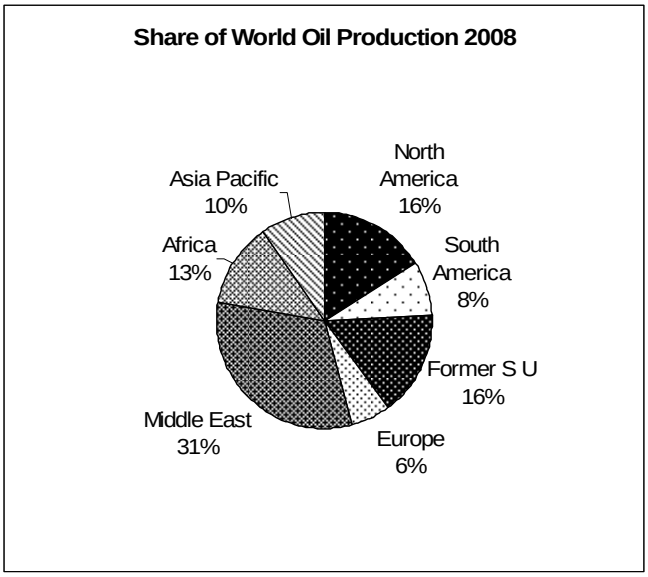
[39] Dmitry Medvedev, "Go, Russia," *President of Russia Web Site,* http://eng.kremlin.ru/speeches/2009/09/10/1534_type104017_221527.shtml.

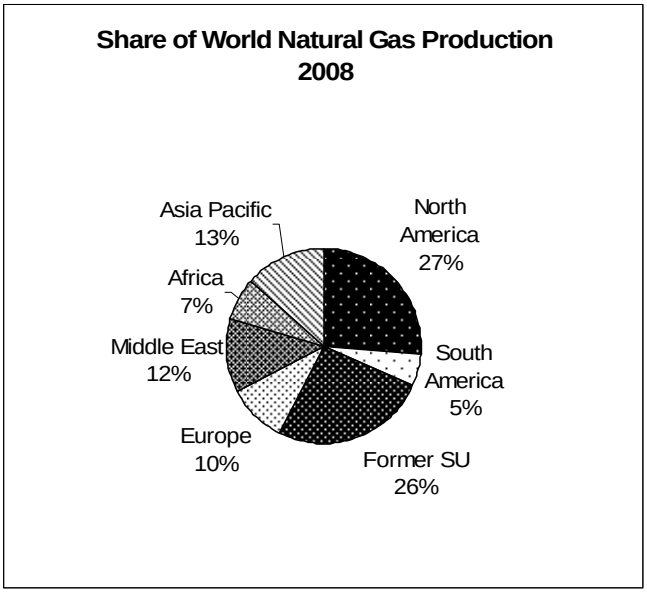
Appendix:

Figure 1: World Share of Oil Production



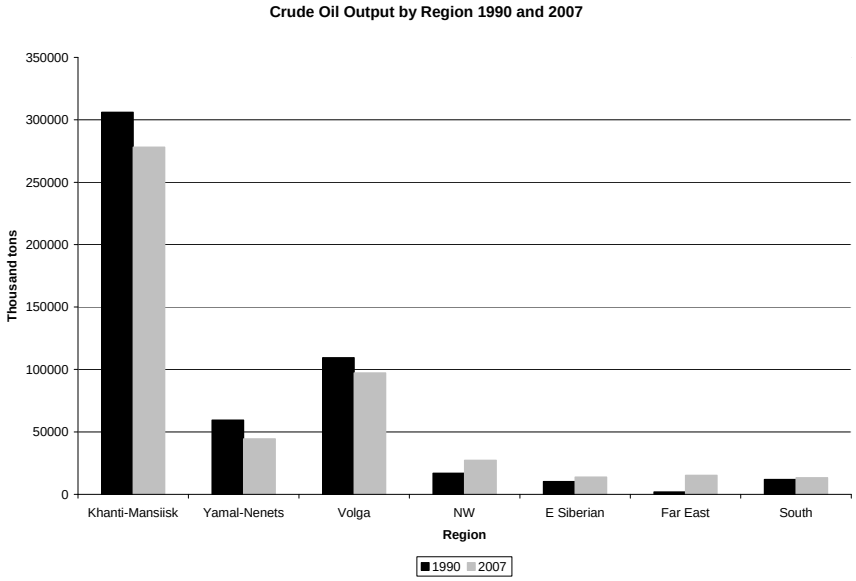
Source: British Petroleum 2009.

Figure 2: World Share of Gas Production



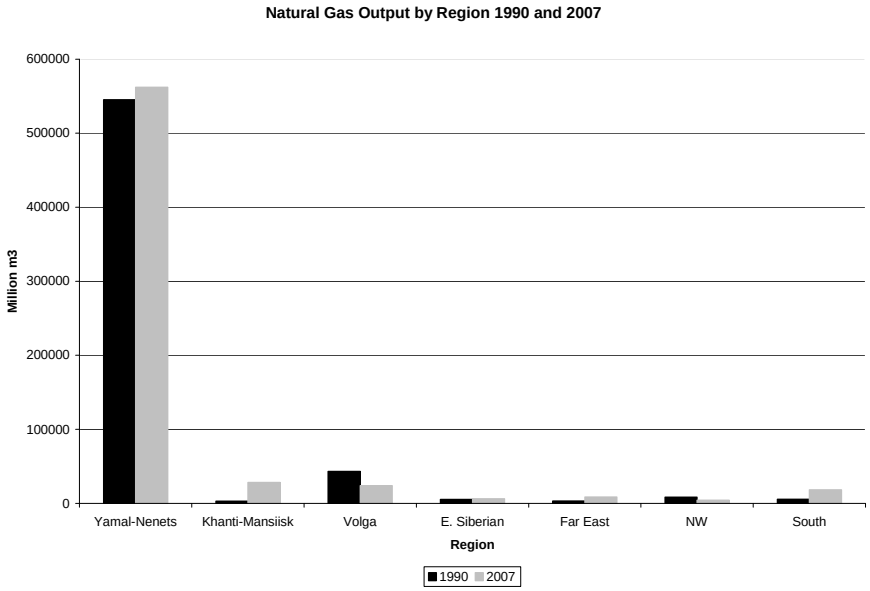
Source: British Petroleum 2009.

Figure 3: Crude Oil Output by Region 1990 and 2007



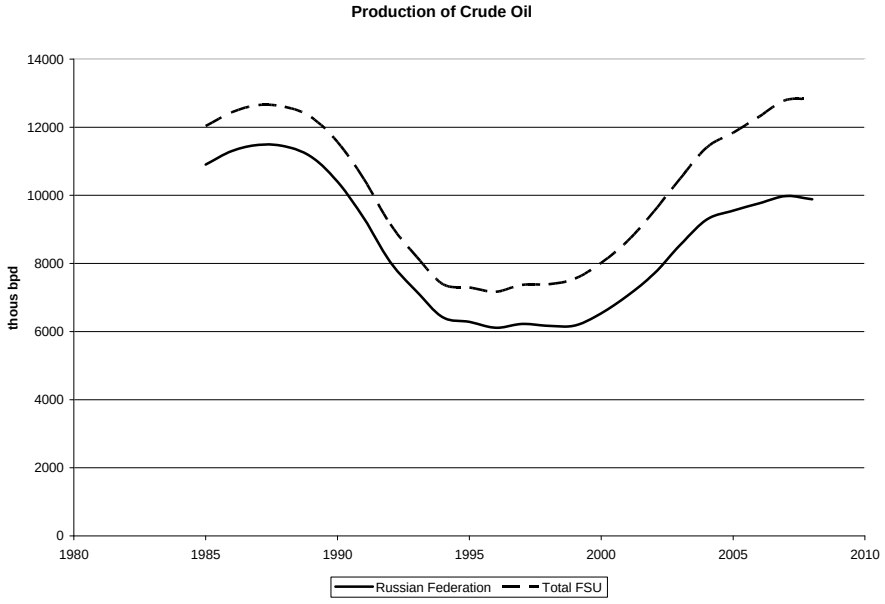
Source: Regiony Rossii, various years.

Figure 4: Natural Gas Output by Region 1990 and 2007



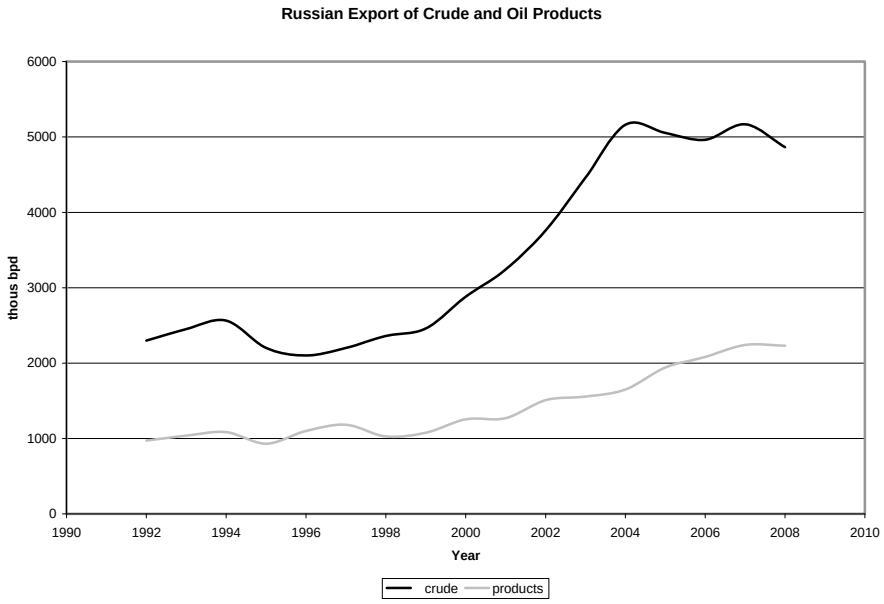
Source: Regiony rossii, various years.

Figure 5: Crude Oil Production 1985-2008



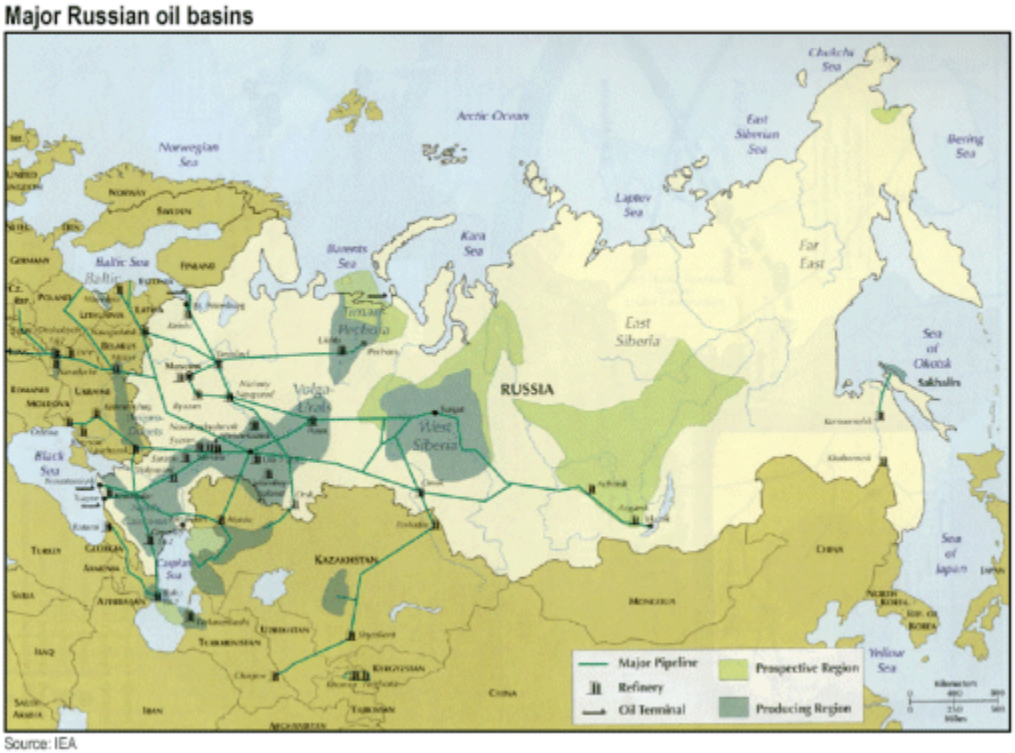
Source: Promyshlennost' various years.

Figure 6: Export of Crude Oil and Oil Products 1992-2008



Source: Russian Statistical Handbook, various years.

Figure 7: Major Russian Oil Basins

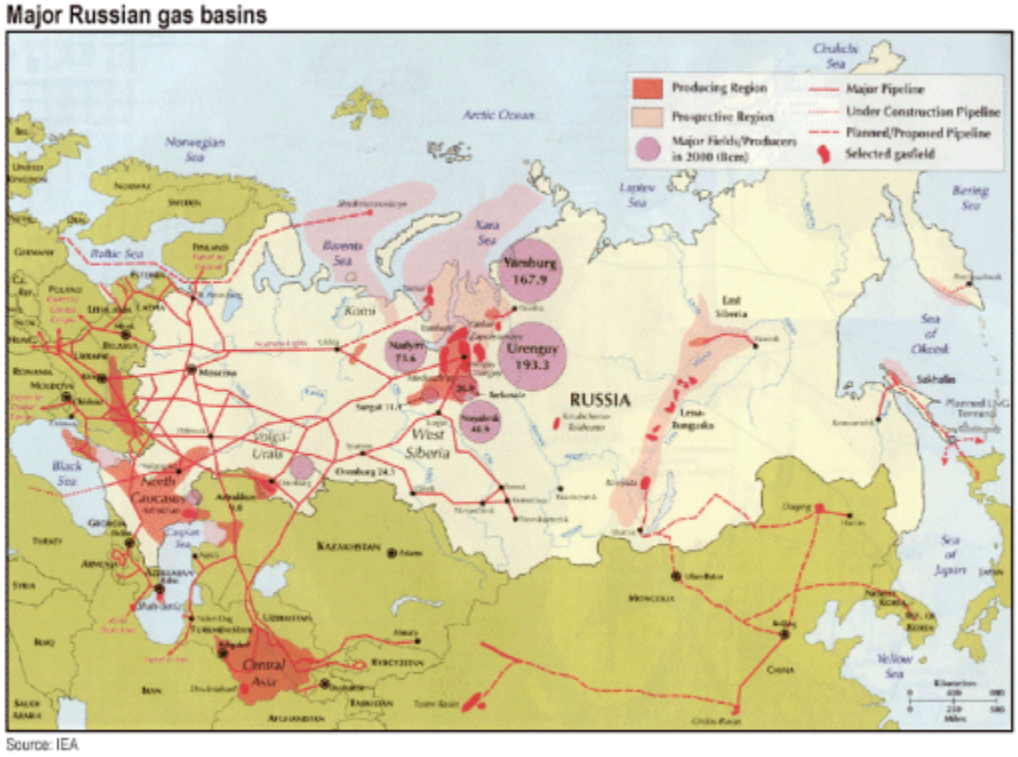


Source: International Energy Agency

Figure 8: Production and Export of Natural Gas

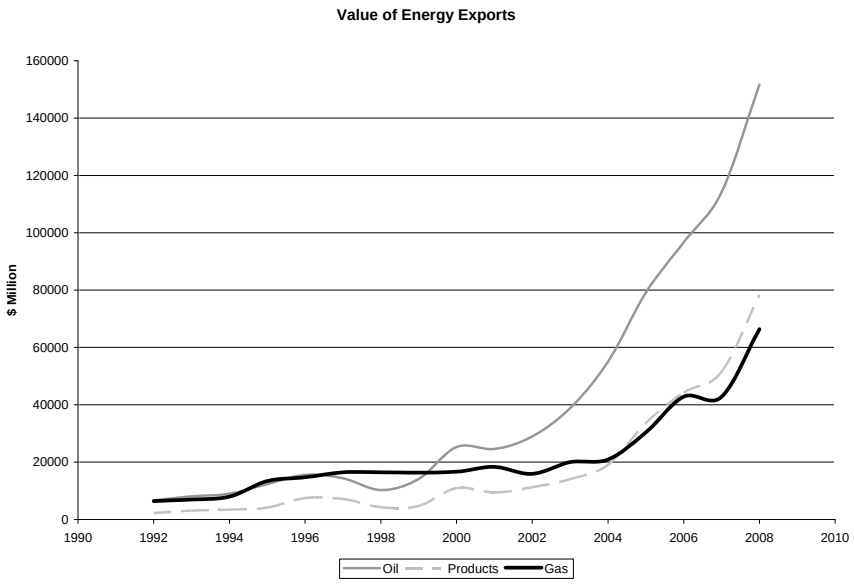
Source: Promyshlennost' various years.

Figure 9: Major Russian Gas Basins



Source: International Energy Agency

Figure 10: Value of Energy Exports



Source: Institute for Economies in Transition. *Russian Economy in 2008; Trends and Outlooks.* Moscow, p. 300, http://www.iet.ru/ru/ob-institute.html.

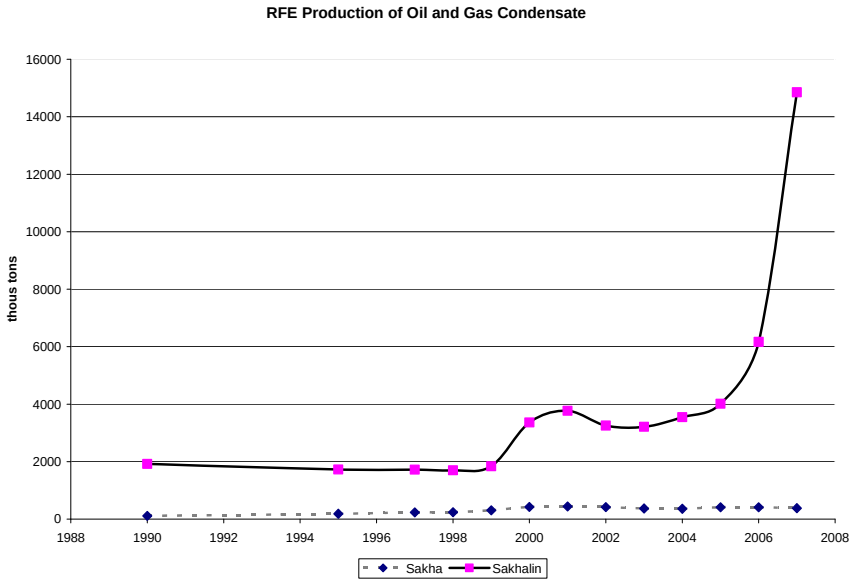
Table1 : Sakhalin Fields

Sakhalin Shelf Projects						
Project	**Fields**	**Reserves Oil**	**Reserves Gas**	**Members**	**Investment to Date**	**Total Invest-ment**
Sakhalin-1	Chayvo	310 mil t	485 bil m3	Exxon (30%), Sodeco (30%), ONGC Videsh(20%), Rosneft'-Sakhalinmornefteg as affiliates (20%)	$7.7 bil	$17.8 bil (total all fields)
	Odoptu Arkutun-Dagi	70 mil t				
Sakhalin-2	Piltun-Astokhsky	150 mil t	93 bil m3	Gazprom (50%+1), Shell (27.5%), Mitsui (12.5%), Mitsubishi (10%)	$15 bil	$22 bil
	Lunsky	3.8 mil t	642 bil m3			$15 bil
Sakhalin 3	Kirinsky	452 mil t	970 bil m3	Gazprom		$15 bil

	Ayashsky East Odoptinsky	114 mil t	513 bil m3	Rosneft'- SINOPEC	$13.5 bil
Sakhalin-4	Pogranichny Okruzhnoye	800 mil bbl	19 tcf	Rosneft(51%) , BP (49%)	
Sakhalin-5	Kaigasko-Vasukansk	5.7bil bbl 30 mil t con	16 tcf	Rosneft (51%), BP (49%)	
Sakhalin-6	Pogranichny	600 mil bbl	200 bil m3	Petrosakh, Alfa Eco	

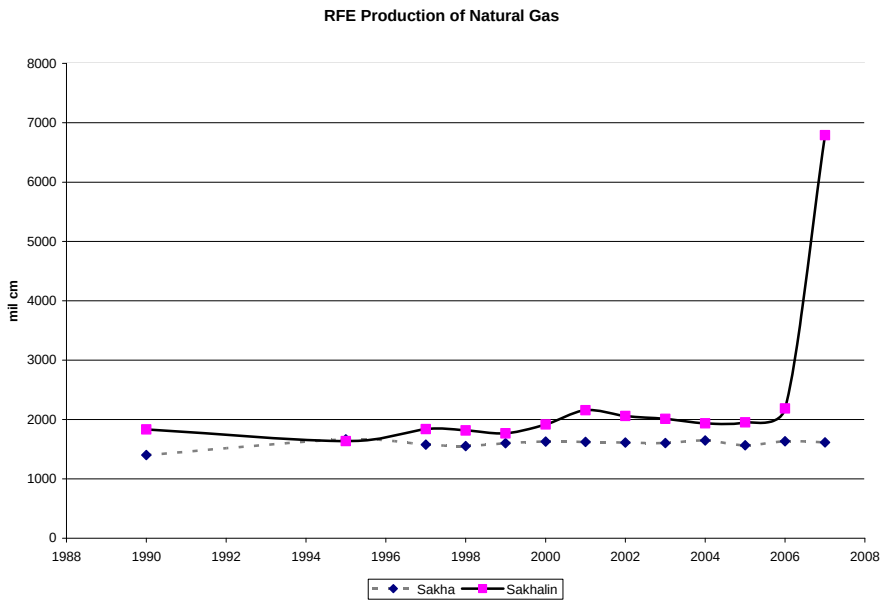
Source: Author's Summary.

Figure 11: Russian Far East Production of Oil and Gas Condensate



Source: Regiony rossii, various years.

Figure 12: Russian Far East Production of Natural Gas

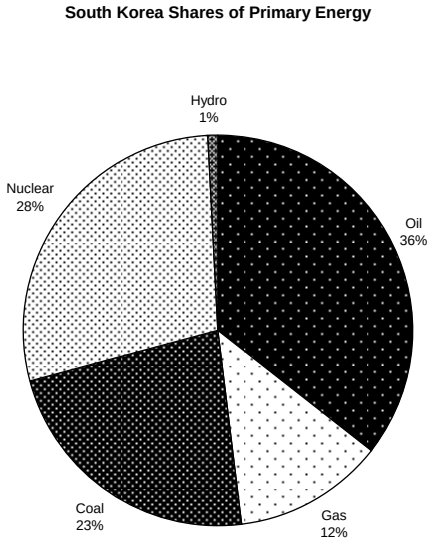


Source: Regiony rossii, various years.

Figure 13: East Siberia Pacific Ocean and Other Planned Pipelines

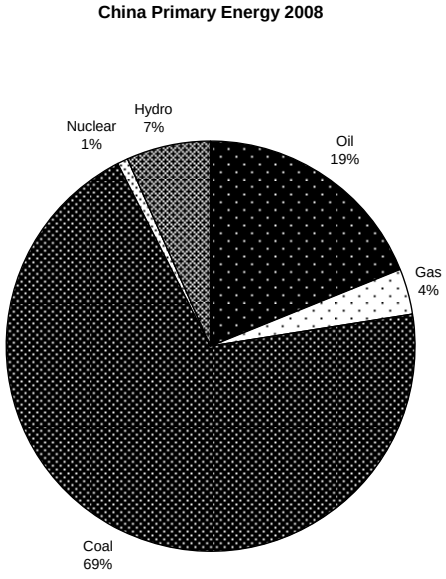
Source: International Energy Agency

Figure 14: South Korea Shares of Primary Energy 2008



Source: BP Statistical Review 2009.

Figure 15: China Shares of Primary Energy 2008



Source: BP. Statistical Review 2009.

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