Energy Sector Reform in Eastern Europe Working Papers

WP-EE-04

The Russian Gas Reserves in Transition - A Fresh Look

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Reprint from 2001

Dresden University of Technology

DREWAG-Chair for Energy Economics

The Russian Gas Reserves in Transition -

A fresh look

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ABSTRACT

The paper assesses the Russian gas reserves, taking into account the systemic change in this country over the last decade. It contrasts the concept of reserves under socialism to that in a market economy. Estimates of Russian gas resources and gas reserves are presented and compared. Based upon these estimates, a scenario of reserve depletion from Russian fields that are currently producing is developed. It highlights the necessity to bring new fields on-stream in the second half of this decade (2006-2010).

Journal of Economic Literature, Classification Numbers: Q41, P20

hirschhausen russian gas reserves_for_ee2.doc; version: 12.02.2005; 3865 words; 25 pages, 4 tables, 2 figures

INTRODUCTION

Gas is among Russia's most important economic activities, in terms of tax payments, exports, employment, etc. Russia's economic development relies upon the efficient use of its oil and gas reserve, among other factors. The gas industry is also seen as having positive indirect effects on the economy; thus Sagers et al. (1995) contended early on that Russia's rich gas (and oil) reserves were a critical factor in the country's overall transition to a market economy. The European Energy Charter argues that Russia's integration into the European and world economy is facilitated by increased gas exports, making possible increased imports of technology and know-how. The future of the countries largest company, OAO Gazprom, representing over 90% of the gas industry, is in some cases even intertwined up with the future of the country itself, according to the slogan: "What is good for Gazprom is good for Russia." The figures on the gas industry's importance in the national economy are indeed impressive: it contributes no less than 10% of total tax revenues (i.e. about RUR 250 bn in 1998). Gas export are about one-sixth of total exports. In terms of employment, too, the gas industry stands out as the 'mother of Russian industries': direct employment of Gazprom, Itera, Sibur, and some smaller companies exceeds 400,000, with indirect employment estimated at 1.5-2 mn. The value of the remaining state-owned shares of Gazprom (37.5% of the total) is about USD 30 bn, which would suffice to cover 1.5 years of the government budget deficit alone. Table 1 provides an overview of the Russian gas balance.

However, in the course of Russia's difficult reform process, and in particular after the August 1998 financial crisis and subsequent economic turmoil, the gas industry, too, has experienced problems. Falling domestic demand, obstacles to price liberalization, the non-payment problem and under-investment are some of the factors that prevent the gas sector from fully developing its potential. Last but not least, estimates of Russian gas reserves are being reviewed in the light

of economic transition. The Russian gas reserves are indeed not only the largest in the world, but have also become the most debated ones in the course of systemic transformation. Under the new conditions of the market economy, the true economic value of these reserves depends upon what amounts of gas can be taken to the marketplace, and are really being paid for. Given decreasing gas output from the large existing Russian gas fields, a reorientation of gas exploration and the commissioning of new fields is imminent. The evaluation of gas reserves is therefore a key parameter for long-term strategic planning.

This paper discusses the economics of Russian gas reserves. The next section reviews the difference between socialist and market economic notions of reserves. The main section of the paper presents different estimates of Russian gas reserves and resources. Depending upon which category is used, reserve figures vary between 18 and 48 trillion cubic meters (tcm). A depletion scenario shows that gas production from existing fields will diminish significantly in the second half of this decade (2006-2010). The paper concludes with a discussion of two related issues, gas exports and financial indicators.

Table 1: The Russian Gas Balance, 1990-98

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THE NOTION OF GAS RESERVES UNDER SOCIALISM AND THE MARKET ECONOMY

The dispute about the true value of Russian gas reserves is directly related to the country's systemic change from a socialist system to some kind of a market economy. The idea that there is a fundamental difference between the socialist and the market economic notion of 'reserves' is nothing new. Yet this has not led to a re-evaluation of the

gas reserves of the former Soviet Union, after the latter underwent radical economic change. Under socialism, a reserve was defined by the physical availability of a natural resource (expressed in m^3, kg, t, etc.). There was a formal nomenclature for the classification of gas resources, from best to worst: A(best)-B-C1-C2-C3-D1-D2. However, once the political decision was made to develop a certain gas field, there were only physical, but no economic constraints on exploiting, transporting, and distributing the resource. For international comparison, gas reserves were defined as the resources included in groups A to C1. The Soviet Union boasted by far the largest gas reserves in the world.[2]

In contrast, in a capitalist market economy, the idea of a reserve is linked to the ability of a profit-oriented enterprise to exploit, transport, and sell a natural resource in such a way as to cover its costs and obtain an appropriate return on capital. Only a natural resource that can be sold at a profit is considered a valuable reserve. Hence, it is not the physical availability and production that count, but the monetary value, expressed in costs and profits. The simplest definition identifies reserves as "those quantities which geological and engineering information indicates with reasonable certainty can be recovered in the future from known reservoirs under existing economic and operating conditions." (BP, 1997, p. 20).[3]

The point is that the energy reserves of any given country are not defined by nature. The characterization of a country as reserve-rich or reserve-poor also depends upon the economic system operating in this country at the point in time in question. A country that was considered to be reserve-rich under socialism - for example the Soviet Union - may appear otherwise when it adopts an economic system based on market criteria and sanctions. This is what has happened in Russia and the other former Soviet Republics from January 1992 onwards, in the course of economic transition (monetary reforms, price liberalization, etc.). As a consequence, the gas reserves of the countries comprising the Commonwealth of Independent States (CIS) countries should have

been re-evaluated in the context of their new economic environment. However, owing to the technical difficulties of this exercise, the high costs, and also some resistance from the Russian gas industry, this did not happen. In the gas sector, the socialist categories A-C1 continued to be translated into Western-type 'reserves'.

This may, however, be a mistake, as it underestimates the change of economic conditions that these countries went through. Indeed, since 1992 many of the former so-called reserves of CIS countries turned out to be economically unviable. This is evident, for example, for most of the Russian and Ukrainian coal, which cannot be produced economically. Also, Kazak and Caspian oil reserves turned out to be economically less promising than expected, due to deteriorating conditions of extraction and thus, increasing costs. Non-fossil fuel reserves of the CIS countries, such as iron ore, aluminum, copper and wood are no longer being produced at former levels (exceptions to this rule being nickel and diamonds). The question then is: are the Russian gas reserves as promising as official statistics suggest, or do these reserves also have to be re-classified under the new economic conditions?

ESTIMATES OF RUSSIAN GAS RESOURCES AND RESERVES

A closer look at the composition of gas resources and reserves in Russia reveals some data inconsistency, but above all the necessity for an in-depth technical-economic analysis. The dominant source of information is still vintage data from Soviet times. The first comprehensive study carried out by a Western geological company (De Golyer and MacNaughton) checked the technical feasibility of existing Russian data on proven and probable stocks of OAO Gazprom; but does not provide a judgement on the economic feasibility of producing and distributing this gas.

Resources

There is some debate on the volumes of gas for which technical and economic feasibility is uncertain, that is, gas resources. Gazprom (1998, p. 63) puts Russian gas resources at 226 tcm (total initial resources of 236.1 bcm minus cumulative production of 10.1 bcm); this corresponds to 40% of total world gas resources. On the other hand, Grace (1995a, p. 73) estimates the "total Russian unproduced recoverable resource base" at only about 165 tcm (see Table 2).[4] A closer look reveals that a large part of what are considered to be gas resources in Russia would hardly fit into the Western definition of resources, which requires that "the existence of assessed volumes be scientifically supported and that the economic and technological prerequisites to their recovery do not demand conditions clearly over the horizon" (Grace, 1995a, p. 73): About 70% of the Russian resource base exists in as of yet undiscovered fields. Considering that the last 'unique field' (that is: over 500 bcm) was discovered in 1976 (Kruzenstern, on the Yamal peninsula), chances that new unique fields will come on stream in the medium-term future are low. The 39 tcm of undiscovered gas offshore (categories D1 and D2) are also unlikely to become relevant even in the long run.

The Russian gas resources, then, realistically boil down to the existing 16 fields that are the basis of current production (Urengoy, Yamburg, Nadym regions) as well as non-producing fields in Western Siberia. Other regions have to be largely excluded from the resource base. The uncertain character of non-western Siberian resources is confirmed by the composition of reserve additions in the first half of the last decade (1991-95): 80% of the onshore reserve additions of 2.9 tcm are from Western Siberia, and less than 10% from Eastern Siberia (Gazprom, 1998, p. 67). If one were to reduce the resource concept to the Soviet categories A1-C2, that is, explored and initially appraised gas, a reasonable estimate for Russian gas resources would be around 60 tcm.

Table 2: Estimates of Russian Gas Resources

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Reserves

The most commonly used figure on Russian gas reserves is 47.3 tcm. This figure is provided by Gazprom itself (1998, p. 63) and regularly replicated more or less by international statistics, most notably the BP-Amoco (1999) Statistical Review. 47.3 tcm correspond to 32% of world gas reserves, and make Russia by far the largest reserve base in the world, far ahead of Iran (16%) and Qatar (8%). The reserves are concentrated in Western Siberia, with minor spots in the Volga-Urals area and offshore (see Table 3).

Doubts on the officially announced reserve figures have existed for quite some time, but no alternative evaluation has been undertaken. The study by De Golyer/Mac Naughton on the gas reserves of Gazprom largely confirmed the physical existence of what Gazprom calls proven reserves; however, only two-thirds of the potential reserves were examined.[5]

In addition to the geological checks of the official reserve data, an economic valuation is required. Only when the Russian gas industry is able to bring the gas resources to the marketplace and sell them to solvent clients is the economic value of the resources proven, and only this gas can be called a reserve. Given the changing economic system in Russia, and constraints on domestic gas consumption, it seems adequate to proceed with some additional modifications of the reserve base. For example, production costs in more complex spheres rise sharply and may thus prohibit an economic use of the gas.[6] Likewise, if capital-intensive infrastructure is required to bring a gas field on-stream, then this field may not belong to the reserves. Table 3 opposes the official reserve figures for the largest fields to what we consider to be economically justified reserve levels (adjusted reserves).[7] Some of the underlying adjustments are the following:

- total reserves at Yamburg were estimated at 4,400 bcm in 1994 (Resunenko and Maichel, 1997, p. 1055). They fell to 3,900 bcm in 1998 (Gazprom Annual Report 1998). However, Cenomanian reserves in shallow, easy-to-extract horizons are only around 2,000-3,000 bcm, while production at deeper horizons (Neocomian, Valanganian) is generally considered to be uneconomic (Grace, 1995b). Thus we include only Cenomanian reserves in the adjusted reserve figure;

- official reserves in Urengoy are 3,700 bcm; by adding the North Urengoy field and other satellites one obtains 5,100 bcm. Once again, the adjusted reserves should include only Cenomanian reserves. For Urengoy alone, these were estimated at 6,200 bcm in 1980; today, they are about 3,000 bcm for this area and 4,100 bcm for the entire region;

- the Medvezhye field has already been in decline for some time, Gazprom itself estimates reserves at 640 bcm. Other fields in the Nadym area (mainly: Yubiley, Yamsovey) are said to contain about 3,000 bcm, but their future development might be more expensive as well. A reasonable figure for other Nadym reserves is 1,500-2,000 bcm;

- Yamal is a very special case. Contrary to international conventions, Gazprom includes undeveloped fields in its reserve base. According to Western criteria, Yamal gas can not be considered a 'reserve' since there are serious doubts about the economics of its exploitation. Discovered 25 years ago, none of the 25 fields on the Yamal peninsula has been developed since. Development has been postponed several times, as domestic demand has contracted and lower-cost alternatives abound.[8] Thus, neither the Bovan and Kharasevey fields under appraisal nor the undeveloped Kruzenstern and other fields seem to be technically and economically viable at this point. Thus, Yamal should be subtracted from the reserve base;

- little information is available on the 10,000 bcm of other West Siberian reserves. One-third seems to be an optimistic estimate of this gas, most of which is only under appraisal;

- reserves in the Astrakhan region are officially estimated at 2,100 bcm. However, the site is under appraisal only, the gas is of an inferior quality (sulphurous) and thus production is likely to be expensive. It seems unlikely that more than 50% will be recovered;

- the Stockman reserves are estimated at 2,200 bcm by Gazprom, but it is unlikely that they will be developed in the next two decades. Stern (1998, p. 112) contends that the Stockman project will precede Yamal, thanks to its greater flexibility of routes through the Baltic States and Finland. However, plans for the development of Stockman in the event of a Baltic Gas Ring have been shelved thus far. Hence, this resource, too, should be excluded from the reserve base;

- of the other reserves, about 5,000 bcm are still less explored than those in West Siberia. Therefore they are discounted to one-fifth, which still seems to be on the optimistic side.

When subtracting those elements from the official reserves for which technical and economic feasibility is not clearly evident, the Russian gas reserve base shrinks to about 18-20 tcm. This is still a significant amount, but less than half of the internationally used figures.

Table 3: Russian Gas Reserves by Major Regions and Fields

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Reserve Depletion and Additions: A Stylized Scenario

The depletion of existing fields is of concern to the Russian gas industry in the medium-term, in particular to Gazprom which owns two-thirds of the reserves. Gas reserve additions have indeed fallen significantly since transition started. In the latter half of the 1980s, average annual reserve additions exceeded 2 tcm, which is about five times the consumption level. However, this ratio was not only inverted after 1994 but fell to a mere 0.19 in 1998 (see Table 4): gas output of 564 bcm was compensated for by only 107 bcm in reserve

additions. Since 1993 the reserve base was reduced by over 1.5 tcm. No change in this tendency, which results from a lack of investment, is to be expected in the near future.[9]

Most of the larger fields in operation have already passed their plateau rate and their yearly production is currently diminishing. This is the case most notably with the Orenburg field and in Siberia in Medvezhye/Nadym and Urengoy. Yamburg has nearly reached its plateau rate of 200 bcm and is likely to decline gradually. This leaves Zapolyarnoye as the only commissioned giant field where a significant production increase is to be expected. Figure 1 shows a depletion scenario for Russian gas reserves from producing fields.[10] We assume that about 75% of reserves are really recoverable.[11] Furthermore, we assume a 'long-tail' for all fields, that is, gradually decreasing production after the plateau phase.

The scenario shows that production from existing fields will gradually decline in the first half of this decade; in 2005, production is still above 500 bcm. However, the fundamentals are likely to change afterwards: with the expected phase-outs of major fields in Orenburg and Western Siberia, gas production from existing fields will fall more significantly in the second half of the decade. By the year 2015, only the giant Zapolyarnoye field will still contribute significantly to Russian gas output. This evidently raises the issue of replacement capacity from other fields, be they new giant, new large fields, or satellites, amply discussed both inside and outside of the Russian gas industry (Gazprom, 1998, Stern, 1997, Mabro/Wybrew-Bond, 1999).

Table 4: Gas Output and Reserve Additions, 1990-98

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Figure 1: Depletion Scenario for Russian Gas Reserves from existing fields[12]

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FURTHER ISSUES: RUSSIAN GAS EXPORTS AND FINANCIAL INDICATORS

Perspectives of Russian gas exports

The issue of gas reserves and their depletion is to some extent linked to the perspectives of gas exports, and the financial strength of Gazprom. Russian gas exports have contributed significantly to the country's trade balance, accounting for about 15% of total exports. The total amount of exports has recovered in the late 1990s, after a slump in the early years of transformation. Whereas gas exports to CIS-countries were significantly lower, non-CIS exports increased over the last several years (see above Table 1).

One major factor determining exports is the structure and development of costs. Some authors have expressed doubts as to whether Russian gas exports to Western Europe will be economically sustainable over the long term. The reasons for this are not only the capital replacement expenditures required for upgrading equipment, pipelines and compressors. They also include the fact that gas transport over long distances is expensive and most Russian gas is located along the Urals (South and North) and in Western Siberia, thousands of kilometers away from the centers of effective demand (i.e. mainly Central and Western Europe).[13] Pauwels (1994) and IEA (1995b, 1995c) addressed the issue by estimating future European gas supply curves. Though based on 1993 data from the very beginning of the transformation process in Russia, they concluded that not Russian, but Algerian and Norwegian medium-cost fields would be able to supply the cheapest large additional quantities of gas to Europe.[14]

On the other hand, official import statistics of the European Union show import prices for Russian gas significantly below the above estimates, in the same range as those of its competitors. In March

1999, the natural gas import price into Europe was 62.3 USD/Tcm (1.87 USD/MBtu) for Russian gas, similar to the 64.6 USD/Tcm (1.94 USD/Mbtu) for gas from the Netherlands, 66.3 USD/Tcm (1.99 USD/Mbtu) for Norwegian gas, and 55.9 USD/Tcm (1.68 USD/Mbtu) for non-specified sources (most likely Algerian gas) (IEA, 2000, Energy Prices and Taxes, 3rd Quarter 1999, p. 32). Only gas from the UK was somewhat cheaper at 2.00 USD/MBtu. As compared to 1994, i.e. the time of the afore-mentioned studies, gas prices were about 20% lower in 1999, but the relative prices between exporters had not changed. If these figures reflect reality, and if Russian gas exporters do not sell below their costs on a permanent basis (dumping), then Russian gas is definitely competitive in Western Europe.[15]

Another issue is whether Russian gas exports can still increase significantly from the current levels of 120-130 bcm. Given capacity constraints on existing pipelines, increasing exports would require new infrastructure. For the time being, smaller export projects dominate the two large-scale projects, i.e. the Yamal-Europe and the Blue Stream projects.[16] An example is the Balkan expansion project, which is supposed to expand export capacity onshore through Ukraine, Romania, Bulgaria, and down to Turkey. Transit capacity is to be increased by 14 Bcm by the year 2002; the first stretch between Ghust (Ukraine) and Satu Mare (Romania) has already been started. Work on the link between the "Northern Lights" pipeline in Minsk (Belarus) and Poland (Kondratki-Wloclawek) is also advancing, with the first 56'' connection having been completed in late 1999, and with increases in capacity being expected from the present 10 bcm to 28 bcm. This provides Russia with not only additional export capacity, but also with a strategic alternative to gas transit to Central/Western Europe that circumvents the politically unstable Ukraine.[17]

Financial indicators for OAO Gazprom

Last but not least, the financial situation of the gas monopolist OAO Gazprom, which accounts for the largest share of Russian gas sales,

will determine the level and the speed of investing in reserve additions. Due to the domestic non-payment crisis, the operating profit of the company and thus its capacity to invest have been curtailed. The normalization of relative prices that had made progress in 1996/97 was stalled for social reasons in 1998. In late 1999, the average domestic fell to about 30% of the export price (against 55-60% pre-devaluation). [18]

The development of the share price can be considered as an indicator of the market's evaluation of Gazprom's strengths and weaknesses. Pre-August 1998 analysis showed that Gazprom was discounted by about 60% compared with the average Russian oil company on a reserve basis; on an output basis, the discount was 36% (Nail, 1997). Things changed somewhat after the financial crisis, in that Gazprom has better resisted than most other companies in the energy sector. The Gazprom share price on the Moscow Stock Exchange fell by "only" 67% whereas the RTS-stock index dropped by 86%.[19] Since late 1998, the Gazprom share price has recovered more than half of its pre-crisis value, and has thus become stronger than most oil titles. Yet when compared to the two most successful oil companies, Lukoil and Surgutneftegaz, the Gazprom share still seems to be lagging behind in the recovery process (see Figure 2). In October 1999, Gazprom's market capitalization to reserve ratio was only 3.5% of the ratio of the two leading oil companies, Lukoil and Surgut.[20] The market capitalization over production ratio of Gazprom was in the same range, at about 7%.[21] If "the market is right" in this case, it might be concluded that investors see Gazprom's development perspective as less promising than those of the oil champions. Part of this perception of OAO Gazprom can be attributed to the collapse of the domestic market and to inefficient governance structures; however, another factor might be that the gas reserves themselves are overvalued.

Figure 2: The development of the Gazprom share price, 1996-1999

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CONCLUSION

The Russian gas industry has been seriously affected by transition, one of the consequences being the current debate on the proper evaluation of the Russian gas resources and reserves. The systemic change from socialism to some kind of market economy requires a new approach to estimating the economic value of the gas reserves. There seems to be a general consensus that not all of the official Russian gas reserves of 47 tcm can be considered as real reserves in an economic, Western sense. Our estimates hint at real gas reserves of about 18-20 tcm, i.e. about 40% of the official figure. Current production levels can be maintained in existing fields until about 2005, afterwards production from existing fields will diminish significantly. The Russian gas industry, and in particular its dominant player, Gazprom, will need to undertake substantial investments in production and reserve additions if they wish to maintain the current level of output.

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ENDNOTES

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[2]In 1976, the Soviet Union's share of world gas reserves was estimated at 40%, in 1998 at 32%. The Soviet Union's share of world gas production was always less: 37% (1986) and down to 24% in 1998 (BP-Amoco, 1997).

[3]A brief overview of the problems of Western and Russian conceptions of gas reserves is provided by Grace (1995a, pp. 73-74).

[4]Grace (1995a, p. 73) explains how the Soviet concept of reserves stretches the Western concept beyond its normal limits. Soviet recoverable volumes are typically estimated based on virtually unlimited budgets and the presupposed application of almost any conceivable technology. Therefore, it is surprising, but not inconsistent, that gas recovery factors still used in official statistics from the FSU assume 100% recovery of gas in place."

[5]Yamburg, Urengoy, Zapolyarnoye, Yamal, and other fields in Western Siberia, as well as Ural-Volga (sum of 18.8 tcm); not analyzed were the so-called reserves in Medvezhye, Astrakhan, Stockman, and others (total of 8.3 tcm). Some industry analysts concluded from this that "the total amount of the proven and probable stocks of Gazprom is 18.8 tcm gas" (AK&M, 1999, p. 32); if this estimate were to be generalized at the level of the entire country, it would imply a level of Russian reserves of roundabout 33 tcm.

[6]Thus, average production costs from Russian fields are expected to rise from the current 3-5 USD/Tcm to 12-15 USD/Tcm by 2015; Grace (1995b, p. 80) confirms these estimates.

[7]Note that the adjustments are not based upon long-term price and cost scenarios, which would require a more in-depth analysis.

[8]The objective of the Yamal-Europe project was to tap the gas on the Yamal peninsula in the Northern Urals, and to export about 70 bcm per year to Central and Western Europe (cf. Resunenko and Maichel, 1997). Given the unexpected slump in Russian domestic consumption, more gas is now available for exports, diminishing the chances that Yamal will be developed soon. The decision of Russia to contract up to 50 bcm per year of Turkmen gas in the future has further reduced the necessity of large new field developments in Yamal. Nowadays, the Yamal project is even rated as inferior to Stockman, as "Yamal is a difficult and inflexible project, which can not be built in a modular fashion." (Stern, 1997, p. 112). Morgan

Stanley Dean Witter (1998, p. 8) also conclude that Yamal "is unlikely to be needed in the near future due to excess supply in the Russian market."

[9]It should be mentioned that from an economic point of view, underinvesting may be rational as long as the market is depressed and ample reserves already exist.

[10]"Other" fields include those commissioned before 1995 (Vyngapurskoye, Komsomolskoye) and those commissioned more recently (Tarkosalinskoye, Yubilyeynoye, Yamsovey); fields to be commissioned in 2001-2005 are not included (these are mainly satellite fields of South Russkoye, Pestcovoye, Gubkinskoye).

[11]According to Grace (1995b, p. 73), about 80% of quoted reserve figures can be considered recoverable whereas other specialists quote a ratio of two-thirds. We assume that reserve additions occur mainly in non-producing fields.

[12]Historical data (1995-98) is adjusted and may not fully correspond to real production of non-associated gas.

[13]IEA (1994) undertook an analysis of the hypothetical costs of gas delivery, assuming capitalist cost accounting, i.e. including depreciation on capital. It concluded that under full-cost accounting, the Russian gas sector may not have been profitable in the early 1990s.

[14]According to IEA's (1995c) estimates, in the year 2020, the least-cost suppliers to the EU should be the Algerian Transmed pipeline at about 35 USD/thousand cubic meters (Tcm) (or 1.06 USD/Mbtu)

at EU-border, Algerian LNG from Montoir (65.3 USD/Tcm, 1.96 USD/ MBtu) and the Norwegian fields Ekofisk (44.6 USD/Tcm, 1.34 USD/ MBtu), Sleipner (51.9 USD/Tcm, 1.56 USD/MBtu) and Troll (65.3 USD/Tcm (1.96 USD/Mbtu) delivery Emden, 76.3 USD/Tcm (2.29 USD/MBtu) delivery Zeebrugge). Even the Norwegian Haltenbanken field, yet to be developed, would be cheaper (at 97.2 USD/Tcm, 2.92 USD/ MBtu) than the cheapest Russian delivery, i.e. Western Siberia (107 USD/Tcm, 3.22 USD/MBtu). In that scenario, Russian Yamal gas (112 USD/Tcm, 3.37 USD/ MBtu) and Turkmen gas (150 USD/Tcm, 4.49 USD/ MBtu) were supposed to be significantly more expensive. Note that at that time, gas prices were about 20% higher than in mid-1999.

[15]High transportation costs from Russia to Western Europe are offset by lower production costs. Gas swaps can provide relief from high transport costs for a certain volume of gas. The devaluation of the Russian Rouble has certainly improved the competitiveness of Russian gas exporters.

[16]Whereas the 'Yamal-Europe' gas export project has been under discussion for 15 years now, no breakthrough has occurred on the critical issue, i.e. the development of the Yamal peninsula gas fields and the connection to the Northern Light pipeline at Uchta (see above). The 'Blue Stream' gas export project, connecting Russia with Turkey through an underground pipeline, too, seems to be encountering more severe technical problems than initially envisaged, and has been delayed several times now. Whereas the

Izobilnoe-Dzubga (Russia, 373 km) and the Samsun-Ankara (Turkey, 444 km) onshore stretches are conventional and modestly expensive (ca. USD 500-800 mn each), the crossing of the Black Sea (396 km, down to 2,150 meters under water, between Dzubga and Samsun) is pushing even Western equipment companies to their limits. The memorandum of mutual understanding signed between Gazprom and ENI in February 1999 confirmed this ambitious project politically, but issues of financing are yet to be resolved.

[17]Opinions diverge on whether Central/Western European markets would be able to absorb large quantities of additional Russian gas exports.

[18]The payment ratio had deteriorated further in 1998: though the cash payment ratio has risen from 12% of the nominal value of gas sales (1997) to 18.2% (1998), the barter ratio had declined from 30.5% to 33.5%, thus raising the share of unpaid gas deliveries from about 37% to 48%. AK&M (1999, p. 32). The government had agreed to increase the gas price for residential consumers to at least 88% of the industrial wholesale price, which it was unable to attain. Gazprom has "failed to disconnect non-paying customers from its supplies, partly as a holdover from its socialist background and partly because it has been encouraged not to by a government keen to retain social cohesion in a country facing so many other problems." (United Financial Group, 1999, p. 20). For an analysis of the political economy aspects of gas sector reform in the CIS see Hirschhausen and Engerer (1998).

[19]At the same time, the London quotation of the Gazprom depository share (ADR) fell by 37%, but the index of Russian issuers corporate securities dropped by 62% (Gazprom annual report, 1998).

[20]Gazprom: market capitalization (Moscow Stock Exchange): USD 3.2 bn, reserves: 295 bn bbl (corresponding to the official 47 tcm), that is 0.011 USD/bbl reserve, against 0.32 USD/bbl for Lukoil and 0.36 USD/bbl for Surgut. The average prices for oil and gas (per million BTU or one barrel) were quite similar in 1998: natural gas European Union c.i.f. import price: 2.27 USD/MBtu; crude oil OECD countries c.i.f. import price: 2.18 USD/MBtu, see BP-Amoco (1999) Statistical Review of World Energy, p. 29.

[21]Gazprom's MCAP/production ratio: 0.95 USD/bbl, against 12.3 USD/bbl and 13.8 USD/bbl for Lukoil and Surgut, respectively.

TABLES AND FIGURES

Table 1 The Russian Gas Balance, 1990-98 [1]

in billion cubic meters (bcm)	1990	1991	1992	1993	1994	1995	1996	1997	1998[2]
Production [3]	640.5	643.0	640.4	618.3	607.3	595.0	601.0	570.0	591.0
Imports	70.2	69.0	7.0	6.5	1.5	3.9	4.7	2.7	2.0
Exports	-249.0	-247.0	-189.0	-171.0	-185.0	-192.0	-197.0	-200.0	-201.0
of which: C.I.S.	140.0	164.0	101.0	75.0	75.0	70.0	69.0	80.0	76.0
Others	109.0	83.0	88.0	96.0	110.0	122.0	128.0	120.0	125.0
Stock Changes	- 5.0	- 2.5	-1.1	-10.1	-10.0	-13.0	n.a.	n.a.	n.a.
Domestic Consumption [4]	456.7	462.5	457.3	443.7	413.8	393.9	408.7	372.7	392.0

[1] Until 1991 RSFSR.

[2] Estimates.

[3] Including associated gas

[4] 1996 - 1998 including unknown stock changes.

Sources: Goskomstat: Statistical Yearbook of Russian Federation, various issues; Goskomstat: Sotsial'no ekonomicheskoe polozhenie Rossii 1998 g., XII/1998; IEA, 1995; OECD: Energy Statistics and Balances of Non-OECD Countries, 1999; Russian Economic Center for Economic Perspectives, 1999.

Table 2: Estimates of Russian Gas Resources

in trillion cubic meters (tcm)					
Grace	165				
IEA	212				
Gazprom	226	of which:	onshore:	68%	
			West Siberia		41%
			Eastern Siberia		19%
			Volga-Urals		6%
			Northern European Part		1%
			Northern Caucasus		1%
			offshore	32%	

Sources: Grace (1995a, p. 73), IEA (1995, p. 167), Gazprom (1998, p. 63).

Table 3: Estimates of Russian Gas Reserves

in bcm Region/field and status		Official Reserve Figure	Adjusted Reserve Estimate
**** Yamburg		3900	2000-3000
**** Zapolyarnoye		3000	3000
*** Urengoj		3700	3000
*** Medvezhye		640	600
*** others Nadymgazprom		3000	1500-2000
** Yamal		10,000	-
of which: ** Bovanenko	(4400)		-
** Kharasevey	(1300)		-
* Kruzensterm	(1000)		-
* others Yamal	(3300)		-
** others West Siberia		10000	3000-4000
*** Orenburg (Ural-Volga)		1000	1000
*** Surgut		1000	1000
*** Severgazprom		500	500
*** Tyum		1000	1000
** Astrakhan		2100	1000
* Stockman		2200	-
Others		ca 5,000	1000
Sum		ca. 47000	ca. 18000-20000
of which:			
Western Siberia		78%	
Volga-Urals		10%	
Eastern Siberia		2%	
Far East		2%	
Offshore		8%	
by state of exploitation:			
**** in operation: plateau or rising			
*** in operation: tail (falling production)			
** under appraisal			
* undeveloped			

(1998),
IEA (1995a), Resunenko and Maichel (1997); adjusted reserve figures: author's calculations, based on specialized literature and expert interviews.

Table 4: Gas Output and Reserve Additions, 1990-98

in bcm									
Year	1990	1991	1992	1993	1994	1995	1996	1997	1998
Production [1]	613	618	620	601	581	570	575	571	564
Reserve Additions	2785	1741	1813	725	265	187	180	545	107
Ratio of Reserve Additions/ Production	4.54	2.82	2.92	1.21	0.46	0.33	0.31	0.95	0.19

1 Production figures differ from Table 1 due to the ommission of associated gas

Sources: Gazprom (1998, p. 68), Gazprom Annual Reports 1997, 1998

Figure 1: Depletion Scenario for Russian Gas Reserves (from commissioned fields)