February 1999 ECN-C--99-027

RUSSIAN ENERGY MARKETS: CURRENT SITUATION AND OPPORTUNITIES FOR CO-OPERATION

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Preface

Present report attempts to give a review of the current state and outlook of the Russian energy sector at the end of 1998. Particularly attention is paid to methodology of forecasts, policies, structural changes of the sector and recommendations for improvement and co-operation with the EU.

The report, which focuses on the current situation and outlook for the energy sector in Russia was based on material collected in and derived from the reports drafted in the Synergy project 97-02, 'Developing the Energy Policy Dialogue between EU and RF'. The project was focused on a preparatory analysis and review of the following topics:

- the energy demand outlook and policies in both the European Union and Russia,
- the developments of the gas market across Europe,
- the energy supply and trade options between EU and Russia.

The objective of the Synergy project was to identify areas, activities for the enhancement of the co-operation between the EU and Russia in the area of energy. The results, conclusions and recommendations of the study were discussed and agreed upon at a high level workshop in Moscow at 26/27 November 1998 at the end of the project. In fact the project started in December 1997 and was finished at the end of 1998 and resulted in three reports, one on each topic, and an executive summary containing final conclusions of the reviews and recommendations for improvement and further co-operation.

The series contain the following volumes:

Volume I	Evolution of Energy Demand in European Union and Russian Federation
Volume II	Developments of Gas Markets across Europe
Volume III	EU - RF Energy Supply Options and Trade
Volume IV	Executive Summary and Recommendations

The institutes that conducted this Synergy study for the EU, DG XVII and the Russian Ministry of Fuel and Energy were ECN (co-ordination), NTUA from Athens, SEO University of Amsterdam at the EU side and the Centre for Energy Policy and the Energy Research Institute (RAS) in Moscow at the Russian side.

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Acknowledgement

The authors thank all the colleagues and institutes, involved in the project and drafting of the reports in the framework of the Synergy project 97-02, for their contribution to the construction of this report on the Russian Energy Markets.

EXECUTIVE SUMMARY

The Russian economy has been and is characterised by a relatively very high energy intensity, abundantly available energy supplies and resources and central planning. In the transition towards a more market-oriented economy the energy sector plays an important role, because of its relative importance to the Russian economy and to stop the wasteful use of the energy resources necessary for a sustainable long run development of the Russian economy and European supply security.

Our study clearly shows that although the major policy objectives in Russia are in practice more or less the same as in the EU, insufficient attention is paid to energy saving and efficiency improvement of end-use in all economic sectors. In order to increase the competitiveness of the Russian economy it is necessary for the government, local authorities, etc. to pay more attention to development of efficiency programmes and policies, to enhance the skills, knowledge and particularly payment of the energy bills by consumers (currently the average non-payment is about 80%).

With respect to supply, the abundant reserves of gas, oil and coal did lead to an inefficient exploration, production and distribution. Therefore it is necessary to gradually implement cost based pricing of fuels for production, transport, distribution and trade, which will lead to a more efficient supply to consumers and allocation of fuels between regions.

The gas market, with Gazprom as the major supplier, should continue its plans for a more efficient production, transmission and distribution of natural gas. It should also pay attention to appropriate pricing of gas, namely based on interfuel substitution.

Furthermore, stabilisation of the economy should also allow and encourage more joint ventures to invest in energy projects, particularly in the field of improvement of efficiency of production, transport and distribution of gas, oil, coal and electricity.

As a consequence of improving the efficiency of the entire energy sector, including end-use in economic sectors, trade between Russia and EU member states can be enhanced, which is to the benefit of both the EU as well as the Russian Federation.

CONTENTS

1. INTRODUCTION

Russia is important in the world energy markets because it contains the worlds largest natural gas reserves, second largest coal reserve and eighth largest oil reserves. Furthermore it is the world's second largest energy consumer and largest exporter of natural gas and second largest exporter of energy and petroleum.

Russia's economy is undergoing serious difficulties in the process of reforming the Centrally Planned Command and Control system into a more market oriented system.

The inheritances from the old system are well-known, namely:
- very high energy intensity,
- distorted pricing system,
- severely polluting activities.

The fact that Russia is surrounded by many countries, which generally have a great need for imports of oil and gas and other commodities increases the relevance of the Russian energy resources and production for its neighbouring countries. Particularly the EU is expected to face a steadily rising import share for oil and gas from Russia. Consequently the EU is keenly interested in the developments in Russia, because of the relevance for European energy security of supply in the medium and long run.

Therefore the EU also has a great interest in developing and fostering a continuous dialogue and co-operation with the Russian Federation on energy issues now and in the future. For that matter it organised a study with respect to several topics of mutual interest of both EU and Russian Federation (RF).

The topics of this general analysis concern a review of the:
- evolution of the energy demand in EU and RF,
- development of natural gas markets across Europe,
- energy supply and trade options in both regions.

A number of conclusions were drawn with respect to the current energy sector and policy situation for the above-mentioned topics in the EU and RF and the enhancement of energy co-operation. However, this paper will focus on the current energy and economic situation in Russia and its implications for the reform process, energy co-operation with the EU.

The paper is organised as follows - section 2 discusses the current status of the reforms, economic and energy demand situation. Thereafter the demand projections/scenarios and current policies are discussed. Next, in section 3, the current situation of the energy markets in Russia will be reviewed. In section 4 follows a brief overview of the trade relationships between EU and RF. In section 5 conclusions and recommendations to improve the current situation in Russia and support the co-operation between EU and RF are formulated.

2. ECONOMY AND ENERGY DEMAND

2.1 Reforms

2.1.1 Unsound and incomplete reforms

It is widely believed that the Russian authorities have failed to push forward the reform process sufficiently. The August 1998 collapse of the Rouble, tearing off 80% of its value to the Dollar, is interpreted by many Western observers as an indication of just how vulnerable the Russian economy still is to confidence crises, as a result of the incomplete adjustments. Problematic corporate governance, slow restructuring and a weak financial system imposed a severe handicap on the transformation process, causing the crisis to bite deeply into the economic developments in Russia. In addition, the Russian government failed to take on the manipulative vested interests, both from the old structures, and from the new oligarchs (EBRD, Transition Report 1998).

In this section we address some of the typical problems Russia has been facing during the last years, which have negatively affected the transition process.

After the early endeavours of privatisation and liberalisation, the more difficult challenges of a 'proper' transition process are:

- corporate governance and enterprise restructuring,
- financial sector reforms,
- infrastructure reform,
- fiscal reform,
- social sector reform.

These challenges demand a great effort of a state, against a background of an overcapacity, underdeveloped economy.

2.1.2 The non-payment issue

A necessary implication of the liberalisation of the energy markets has been the liberalisation of the energy prices. The dilemmas of the state have been:

- should we liberalise completely, or should we continue to protect certain sectors of the economy,
- should we liberalise by shock or gradually.

The choice with respect to energy prices has been a mixed one. Energy bills have not been paid for by large groups of consumers, either because salaries and social security or pension transfers have been eroded by accelerating inflation, or postponed entirely, or because energy bills have soured. This issue should thus be sub-divided into two parts - actual (and possible) financial status of consumers and their payment discipline.

2.1.3 Vested interests

Russia has witnessed the rise of a limited number of tycoons, who have built up conglomerates of enterprises, while at the same time developing networks with politics, which they use to protect the interests of the commercial activities. The conglomerates are typically spread across sectors, and always include a private bank. Some of the tycoons have started from scratch, but several have risen from the old structures (oil and gas companies, the State Bank, even the secret police). The power in Russian politics and business of the few stretches far in Western standards, but it should not be exaggerated: estimates of their direct influence amount to 5% of GDP. Moreover, the recent financial crisis seems to have weakened the financial basis of the better part of their power. Notable exceptions are the tycoons whose powers stem from the gas and oil industries, Gazprom and Lukoil (R. Vyachirev and V. Alekperov).

'The Black Hole'

A substantial amount of Russia's foreign exchange reserves have been concealed in a Jersey-base company, named FIMACO, over the last five years. Estimates by the state prosecutor who has been investigating the Central Bank's spending, amount to $50 billion. The motivation is said to have been partly to 'avoid complications' in negotiations with Russia's creditors. The construction has been hidden for parliamentary control. However, this is probably one of the most extreme cases, but not an exception, because it is also observed that small companies are using this practise for avoiding taxes.

The tax system

The Russian fiscal system is characterised by large imbalances. It is obscure and distorted, and the tax collection authorities operate ineffectively. The tax base is still small - and currently shrinking as a result of the declining economy and increasing non-payment by companies. Taxes are evaded and avoided, as the financial burden is often too high for the majority of the enterprises and due to the increasing practices of non-payment.

2.2 Energy policy

2.2.1 Policy objectives

In January 1992 the RF government made a decision to develop the Energy Strategy of Russia. The Energy Strategy of Russia received government approval in December 1994 and was adopted by a presidential decree in May 1995. The main goal of Russia's Energy Policy is to get ways and conditions for the most efficient use of energy resources and the energy production potential for raising the living standards of the population and the socio-economic revival of the country.

With a competitive price and tax policy, the country's vast energy reserves can and must provide internal and external financial resources for relieving public taxation, curbing inflation and supporting Russian commodity producers and thereby raising national income.

The next goal of the RF Energy Policy is to stimulate productivity and the quality of life. Energy supplies should be made reliable and reoriented to raising the energy services to

the population. Communal needs, passenger transport, and food production should be satisfied with high quality energy carriers, such as electric power, natural gas, motor fuels and others, while the share of industrial consumption in the general energy balance should be reduced.

Other important objectives of the RF Energy Policy are:

- To lower the environmental impacts of the energy industries significantly.
- To support and reinforce Russia's energy independence and make use of the energy systems as a most important tool of integration of the Russian regions and the CIS countries.
- In addition, the RF Energy Policy is focused on a radical reduction of the use of materials, labour and natural resources for meeting the energy needs of the community.

2.2.2 Energy policy instruments

The general tool for implementation of the Russian energy policy objectives and priorities is the development of an internal energy market, controlled by the state (as formulated by the Russian Ministry of Fuel and Energy) in the long run by means of:

- Price and tax policy, which would keep steady prices of energy carriers and other commodities and gradually introduce fuel prices whose upper limit would match world market prices and whose lower limit would match enterprises' self-financing prices; lower taxes on the processing industry and services financed by rent payments and taxes on excess profits of fuel enterprises.
- Consistent policy of forming a competitive environment in the energy industry through creating full-fledged market rules and a market infrastructure.
- Improving the law and drafting a sufficiently complete system of regulations in the form of the Russian Federation's Energy Code, which will regulate relationships between subjects of the energy market and the state administration bodies and the public.

Within a regulated market the state must ensure:

- The creation of a system of incentives and conditions for energy conservation and higher efficiency of production and use of energy.
- Deregulation of export of energy resources and import of energy equipment and materials with an effective state control over the observance of the country's interests.
- an active investment policy by creating conditions for the self-financing of fuel-energy enterprises and enlarging the number of domestic and foreign investors, while keeping budget investments to a minimum.

2.2.3 Forecasting and planning

It was compulsory in the former Soviet Union to provide energy consumption ‘predictions’ 20 years ahead – as part of the overall state planning process, which was following a five-year schedule.

In accordance with current Russian laws, such energy consumption forecasts are now run annually and cover three next years, they are supplemented by estimates for the end of each next five-year period. In addition to this, forecasts of energy demand and develop-

ments were provided in Russia between 1993 and 1994 to highlight the regional breakdown through 2010. These forecasts have been incorporated into the Energy Strategy of the Russian Federation. Its major provisions were approved by a presidential decree and government ruling in 1995, and the background materials were published in full in [1].

Due to continued economic recession in Russia, the energy consumption outlook through 2010 was essentially revised in 1995 when the country's gas industry development strategy was under study. These data were published in [4, 5].

Figure 2.1 shows the difference between GDP profile predictions of 1994 when the Energy Strategy was under development (lines 1 – 3) and those made in 1996 (lines 4 and 5). Figure 2.2 illustrates related changes in predictions for primary energy consumption.

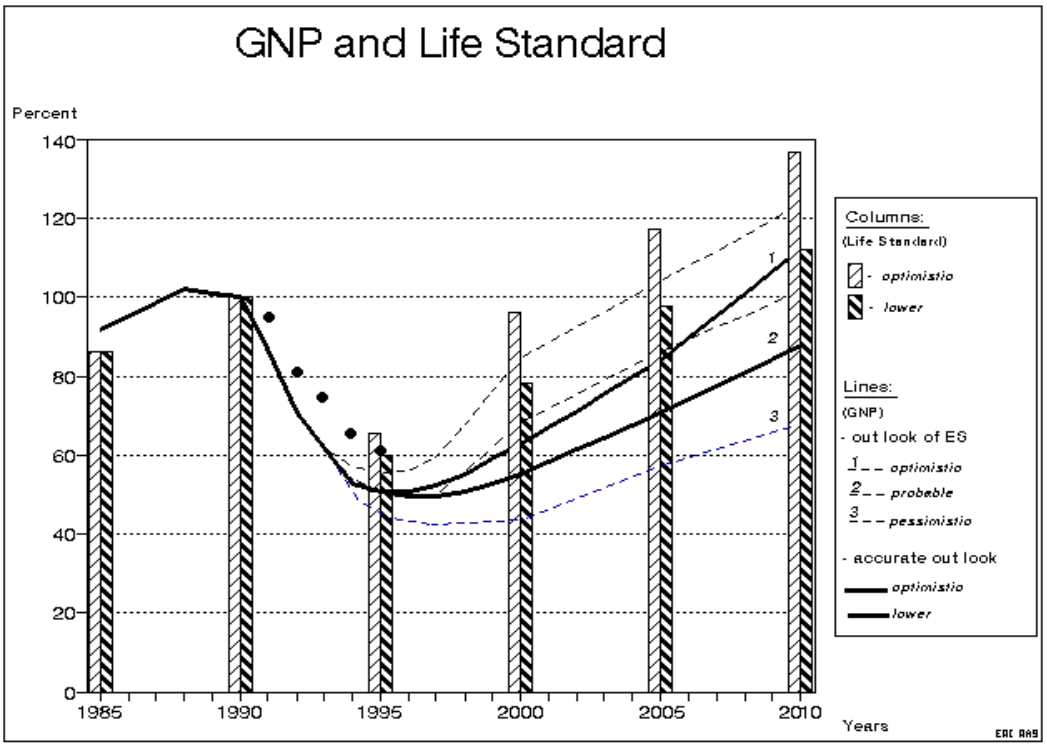

Figure 2.1 *GNP and living standard projections for the Russian Federation*

In 1997, Energy Research Institute was requested by the Russian Ministry of Fuel and Energy to conduct an energy consumption and development study through 2030.

For the Russian Federation, clearly the most authoritative set of scenarios incorporated into the Energy Strategy of the Russian Federation, approved by decree of President Yeltsin, have been selected for further analysis and evaluation. Without a doubt, these scenarios form the cornerstone of energy policy in the Russian Federation. Besides the ‘Optimistic’ and ‘Probable’ scenarios, the ‘Pessimistic’ scenario is not elaborated in full scale of details and was not considered on the period until 2030. Therefore, it is not taking into account in the next chapters.

2.2.4 Review of the scenario approach

Energy consumption forecasting methods are employed by the majority of developed market countries, but could not be used in Russia so far. These methods are built around current trends which are updated using statistics and econometrics. The main shortcoming for Russia however is the lack of a comprehensive series of report information and, most importantly, incorrect use of these data under the circumstances of a transition to a market orientation and the current severe economic recession and its side-effects.

Previously, in the centrally planned economy, it was more effectively applied. Now, properly under the new conditions, the detailed energy consumption estimation methods fail to operate due to absence of necessary background information. Moreover, these methods completely ignored numerous economic factors such as energy demand curves under varying energy prices, consumer solvency and other. These had to be remedied on the basis of fragile empirical evidence.

Demand for energy is determined from the following main factors, see figure 2.2.

- economic development - growth rates and restructuring,
- energy prices - government's pricing and tax policy in the energy area and a price profile required to enforce demand and supply equilibrium,
- energy conservation - potential for fuel and energy savings, cost indicators and possible implementation rates,
- energy substitution - technologies and economic opportunities for switching between various fuels and energy types,
- financial status and payment discipline of consumers.

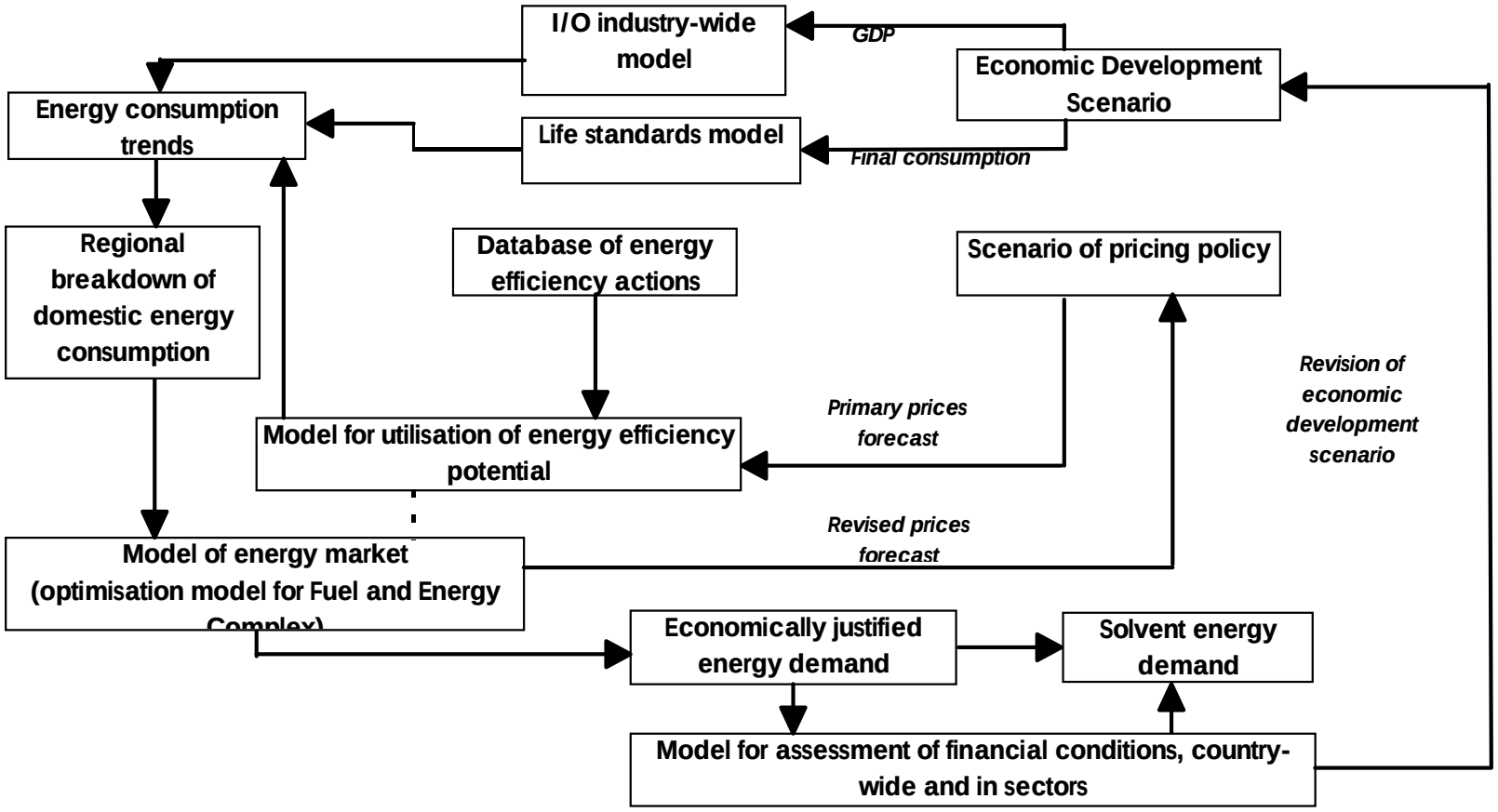

Figure 2.2 *Procedure for forecasting Russian energy demand*

These factors are mutually interdependent under market economy conditions and depend on pricing and tax policies. The Russian government is enabled to effectively control price conditions in the fuel and energy sector, both through direct price control for natural monopolies (gas, power, centralised heating, oil and refined product pipelines) and indirectly - by means of taxes, excise duties, etc.

Energy conservation potentials

A great role of energy outlooks in Russia is attributed to the vast unused energy conservation potential. It has been accumulated in the country over decades of development under artificially understated energy prices and now totals 40 - 45% of the cumulative energy consumption. The potentials are listed in Table 2.1. Energy conservation outlooks require the rated pay back periods for energy conservation projects to be pre-defined. Such ratings are set equal zero in 1997 (no energy conservation investments), rising to four years by 2005 (the longest implementation period for such projects).

Table 2.1 *Energy conservation potential in the Russian Federation for the year 2020 according to the Optimistic and Probable scenario*

Energy consumers	Gas [bcm]	Refined products [million tce]	Coal and coke [million tce]	Electric power [billion kWh]	Heat [million GJ]	Total [million tce]
Fuel and energy complex	50-60	15-17	33-39	38-46	670-760	150-180
Including:						
Oil production	8-10	1-1.5	-	3-4	10-15	10-15
Coal production	-	-	-	8-10	-	3-4
En. transmission	8-9	-	7-8	30-36	630-710	52-59
Power & heat	32-42	10-12	26-31	-	-	80-97
Refining	1-1.5	4.5-5	-	1-1,5	40	9-11
Residential sector	10	0.6-0.8	21-23	65-70	500-600	75-83
Agriculture	1.4-1.5	14-15	1.5-1.7	8-10	15	27-29
Transport	-	29-34	-	-	-	42-50
Industry	34-42	6-7	12-14	220-265	700-870	158-190
Including:						
General operations	10-13	0,5	-	150-185	310-420	73-92
Metallurgy	12-15	2	10-11	20-24	20-25	34-39
Machinery	-(3-4)	0,5		55-60		15-16
Constr. materials	10-11.5	1,7-2	2-2,5	-(8,5-10)	170-190	20-23
(Petro-) chemicals	5-6	-	-	4-5	50-60	9-10
Wood and paper	0.3-0.7	1-2	-	-	150-170	8-10
Totals	100-110	65-75	70-80	330-390	1,880-2,250	450-540

Energy carrier substitution

It is important when addressing demand for individual energy carriers, gas in particular, to consider its substitutability between fuels and energy types for different consumer categories and regions, rather than opportunities for energy conservation alone. Quantity estimates of energy switching capacity are affected by its negative impacts on energy production prices and energy market prices as a whole, when addressed together with energy conservation.

This requires the use of a detailed (regionally, by consumer category and energy producer) energy market model for gas demand estimates. In fact, this model comprises a fuel and energy balance optimisation model for a market economy. It helps to define demand and outputs for each fuel and energy type, combined with related equilibrium (and, as necessary, monopolistic) prices in regions.

Financial status of consumers

The above mentioned demand forecasting methods offer to define its economically justifiable levels, but fail to identify the consumer solvency.

This issue should be sub-divided into two parts - actual (and possible) financial status of consumers and their payment discipline. The proposed methodology initially centres on analysis of potential ability of major (energy-intensive) consumers to pay annual energy bills (sized in accordance with economically reasonable demand) under various pricing policy options. If the fiscal capacity of energy-intensive consumers is sufficient for paying such bills, their economically viable demand will be interpreted as a *solvent one***.** In contrast, a consumer will be considered bankrupt and the solvent demand will be defined by taking away his energy consumption from the economically reasonable demand.

Energy forecasts

At the request of RF Mintopenergo, the Russian ministry of fuel and energy, Energy Research Institute (ERI) of the Russian Academy of Sciences developed *Conceptual long-term outlooks for fuel and energy development in Russia* in 1997.

2.2.5 World energy development

Studies involved in the long-term energy development outlook for Russia were preceded by a review of available world energy consumption predictions published between 1992 and 1997. However, they have been found to provide misleadingly wide energy consumption ranges: from 10 billion to 17 billion tons of oil equivalents (toe) in 2020. This has urged the execution of in-house world energy consumption studies, based on new trends in the 1980s and still more pronounced in the 1990s.

The outlook was built around UN's predictions of population growth broken down by typical groups of countries, WEC-IIASA trends in per capita energy consumption. and IEA energy prices outlooks. Employment of the new world energy consumption trends enables to refine the previous predictions, both in the absolute terms – by the end of the addressed period – and with regard to consumption dynamics in the interim period.

The World level crucial inputs were augmented by two economic development ingredients:

- *The optimistic scenario* assumes efficient management of the country, extensive investment from abroad, and favourable political environment and world market conditions. It is believed that it is possible to achieve high GDP growth rates in Russia, averaged at nearly 4% a year, over the entire projection period.
- *The probable scenarios*, in contrast, assumes that the national economic reforms would not be accompanied by favourable conditions in the exterior and domestic resources would thus become the major source of revenue for the industry. Average annual growth rate would not exceed 3% in the addressed period. This scenario supposes reduction of the technology gap between Russia and the leading technology nations to 15 - 18 years by the end of this term.

The GDP profile is not expected to be smooth in the two scenarios. Completion of the first phase (recovery to a pre-crisis GDP level) is expected to be accompanied by slowdown of economic growth. However, emergence of the profound industry base during the second phase would lead to its upper performance limit, accompanied by economic stagnation and restructuring. For this reason the last decade of the addressed time interval is also likely to become a GDP deceleration period.

In general, GDP could jump 2.9-fold in the optimistic scenario and by a factor of 2.3 in the probable one scenario during 1990 - 2030. Individual consumption is expected to rise in a smaller proportion in this interval (table 2.2). There will be noticeable delays in these growth rates compared to GDP, both at the recovery stage and in early years of the second and the third phases, with outstripping pace in mid-years of these periods.

Note that the economic development scenarios were built around reduction of inflation rates from 12% in 1997 to 8 - 9% in 2000, 5 - 6% in 2005 and down to 4% by 2010, with sustainable levels of 2 - 3% a year in next years. All outlooks are in Dollar terms: the Rouble is forecasted to loose 90% of its 1997 value in the long run.

Unemployment is expected to rise from 2.4 million in 1997 to 2.9 million in 2000, and 3.6 million by 2005, and will increase to 6% of the employable population.

Our outlooks assume that governmental policies pursue liberalisation of coal, crude oil and refined product markets and, starting in 2000, emergence of a competitive wholesale electricity market subdivided into three or four zones of the country, in addition to free access to gas grids of independent producers based on direct purchase contracts with consumers (with uncontrolled prices).

Increasing liberalisation of energy markets and further property privatisation are expected to promote foreign investments, as shown in table 5.4. The share of these funds is expected to rise from 0.5% at present to 15 - 17% between 2005 and 2010.

Table 2.2 *Key indicators of Russia's economic development scenarios (Probable and Optimistic) up to the year 2030*

	1995	2000	2010	2020	2030
[real terms]					
Population [million persons]	148	148	150	154	160
		146	147	150	155
Gross Domestic Product [billion $]	626	646	1,040	1,465	1,800
		588	875	1,145	1,425
Per-capita GDP [thousand $]	4.23	4.4	6.9	9.5	11.3
		3.9	5.8	7.4	9.0
Investments [billion $]	100.7	99	190	325	270
		86	110	150	185
[index 1990]					
Population	99.8	100	101	104	108
		99	99	101	105
Gross Domestic Product	65.2	67	108	158	187
		59	88	116	144
Per-capita GDP	63.2	66	103	142	169
		59	87	111	135
Investments	31.0	31	59	100	83
		27	34	46	57

2.2.6 Energy prices and tariffs

Two concepts for domestic fuel pricing in Russia have been addressed in the outlooks. Unlike in the majority of western countries where the pricing is mainly based on the World oil price, pricing of energy carriers in Russia is constrained from below by the extraction and transportation costs. Gas and coal prices will be differentiated across the country since high transmission costs are involved. Gas prices are expected to be higher than those for coal as gas consumption yields additional economic and environmental benefits, see also next chapter.

Attaining competition between gas, coal and nuclear power in the electricity market is the central theme for the second concept of ‘Regional Domestic Gas prices. For this reason the upper bounds in table 2.3 correspond to conditions when the existing coal or nuclear power plants become competitive with gas-fired generators in major regions of the country.

Table 2.3 *Wholesale gas and coal price projections for Russia's regions**

	Gas {$/1000 cu m]			Coal [$/toe]		
	2000	2010	2020	2000	2010	2020
Central regions	79-91	92-100	99-147	60-65	63-70	64-71
Southern regions	88-92	103-114	138-146	60-63	64-66	71-76
Volga	72-82	85-192	110-138	56-61	59-66	57-64
				44-49**	46-51	44-49
Urals	63-73	76-81	105-131	51-55	57-60	53-60
				36-40	38-42	40-45
Western Siberia	58-70	73-78	100-125	42-45	45-50	46-51
				23-26**	25-28	26-30
Eastern Siberia	60-76	65-75	90-102	25-28	34-37	40-44
				18-21**	20-23	21-25
Far East	-	82-90	105-120	60-62	63-65	70-74

* Smaller figures relate to European market prices after extraction of RF transportation costs and larger ones to free market prices. Consumer prices (except for privileged tariffs) will be higher than those shown, at least by a margin covering distribution costs.

** Kansk-Achinsk coals.

Although Russia will develop into a major oil exporter over the considered period, export prices are expected to be invariably lower than the world levels, over the next decade at minimum, due to the desire to maintain the competitive edge of domestic refiners whose yields of light products are extremely low. Renovation of the domestic refining industry will take at least 10 - 15 years to be completed, and crude oil prices will remain below the world levels. Gasoline and diesel fuel prices are expected to be in rough agreement with world wholesale prices, or slightly higher, and residual fuel oil prices will be driven by competition with natural gas (table 2.4).

Table 2.4 *Wholesale oil and oil product price projections for Russia ($/t)*

	2000	2005	2010	2020	2030
Crude oil	90-100	105-115	115-130	125-150	138-165
Motor gasoline	170-175	173-180	175-180	180-200	190-215
Diesel fuel	145-155	150-160	155-165	160-180	170-195
Fuel oil	65-70	70-77	75-85	80-90	87-98

Table 2.5 summarises predicted electricity prices broken down by competition zones of the wholesale market based on data in tables 2.3 and 2.4.

Table 2.5 *Electricity transfer price projections for different borders in a 'liberalised' electricity market [$cent/kWh]*

Market zone	2000	2010	2020
European	5.8 - 6.7	6.7 - 7.8	7.2 - 8.5
Siberian	4.0 - 4.8	5.1 - 6.1	5.7 - 6.9
Far East	7.2 - 7.5	7.0 - 7.5	7.4 - 8.2

Electricity end-user tariffs will be 50- 60% higher than those in the wholesale market. Notably, the tariffs for residential consumers (which are now 30-40% lower than averages) will become equal to those for the industry in 2001- 2003, and the tariffs for all consumer categories will be only differentiated in proportion with energy supply costs after 2010. All price outlooks have been made to comply with the current taxation system in the country.

Structural analysis of the technology potential involved in energy conservation and implementation costs enables to identify three groups of energy conservation measures:

- *Low-cost* actions which imply ordering of fuel and energy utilisation. The energy conservation potential for low-cost actions accounts for 100 million toe or 15% of present primary energy consumption in Russia. The scope of implementation was set in proportion with increases of domestic prices for each individual energy type, from the current ones to the world market level.
- *Capital-intensive* measures which require significant investments. The energy conservation potential for these measures amounts to 270-320 million toe in 2010 or 33% to 44% of the projected primary energy consumption, and target actions are driven by comparison between estimated pay back periods and rated ones, with the latter being gradually increasing in line with economic improvements in the country.
- *Accompanying* actions taken during facility retrofitting, when energy conservation is concerned as an associated factor (3% to 9% of the projected primary energy consumption for the year 2010).

The energy conservation outlooks, both cumulative and for individual energy types are highlighted in table 2.6. In total, energy conservation measures concern an amount of energy equal to half (probable scenario) or even two third (optimistic scenario) of the projected primary energy demand for the year 2010. The presently available energy conservation technology potential is assumed to be fully implemented by 2015- 2020, and the Russia's trailing off the world technology level could be much shorter in the next years.

Table 2.6 *Energy conservation options projected to be implemented in the Probable and the Optimistic scenario for the RF in the different years* *

Energy conservation	Total [million toe]	Electricity [billion kWh]	Heat [million GJ]	Natural gas [billion cu m]
Total				
1998	25/40			
2000	49/97	38/75	315/50	10/22
2005	160/284	140/225	900/320	30/68
2010	330/490	280/365	1500/2240	75/116
Incl. Groups of measures:				
Low-cost:				
2000	39/63	26/40	240/360	9/15
2005	69/99	45/68	440/630	16/23
2010	86/103	60/73	570/710	20/23
Capital-intensive:				
2000	10/32	12/32	75/140	1/7
2005	85/167	90/138	480/700	16/45
2010	225/320	200/225	920/1500	60/92
Associated:				
2000	0/2	0/2	0	0
2005	4/18	4/17	0/10	0
2010	19/67	20/64	10/30	0/1

* Numerator is the so-called Lower prices and Probable development scenario; denominator is the Higher prices and the Optimistic scenario.

Table 2.7 *Developments of the Per-capita energy consumption profile in Russia as projected by the Probable and Optimistic scenarios**

	1995	2000	2010	2020	2030
Primary energy [toe/person]	6.19	5.90	6.30	6.80	7.05
		6.10	6.65	7.35	7.65
Of which:					
Food	1.36	1.30	1.35	1.35	1.35
		1.30	1.35	1.4	1.35
Homes	1.58	1.60	1.60	1.60	1.80
		1.60	1.65	1.75	1.90
Transport	0.84	0.95	1.10	1.30	1.40
		1.00	1.15	1.35	1.50
Public needs	1.04	0.85	0.95	1.00	1.05
		0.90	1.00	1.05	1.10
Electricity [MWh/person]					
	5.69	5.7	6.9	8.4	9.7
		5.9	7.4	9.0	10.3
Of which:					
Food	1.07	1.00	1.20	1.35	1.55
		1.05	1.25	1.40	1.55
Homes	0.79	0.85	1.05	1.30	1.55
		0.85	1.10	1.35	1.65
Transport	0.52	0.65	0.85	1.25	1.65
		0.70	0.90	1.30	1.65
Public needs	0.89	0.90	1.05	1.15	1.20
		0.95	1.10	1.25	1.30

* Numerator is so-called Probable, and denominator the Optimistic scenario of economic development.

However, increasing budgets of families will be focused, mainly in the optimistic scenario, on brand new demand categories typical for post-industrial, information society. It is noteworthy that the individual energy consumption attributed to traditional, vital needs - food and homes - will be flat in the probable scenario over nearly the entire projection period (and higher consumption for home needs is likely in the last decade), while the optimistic scenario predicts moderate growth in this area, see table 2.7. Significant energy consumption growth is envisaged for the transportation sector, in addition to partial recovery of energy consumption in the public and government sector (mainly in the defence industries) after 2000.

Per-capita energy consumption trends feature a consistent growth following a 21% decline between 1990 and 1995, thus projected to overshoot the pre-crisis level by 2012 in the probable and by 2009 in the optimistic scenario. Notably, better food would not require extra energy, housing costs will jump more than twice and transport services will expand nearly 4-fold. Individual energy consumption attributed to public needs will be rapidly expanding too. In general, electricity services are most likely to become significantly larger.

2.2.7 Fuel and energy demand outlooks

Energy consumption in Russia in 1995 is highlighted in table 2.8 in accordance with the OECD format. The outlooks were calculated using different methods depending on time horizon.

For the period through 2010, the energy consumption estimates used the industry link model which incorporates 70 physical indicators for main products and services. Concurrently, the energy consumption outlook over the entire projection time-span was provided through living standard indicators using integrated energy requirements per unit of each individual end-product demand. In addition to direct energy costs (for food, clothing, durable goods, energy conservation in homes, public buildings and at passenger transport) these indicators also include indirect energy costs across the entire chain of associated industry facilities including the expansion of necessary industrial capacity.

Energy consumption calculations for the addressed scenarios of economic development include various energy conservation patterns. The first (optimistic) scenario was addressed in conjunction with maximum energy conservation and the second one accounts for relatively moderate conservation rates. Energy demand outlook for these scenarios is summarised in table 2.8.

In the probable scenario, Russia's demand for primary energy is expected to decline through 2000, followed by resumption to the 1995 level in 2010. In the optimistic scenario, energy consumption declines are expected to terminate as early as 1998 (!) and the 1995 level will be achieved by 2002-2003. In the next decades, moderate growth rates are expected, and the 2030 energy consumption level in Russia is set to exceed the current one by a factor of 1.34 according to the optimistic scenario and only by 1.16 in the probable one. The projections indicate rapid reduction of specific energy intensity of GDP, between 2015 and 2020 in particular, when the vast accumulated energy conservation potential could be progressively utilised. In general, the GDP energy intensity is expected to reduce with average rates that match those of Japan in 1960-1995, in the optimistic scenario, and those of Western Europe in the same period, in the probable one.

Table 2.8 *Domestic fuel and energy consumption developments according to the Probable and Optimistic scenarios for Russia**

	1995	2000	2010	2020	2030
[real terms]					
Primary consumption	650	635	730	795	860
[million toe]		600	680	730	765
GDP energy intensity	1.04	0.98	0.67	0.54	0.48
[kg oil equivalent/$]		1.02	0.77	0.64	0.53
Electricity [billion kWh]	842	870	1,105	1,380	1,650
		825	1,010	1,240	1,465
GDP electricity intensity	1.34	1.35	1.07	0.95	0.92
[kWh/$]		1.41	1.17	1.10	1.05
Final consumption	434	425	568	634	675
[mln toe]		416	502	572	610
[index 1990]					
Primary consumption	72.8	72	80	90	97
		69	74	81	87
GDP energy intensity	112	107	74	59	46
		112	81	68	52
Electricity	72.8	75	96	119	143
		71	87	107	127
GDP electricity intensity	120	121	95	85	74
		126	104	98	85
Final consumption	69.1	67.7	90.4	101.0	107.5
		66.2	79.9	91.1	97.3

* Numerator is the Optimistic, and denominator is the Probable economic development scenario.

A more dynamic growth profile will be typical for consumption of electricity – 1.31 times for the optimistic scenario and 1.2-fold for the probable one through 2010 and, accordingly, by 2.2 and 1.9 before 2030, compared to the present level. Power intensity of GDP is expected to decrease over the entire period after 2000.

2.3 Conclusions

Russian Energy Policy

Although the major policy objectives in the RF and EU are differently formulated and also prioritised in a different order, in general policy objectives and, to a certain extent, also the accompanying policy instruments are similar in the RF and the EU. It is fair to say that the first priority for energy policies in the RF is supply security, but in the EU it is the improvement of economic competitiveness. Maintenance of social cohesion and improvement of the environmental protection are also important objectives in both regions. In our opinion it should be realised in Russia that, as has been demonstrated in the EU, prioritising competitiveness in the RF will also enhance objectives such as supply security and environmental protection.

However, large differences exist between the EU and RF with respect to intensity and effectiveness in which these objectives are pursued. This is partly due to the stage of 'transition' in which the RF economy finds itself in comparison to the EU. This is to a large extent

attributable to differences in the institutional framework of policy implementation between the EU and RF. Furthermore, the role and responsibilities of the European Union in the area of energy policy, in relation to its member states, are also quite different from those existing today between the Russian government and Russian regions. Clearly there is enormous scope for enhancement of the effectiveness of energy policy preparation and implementation in the RF using the practices and experiences in EU.

EU demand scenarios and policies

The EU scenarios (1995) have acquired wide acceptance and credibility, as they are used as a benchmark for many national and international studies, by EU, member state governments and companies. Unfortunately in general the transparency concerning the used energy models and country authorisation is not always clear to the outsiders, because the models and linkage of the models are not completely described in publications accessible to the consultants. However, the applied scenario philosophy is challenging and provides a very useful approach which is very meaningful for the exploration of the possible trends and scope, effectiveness, robustness, etc. of energy policy decisions.

Improvement of efficiency of energy markets and promotion of energy conservation in end-use sectors are priorities in the EU and in member states. Given the importance of this subject with respect to the realisation of the three main EU policy objectives 'supply security, competitiveness and environment', several very important EU programmes have been launched and Communications drafted to promote energy conservation in the EU and its member states, EU programmes such as SAVE, Thermie and Altener, which are backed by important EU directives, have been launched in the past few years.

RF demand scenarios

For the Russian Federation, clearly the most authoritative set of scenarios from the Energy Strategy Study (1997) of the Russian Federation, approved by decree of President Jeltsin, has been selected for further analysis and evaluation of RF demand. Without a doubt, these scenarios form the cornerstone of current energy policy preparation in the Russian Federation. However, it is not completely clear to the consultants in what way these scenarios are used for preparing energy policies, particularly with respect to the development of programmes for improvement of efficiency of energy end-use in all economic sectors. Since all available material is in Russian, background information is limited and the RF developers themselves sometimes experience difficulties in explaining some of the key changes and developments of demand projections, it is necessary to increase the transparency of assumptions and results in more detail. This would help the mutual exchange and use of this information for tuning of ideas and views between EU and RF. This is also important for developing EU policies and scenarios given the large and increasing interdependence between EU and RF.

Another remark regarding the RF scenarios concerns the lack of distinction between the different regions of the country with respect to demand analysis and underlying macro-economic projections. Distances between regions are huge and energy transportation costs are highly important. Furthermore the available energy resources and energy requirements per region differ widely in the RF. Consequently, regional developments should be taken into account by any approach for developing RF demand scenarios. Particularly because the economic structure and developments of many RF regions will differ more in the future. This constitutes an additional argument for distinguishing regions in a new scenario study for the RF.

Noted was also a limited display of effects of reforms in the economy and energy sector, as well as the end-use efficiency programmes on energy demand projections. The consultants assume that in general these efficiency increases are underrated, but whether this is attributed to limitations of the analytical tools, ineffectiveness of programmes, or limited insights in these issues is unclear. Obviously, more insights in the relationship between reforms, efficiency programmes and their impacts on demand are necessary. But indirectly one can also observe that in the RF policy making the improvement of energy efficiency in industry, transport and sector buildings still has an insufficiently low priority, if it comes to implementation of efficiency policies.

Finally it is noted that the reliability of data inputs used for the demand scenarios is rather weak. This is partly due to the fact that in the past data collection in RF had a different priority and orientation than is currently necessary for policy analysis in a period of transition to a market oriented system. In fact, recently the increasing importance of phenomena of 'hidden economy' and 'non-payment' of bills and taxes has aggravated this data situation. The rising magnitude of these phenomena leads to less reliable official statistics for economy activities and particularly energy consumption and to more barter-trade and self support. Furthermore frequent definition breaks, low response rates and biased answers are also contributing to the low quality of energy data. Consequently the solution of this dangerous trend which leads to highly inefficient economy must be reversed as soon as possible by the policy makers in RF. But the issues of non-payment and hidden-economy themselves should also be captured in the policy analysis and tools as soon as possible, to conduct analyses which are as reliable as possible.

3. ENERGY SECTOR

3.1 Fuel reserves and production

Russia has large resources of fossil fuels. At the same time the level of their development (accumulated production since the beginning of exploitation) is relatively low. Oil accounts for 20% of estimated resources, and for natural gas this indicator is much lower - about 4%. As far as coal is concerned, the share of developed resources is practically nil. It is worth mentioning that according to experts' evaluations, if the share of accumulated production of any fossil fuel in the total volume of its estimated resources is less than 25%, it means that the level of production, can essentially be increased. RF has obviously not achieved the aforementioned level and will not achieve it in the near future, because the latest years Russia faced a number of serious problems in developing its energy resources base.

3.1.1 Oil reserves

The volume of the proved recoverable reserves of crude oil and natural gas liquids in Russia account for 7 billion tons. The most actively developing oil regions in Russia in the first half of 90's are: West Siberia, Komi, Volga-URLs, North-Caspian and North Caucasus. RF also owns a large volume of estimated oil reserves, which account for 12-13% of the world's oil reserves of this category. The major oil producing regions are depicted in Figure 3.1.

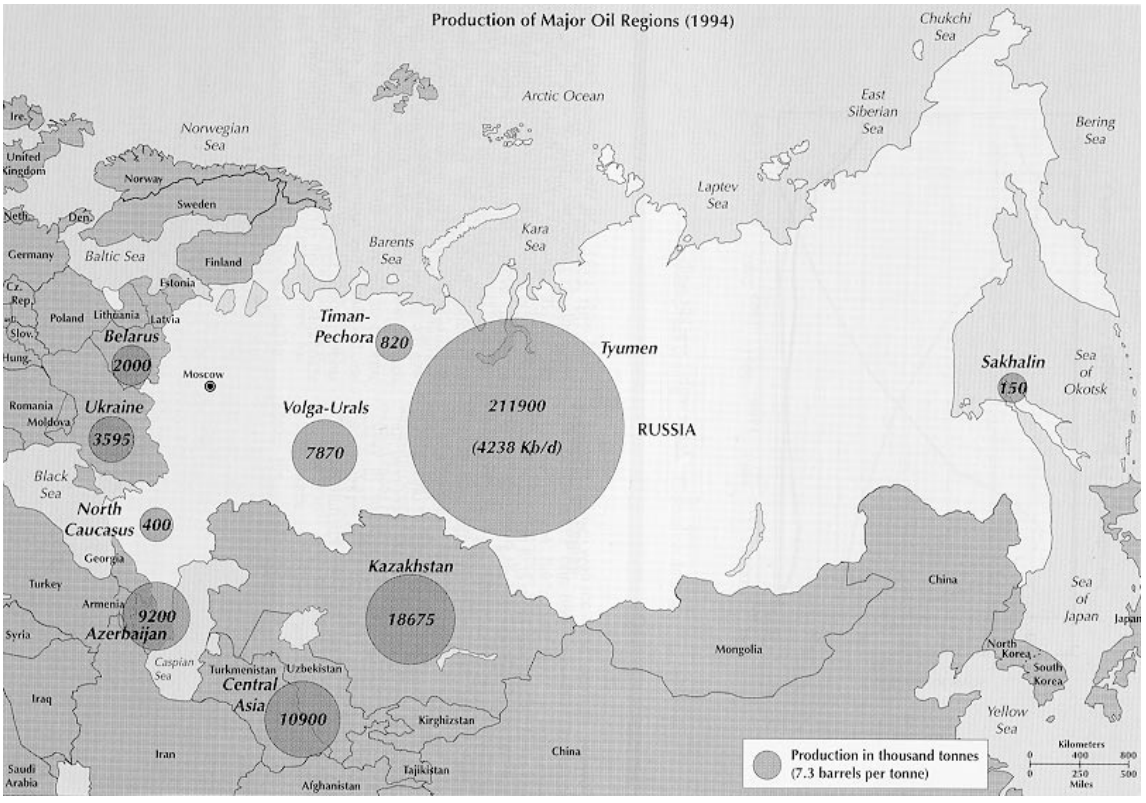

Figure 3.1 *Major RF Oil producing regions. Source: Energy Policies of Russian Federation, IEA*

The regional breakdown of the Russian forecasting oil reserves is given below:

- Western Siberia - 52%
- Eastern Siberia and Far East - 18%
- Shelf - 19%
- Other districts - 11%

Most part of Russia's estimated oil reserves is located in remote and hardly accessible regions the development of which will require substantial material and financial outlays.

3.1.2 Natural gas reserves

Russia's ultimately recoverable gas resources are currently estimated at 236 trillion cubic meters. This amount, which is approximately four times higher than that of the North American continent, comprises 42,3% of the world's estimated gas resources.

Rising gas demand in Europe and Asia will undoubtedly push for a further development of the Russian Federation's gas resource base. During the past 20-25 years, a series of major new gas discoveries were made in Russia.

About 750 gas-producing fields have been discovered in the Russian Federation by early 1996, about 40 per cent of which are currently producing or are under development. The breakdown of Russia's gas-producing fields according to the volume of resources is given in Table 3.1.

Table 3.1 *The structure of Russia's gas-producing gas fields*

The volume of gas resources	The quantity of gas-producing fields	Resources and* reserves, %	
		A+B+C1	C2
Largest	23	74,4	62,3
Large	118	23,0	32,2
Medium	63	1,3	3,3
Small	545	1,3	2,2
Total	749	100	100

Source: 'The strategy of the Russian gas industry development', Moscow, 1997

The regional structure of Russia's gas-producing fields is given in Table 3.2.

Table 3.2 *Regional structure of Russia's gas-producing fields (Jan. 1996)*

Region	Proven reserves, [trln. m^3]	Developing reserves, %	Cumulative gas production, [trln. m^3]
Western Siberia	36,9	43	7,19
Eastern Siberia and Far East	2,1	10	0,07
URLs-Volga	4,0	97	1,16
European North	0,6	33	0,38
Northern Caucasus	0,3	83	0,67
Shelf	3,9	0,2	0,01
Russia	47,8	42	9,48

* According to the Russian methodology A + B+C1 - proven gas reserves, C2 - preliminary estimated gas reserves.

Source: 'The strategy of the Russian gas industry development', Moscow, 1997

Over 95% of total proven gas reserves in Russia are located in the largest (over 500 bln. m3) and large (30-500 bln. m3) gas-producing fields, providing almost the total current gas production in the country.

The major part of these gas-producing fields was discovered 10-20 years ago. In the more recent period the largest and large gas-producing fields have been discovered mostly in remote areas of Eastern Siberia, Far East and the arctic shelf. Figure III.2 depicts the major gas producing fields of RF.

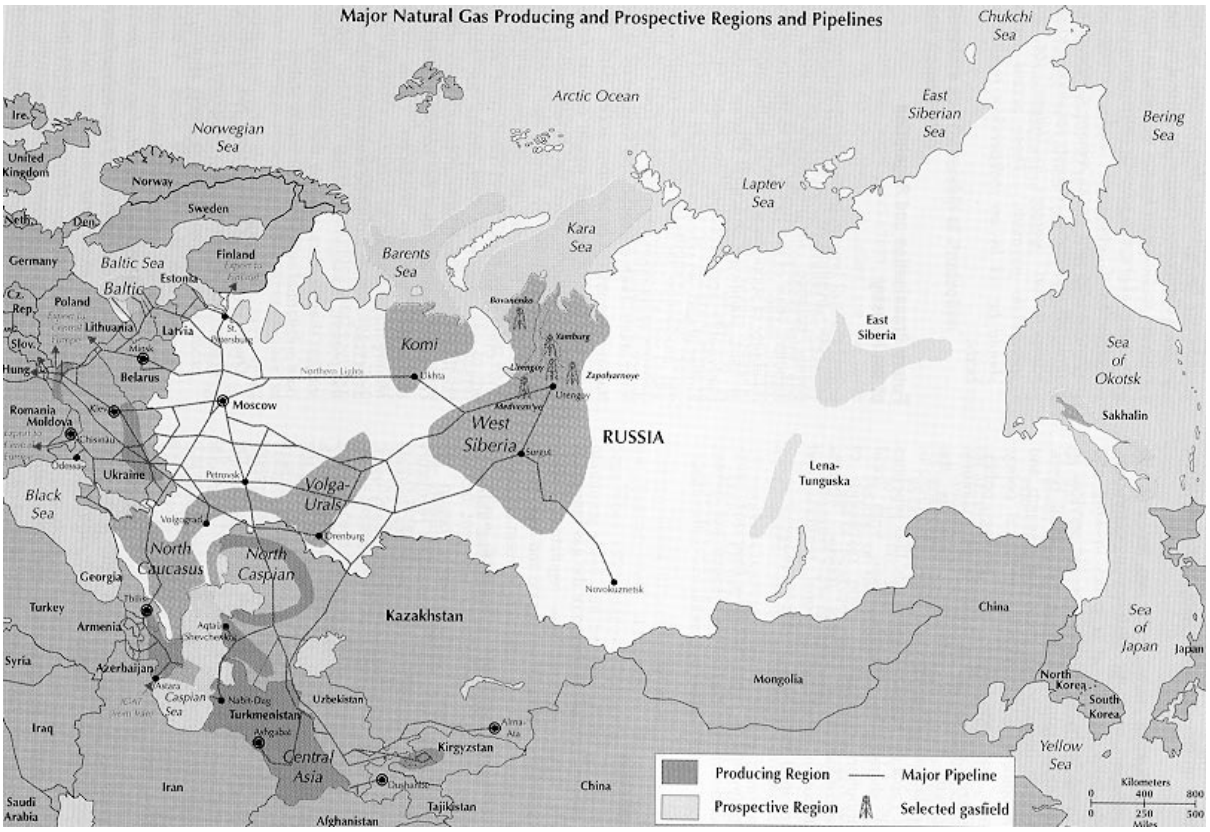

Figure 3.2 *Major RF Natural Gas producing regions.*
Source: Energy Policies of Russian Federation, IEA

The regional structure of Russia's proven gas reserves clearly illustrates the dominant role of gas-producing fields located in the remote areas (Western Siberia for example) in the total volume of reserves of this category. The above mentioned areas have a similar role in the structure of estimated gas reserves.

About 90% of Russia's proven gas reserves are located in relatively shallow productive sections, i.e. at depths of less than 3000 m. Deeper layers play a significant role only in certain regions of the lower Volga area, the Northern Caucasus, and Eastern Siberia.

Gas fields throughout the major part of RF are generally free of contaminates. Hydrogen sulphide is present in approximately nine per cent of the nation's total reserves, principally in the Astrakhan and Orenburg fields. Approximately 50 per cent of the Russia's proven gas reserves contain economically recoverable volumes of condensates and natural gas liquids (NGLs),

which include propane and butanes. Russian natural gas reserves also include approximately 20 Tcm of ethane-rich gases, i.e. in concentrations of three per cent or higher. Gases rich in NGLs provide a suitable feedstock for the production of essential chemicals and petrochemicals. In particular, the ethane content in gas/condensate deposits of the major fields in Western Siberia including Urengoi, Yamburg, En-Yakhinsk and Zapolyarnoye, ranges from 80 to 98 grams per cubic meter (g/cm). These fields are projected to produce over 5 million tonnes of ethane annually by the year 2000.

The development of the reserves of Russia's gas industry since the beginning of 90-ies has being going with the constant declining of the ratio gas reserves growth/gas production. The dynamics of this indicator is given in Table 3.3.

Table 3.3 *The dynamics of RF's proven gas reserves growth during the 1985-1995*

	Natural gas production [bln. m^3]	Proven gas reserves growth, [bln. m^3]	Proven gas reserves growth Gas production
1985	437	1495	3,48
1986	474	2285	4,87
1987	518	2793	5,49
1988	562	2015	3,65
1989	589	1935	3,35
1990	613	2785	4,62
1991	618	1741	2,86
1992	620	1813	2,98
1993	601	725	1,23
1994	581	265	0,45
1995	570	187	0,32

Source: 'The strategy of the Russian gas industry development', Moscow, 1997

In the future, most of Russia's growth as far as the proven gas reserves are concerned, is expected to come from the eastern and western Siberia, and Far East regions, as well as from offshore areas of the Arctic and Far-East regions. For example, only approximately 40 to 45 per cent of the potential gas reserves in the Tyumen area have been explored to date, even though more than 8 Tcm (280 Tcf) of Tyumen gas has been produced so far. Consequently, unexplored areas will eventually increase levels of proven and potential gas reserves in this prolific region, thereby ensuring continued high output for a long period of time. The majority of reserves are located on-shore (92%) and mostly in West Siberia (78% of total proven Russian reserves).

In the period 1960-1990 a total number of 591 gas field were discovered. Total gas resources accordingly increased by 42 times. Starting from 1991, the growth rate of gas reserves discoveries fell down dramatically because of decreased investments as well as technical and material provision of this activities. (See Table 3.4)

Table 3.4 *Increase of Gas Proved Reserves by Periods of Time [tcm]*

Regions	1961-1970	1971-1980	1981-1990	1991-1995
Total RF	11,125	20,573	20,234	4,730
On-shore	11,124	20,506	18,215	2,864
of which				
North Region	410	492	105	8
Urals-Volga	1,253	1,070	2,560	25
N. Caucasus	223	41	90	56
West Siberia	8,814	18,334	14,648	2,317
East Siberia	136	135	487	302
Far East	288	434	325	156
Off-shore	1	67	2,019	1,867

The contribution of offshore gas reserves is also expected to grow, but will require extensive drilling efforts and a diversity of onshore support industries, approximately on the scale of the Gulf of Mexico or the North Sea fields.

3.1.3 Coal reserves

Proven coal reserves in Russia can be estimated at 240 billion tones. About 80% of coal reserves are located in Western and Eastern Siberia. At the same time the share of European part of Russia, the most industrially developed Russian region, accounts for 10% of total volume of proven coal reserves.

The list of the main coal basins is given in table 3.5.

Table 3.5 *Main Russian Coal Basin.*

Coal Basin	Total volume [bln.t]	Coking coal [bln.t]
Kansk-Achinsk	81,0	n.a.
Kuznetsk	61,2	28,8
Pechora	8,2	3,6
Donetsk	6,4	0,3

Source: Robert E. Ebel 'Energy Choices in Russia'

The large coal basins in Russia are also located at Eastern Siberia, Baical region, South Yakutia, Far East and Sakhalin. 58% of the total volume of proven coal reserves are available for open development. Industrial coal reserves within existing coal mines can be evaluated as 20 bln. t.

The quality of the Russian coal reserves, is much lower than in a number of foreign countries. The share of coal reserves with favourable conditions of development is about 20%. Over 50% of underground produced coal can not be developed by any means of complex techniques.

The level of heating value (lower/higher?) of coal produced in Russia is different by regions: in the Moscow region, coal basin accounts for 1897 kcal/kg, while in Kuznetsk 6125 kcal/kg.

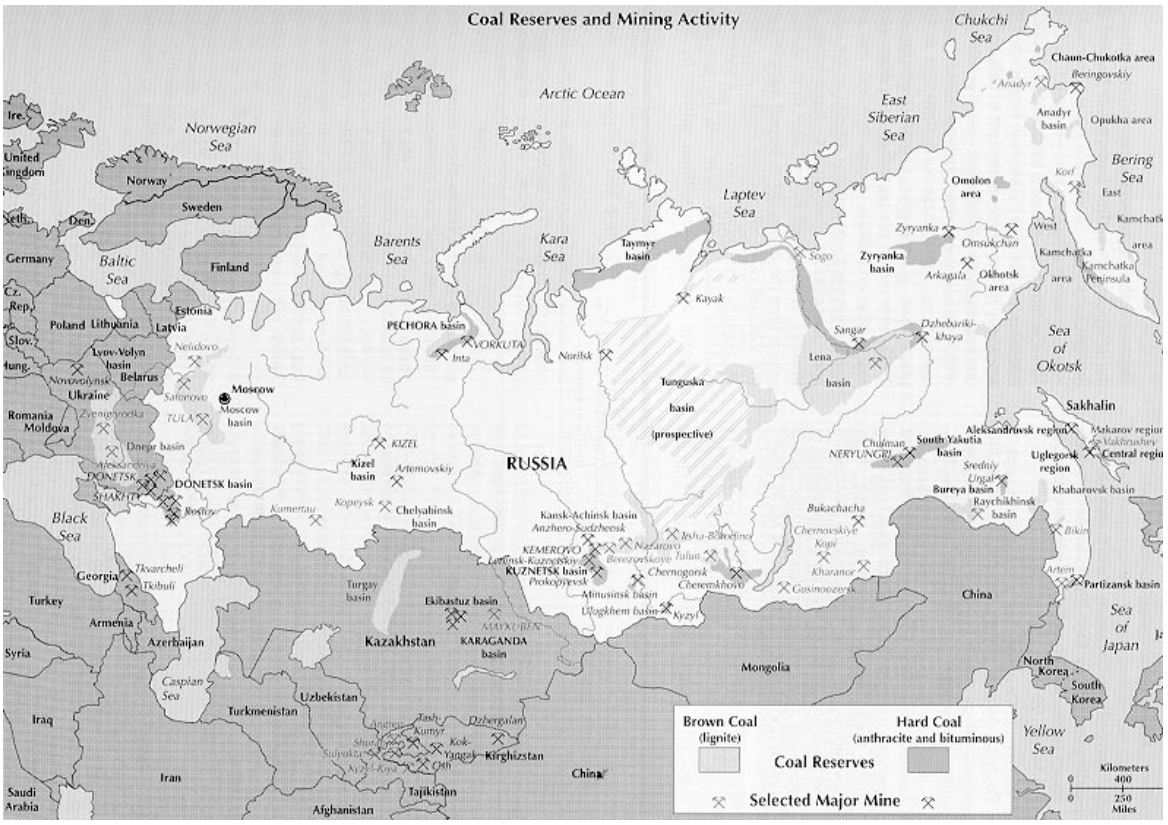

Figure 3.3 *Major RF Coal producing regions. Source: Energy Policies of Russian Federation, IEA*

3.1.4 Current gas production

The production of natural gas was the most stable factor during the restructuring period (1988-1998) of the Russian economy. Gas output has invariably met indigenous demand and export needs, while crude oil production has dropped in 1997 with about 40.4% (from a 1987 peak of 569.5 Mto) and coal volume declined 33.8% over this period. This has resulted in an increasing share of natural gas: from 40.1% in 1990 to 49.1% in 1995, accompanied by large declines from 39.4% to 31.3% of the share of coal. Forecasted for 2020 is a decline of this coal share to around 15%

No substantial changes are expected prior to 2000: a continued oil decline (up to 28%) and mostly flat share of coal, resulting in a growing share: around 51 - 52% of the total energy output. In the next decade, the share of gas will either be unchanged or rise to 53 - 54%. These changes in the energy industry will be positive for both the industry's economic performance and environmental protection.

Greater use of natural gas will be essential for reduction of hazardous atmospheric emissions. The estimates reveal that a 1% increase of gas in the total energy supplies reduces greenhouse gas emissions by 0.7% and atmospheric pollutant releases by 0.8%.

About 300 natural gas, natural gas condensate, and petroliferous deposits have currently been developed in Russia. The gas pipeline network is 148,000 km long, with an installed pumping

capacity of around 40 GW. There are 23 underground gas storage facilities and 20 gas processing plants.
In 1990 the annual gas production amounted to 640 bcm. In 1995, it decreased to 595 bcm. In recent years, gas production had somewhat increased in the key producing areas of Tyumen region until 1992 and after that dropped in 1993-1995 up to 539 bcm, levelled off in the Orenburg region, and Krasnoyarsk territory, and decreased in the Timan-Pechora region.

The decrease in oil output caused a decline in the associated (petroleum) gas production from 38.5 to 24.8 bcm, mostly in Western Siberia. The old oil-producing regions are known to utilise about 80% of associated gas, whereas in Western Siberia this figure is 77%. About 10-12 bcm of gas were flared off, of which 8-9 bcm are located in Western Siberia. This is linked to a failure in the rehabilitation of the petroleum industry, and construction of suitable associated gas utilisation facilities.

The trailing development of gas processing facilities promoted an irrational utilisation of huge amounts of light hydrocarbons produced along with gas. Only 25-30% of the potential valuable components contained in gas is extracted and utilised in the national economy.

At present, no more than 25% of the productive assets meet typical world technical standards, while 30% of the inventory are old and technically out-of-date, thus urgently needs replacement. Of 148,000 km of pipelines, about 15% have already exceeded the designed service lifetime.

By the beginning of 1997, total gas production amounted to 601 bcm, which is expected to increase by 2000 and 2010, to 640-680 and 765-885 bcm respectively. This implies the commissioning of about 500 bcm of new capacities in total, given the reduction of 417 bcm of production capacities. The gas production outlook for the regions of Russia are outlined in Table 3.6.

In 1995 the running stock of gas wells amounted to 6,473, of which 981 were not used for different reasons. As a result, the stock utilisation factor was about 85% in 1995. The amount of unrecovered gas with regard to the daily average discharge of development well, was estimated at over 100 bcm for the industry as a whole in 1995.

In the considered time period, the daily average discharge of Russian gas wells was considerably high (over 300,000 cm), which is linked to commissioning of rich deposits in the northern Tyumen region. Due to an intensive exploitation of these deposits, the daily average discharge of wells tended to decline, starting from 1991, and amounted to 727,000 cm/day in 1992, compared to 750,000 cm/day in 1990-1991. The output is expected to increase to 513,000 cm/day and 413,000 cm/day in 1995 and 2000, respectively. The well utilisation factor has remained rather high in recent years, exceeding 95%, given an average of 348 days of well operation a year.

Forecasts show that before 2000-2010, it will be necessary to increase gas output by 95-115 bcm. This requires development and commissioning of the Komsomolskoje (25 bcm), Jubileinoe (15 bcm), Tarkosalinskoje (15 bcm), Yen-Yakhinskoje (5 bcm), Yamsoveiskoje (20 bcm) and Harvutinskoje (30 bcm) deposits. In the European part of Russia, upgrading of Astrakhan gas project will have to be completed, bringing gas output to 12 bcm per year as compared to 4 bcm in 1995.

During the period 1997-2010, it would be necessary to develop large-scale projects such as the Lunsky gas condensate field on the Sakhalin shelf, with up to 15 bcm annual capacity, the Zapolyarny and Bovanenk deposits in Western Siberia with an expected output capacity of up to 100 bcm per year each, and the Shtokman deposit in the Barents Sea. In Eastern Siberia, the cities of Irkutsk and Krasnoyarsk, and their adjacent regions, will receive gas from large discovered fields named Kovytkinskoje, Yurubchenskoje and Bratskoje, with total capacity of 10-15 bcm of gas per year.

Table 3.6 *RAO 'GAZPROM' Gas Production [bcm]*

Region, branch		Forecast					
	1995	2000		2005		2010	
		I	II	I	II	I	II
RAO 'Gazprom'	559	624	665	677	763.5	733	821.5
including:							
1. West Siberia:	519	587	628	672	761	700	788
Nadym-Pur-Taz	519	587	628	641	673	592	625
Yamal	-	-	-	31	88	108	163
2. Komi Republic	3.2	2	2	7.2	7.2	7.4	7.4
3. OrenburgGazprom	30.8	25.5	25.5	20.4	20.4	15.8	15.8
4. AstrakhanGazprom	4.1	10	10	10	10	10	10
5. KubanGazprom	1.9	1.8	1.8	1.3	1.3	0.9	0.9
6. CaucasGazprom	0.3	0.2	0.2	0.2	0.2	0.2	0.2

3.2 Gas demand and prices

3.2.1 Gas prices and tariffs

In the 1980s, gas prices in the former Soviet Union (FSU) and Russia were below production costs and thus insufficient for complete cost coverage of operations of the gas industry. The price liberalisation in 1992 had no implications for the gas sector, which was considered as a 'natural monopoly', with prices totally controlled by the state. As a result, gas prices for industry in early 1994 in CEECs were 20% below those in Europe and, as before, remained inadequate to sustain this sector.

However, government actions in pre-accessions in late 1995 made it possible to increase gas prices above the self-financing level in this sector. Since then, and through the end of 1997, the gas price for industrial consumers (including excise duties) was kept at nearly 70% of netback level calculated from gas prices at border points of sale in Central Europe. On 1 December 1997, the Federal Energy Commission of Russia (FEC) established - for the first time ever - differentiated gas prices broken down by six zones to make provisions for gas transmission tariffs (see first column in Table 3.8). Wholesale gas prices in each zone would have been set different for industrial consumers and electricity generators. Up till now, this has not been observed to have taken place in the RF.

Retail gas prices in end-user services of distributors were USD 5/1,000 cum higher than the wholesale prices. Gas prices for residential consumers were nearing USD 20 / 1,000 cum in early 1998 and, although rising with an additional 30% in April 1998, still remained lower than wellhead averages and thus not reflecting the rate of inflation.

The government's pricing policy in the gas sector is likely to significantly differ – between the present day, when non-payments abound, and in a later period when this problem is gradually resolved. Under escalation of non-payments, it would be inexpedient to pursue a policy to rising prices for production of 'natural monopolies' in general, and the gas sector in particular. According to estimates, non-paid bills constitute more than 40% of cumulative gas sales so far, for which reason further gas price increases would only add to overdue payments. Besides, a promotional presidential decree was issued to encourage solvent consumers, it enables gas prices to be cut down to 75% of FEC tariffs when payments are met. Taking these considerations into account, the upper indigenous gas price limit during the non-payment crisis is likely to remain equal to the current prices, i.e. will grow nearly in line with inflation (in ruble terms). Concerning the bottom gas price level in the domestic market, it is likely that it will remain at the wholesale rating established by FEC on 1 December 1997.

If non-payments for gas supplies are resolved, domestic fuel prices will gradually approach world market levels. Being a major energy exporter and operating in an opened-up market, Russia would have to keep indigenous prices in competition with European oil and gas prices (Russia's main marketplace for exports), less all associated export duties and costs. However, if domestic (at the border) gas prices are too high in comparison with competitive supplies outside Russia the downward pressure on export gas prices would be the result. However, this is presently hardly the case in the RF.

The natural gas full cost prices in European regions of Russia (including the Urals) and Western Siberia is defined by subtraction of gas transit fees in the Ukraine, Slovakia and Czech Republic (with Belarus and Poland after 2000), and domestic transmission tariffs between production site and border, from forecast gas prices at border points of Central European countries.

Gas companies' *sale prices* under normal payment conditions would exceed the equilibrium price by extra charges associated with consumer services such as uninterrupted supplies, seasonal and weekly control, gas quality assurance, etc. These charges will be differentiated by consumer and amount to 20 - 30% of equilibrium gas price according to RF experts. However, trying to start with a gas price achieving cost covering levels must take place first.

Employment of sale and, moreover, full cost gas prices - obtained in this way - in the electricity and centralised heating sectors implies that coal, nuclear and other alternative technologies could be fully squeezed out by gas in the long run. Aiming to ensure competitiveness of different fuels to benefit the national security. Some RF experts claim that a special *gas tax* for power plants and district heating boilers, as is the case, for instance, in Germany, should be introduced. This tax should perform in a way whereby the additional earnings from gas could be used for pushing coal- and nuclear-plant electricity prices down to enforce their competition with more expensive (as a result of this tax) gas-fired plants[1]. However, this is a very uncommon method of taxing energy in the EU.

Gas competition in the electricity fuel market with coal and nuclear fuel is expected to drive *regional consumer gas prices* in future. Due to high technological and economic advantages of gas-turbine and steam-gas units over 'environmentally-compliant' coal-fired and 'safe' nuclear

[1] Not all authors agree with this vision.

power plants, consumer gas prices in majority of Russia's regions are likely to be significantly higher than the equilibrium and sale (transfer) prices.

Table 3.7 summarises domestic gas price outlooks for two non-payment recovery scenarios. To make provisions for current prices, these outlooks were broken down by six price zones established by FEC in 1 December 1997. (EU consultants noted that these prices are not paid currently)

Table 3.7 *Natural gas wholesale prices on Russia for industry (upper figures) and wholesale-market power plants (lower figures), Rb/1,000 cu m [current rubles]*

Price zone	1998*	2000	2003	2005
1.	224	224-255	225-290	225-300
	193	193-216	195-290	195-420
2.	245	245-280	245-310	245-320
	211	211-240	212-310	215-465
3.	264	264-300	265-330	265-345
	227	227-260	230-330	230-505
4.	270	273-307	280-360	280-405
	232	236-265	240-360	245-580
5.	275	282-315	290-415	290-465
	236	240-272	250-415	250-645
6.	280	292-318	300-500	300-560
	241	250-280	255-500	260-735

* Beginning of the year.

The lower price ranges in Table 3.7 correlate with a scenario of lingering non-payment crisis that would last over the entire period of consideration. The upper ranges apply to a favourable economic scenario that foresees the non-payment crisis to be mainly resolved by 2003. According to this scenario, the increase in gas price is expected to match the inflation rates through 2001, followed by nearly equilibrium prices for all industrial consumers, including power generators, to 2003. In the absence of cost covering and inter-fuel substitution pricing of gas, a special tax for gas-fired power plants and central boilers would be required by 2005 to sustain other fuels.

3.2.2 Gas consumption

Russia is unique in terms of its high gas share in indigenous energy consumption. It rose from 41.4% in 1990 to 48.1% in 1995, with projections for further increases to 50 - 57% (Table 3.8). Within the transmission gas pipeline coverage area, the share of gas in meeting the country's total energy demand is 61%; in the European part it is 70.5%, which will be boosted to 80% by the year 2010. These increases have been accompanied by a nearly 15% absolute gas consumption shortfall over the past five years. In official RF forecasts, this situation is expected to improve in line with recovery from the economic recession. Given the recent uncertain economic development, these figures should be used carefully.

Table 3.8 reveals that the highest gas demand growth rates to 2010 are expected in motor fuel and agricultural applications. In the absolute terms, however, these areas are insignificant for gas uses and their cumulative shares are unlikely to exceed 5% in the total Russian demand by

2010. Thermal plants appear to be the most significantly growing gas application, despite being nearly flat in the overall indigenous gas demand: 39.7% in 1995 and expected variations between 38% and 42% by 2000 and in the 37 - 41% range in 2010.

It is noteworthy that in any event, the justifiable gas demand is expected to grow both in the entire Russia and its each individual region. In some cases one can expect a decline in gas consumption in industry, but it will steadily grow in the municipal and residential sector and in agriculture (Table 3.9)

Again, in any case, gas will continually dominate the energy resources throughout the projection period. Its share in primary energy is expected to be either unchanged from the present 49% or rising to 51 - 52% between 2005 and 2010; the share of gas fired in furnaces and boilers will be up from 62.5% in 1995 to 65 - 67% in 2005 - 2007.

Table 3.8 *Predicted ranges of gas demand per sector [bcm]*

Sectors	1990	1995	1997	2000	2005	2010
Total indigenous gas consumption in Russia *including:*	461	385	381	376-384	410-425	425-450
gas pipelines own use	57	55	52	54	57-58	59-60
power plants	198	158	156	152-154	170-173	170-175
boilers	75	75	68	68-71	72-75	80-87
industry	69	58	50	43-46	47-52	50-53
transport (as motor fuels)	-	-	0.2	0.5	1.4	3
agriculture	5	7	8	10-11	13-14	16-17
municipal and residential in cities	28	37	40	41-42	42-48	45-52

Table 3.9 *Predicted ranges of gas demand per region [bcm]*

Regions	1990	1995	1997	2000	2005	2010
Total indigenous gas consumption in Russia *including:*	461	385	381	376-384	410-425	425-450
North	18	15	14	15-16	18	18-20
Northwest	19	18	18	18-19	21-22	23-24
Central	98	80	77	76-77	82-85	85-87
Central-Chernozem	21	19	19	18-19	20-21	21-22
Volgo-Vjatsky	19	19	18	18-19	20-21	21-23
Povolzsky	68	60	58	58-59	62-67	64-68
North Caucasus	36	31	31	31	32-34	33-36
Urals	101	86	82	77-80	86-88	87-90
West Siberia	74	58	55	56-57	59	60-62
East Siberia	5	4	5	5	5-6	8-10
Far East	3	4	4	4	5	6-8

Promotion of gas use in Russia

At present, the Russian gas service includes 968 towns, 1,864 worker settlements and 83,300 rural area settlements and villages. The household gasification coverage (with natural gas and LNG service) in towns and worker settlements has reached 80% and that in rural areas 75%, with natural gas standing for 54.6% and 18.7%, respectively.

There are 317,600 km of gas distribution pipelines now under operation in Russia, as well as 441 gas-filling vehicle stations and LNG consumer service points. More than 20,000 km of spur lines are laid annually and nearly 830,000 apartments are switched to gas service. Gas sales to households have grown two-fold, or even by a factor of 3 when compared with 1988.

Overall consumption of liquefied gas has dropped nearly 30%, the same applies to LNG consumption by households switched to gas (down to 109 kg at present from 160 kg in 1990).

The government program 'Gasification of Russia' envisages an expansion of gas supplies to households in the country, as is shown in table 3.10.

Table 3.10 *Percentage of homes switched to natural gas and LNG in Russia*

	LNG	Natural Gas	Total
1997			
Towns and settlements	19.9	55.4	75.3
Villages	57.0	20.9	77.9
2000			
Towns and settlements	16.4	59.3	75.7
Villages	52.1	32.5	86.4

To meet the target figures of the program, it was planned to expand home gasifications and extend the length of distribution grids (see Table 3.11).

Table 3.11 *Gasifications in Russia*

	Households, thousand		Gas grids, thousand km	
	In total	Incl. rural	In total	Incl. rural
1991	817.4	310.0	13.80	10.79
1995	851.1	322.2	21.98	16.91
1997 estimate	805.0	345.0	23.30	17.50
2000 forecast	1,134.0	472.0	33.90	30.00

3.2.3 Gas consumption other CIS countries

Total gas consumption in other CIS countries reached 180 bcm in 1995, of which the majority was consumed in the Ukraine (81 bcm) and Uzbekistan (44 bcm). In the period 1990-1995 gas consumption decreased dramatically, mainly due to the economic crisis. In addition, pipeline blockades, ethnical, political and economic conflicts between CIS countries further reduced the consumption of gas. Gas consumption is expected to increase in the coming years, but the past levels of consumption in the years 1990 and before is not expected to be reached within the next 15 years.

The gas market plays an important role in most CIS countries. The share of gas demand in total primary energy consumption is between 40% and 65% in Azerbaijan, Belarus, Turkmenistan

and the Ukraine and even over 80% in Moldova and Uzbekistan. Surprisingly the current share of gas is relatively small in Kazakhstan, which is one of the biggest potential producers in the region. Several projects for pipeline construction and exploration of fields are identified to develop a more mature gas market in Kazakhstan in the near future.

The share of gas consumption for power generation is relatively large in Belarus (59%), Kazakhstan (43%), Moldavia (57%) and Turkmenistan (35%), and relatively smaller in Azerbaijan (15%), Ukraine (14%) and Uzbekistan (25%). In Armenia gas is almost entirely used for power generation since supply to the industry and residential sector was practically stopped in 1993.

3.3 Gas policy and regulations

3.3.1 Relevance for the economy

Introduction

Given the harsh climate, gas demand in Russia is relatively high for heating purposes. However, the gas infrastructure is inadequate to supply small towns and settlements, rural areas in particular. Improvement of the gas infrastructure would improve the living comfort and overall living standards, and will thereby, increase labour conditions, mainly in farming. 'Gasification' of industrial plants and household buildings is believed to guarantee the sustained growth of agricultural productivity by improving local labour conditions (in particular in small family farms), by making these agro-businesses more efficient. It is no exaggeration to say that a wide-scale rural penetration of gas use is necessary to make Russia self-sufficient in food and thus to meet the nowadays, competitive challenges of agricultural imports. Although as little as 1.8% of the country's gas is used in these applications, gas self-sufficiency in these rural areas would require only a 5% share of gas to be accomplished. Clearly the social and economic implications of rural gasification of rural areas can hardly be overvalued for deriving economic prosperity and national security.

Natural gas exports are of enormous economic and political value for Russia. Gas is a unique product in the Russian economy. The gas sector has reported production increases over the past 25 years, sustained output during the reforms period and good opportunities for production increases in the next 20 - 30 years. Today gas exports are essential since the country has a severe shortage of foreign currency which is required for the financial stability and to guarantee solvency against foreign creditors. Expanding the gas exports could also provide more business activities from foreign customers for orders towards domestic enterprises, thereby offering them a direct way to world markets. This is vital for providing enough opportunities for market adaptation and becoming really competitive on international markets.

Tax and price policy

Particularly in the past five years, the Russian gas industry has provided (on behalf of RF government) the largest financial support to households, industry in RF and other CIS countries. This was mainly achieved by multi-fold lower gas prices - largely unchanged till today for all consumers, which was an important component of the RF government's social policy in the past five years. However, it was claimed that industry gas prices did almost reach full economic cost coverage levels by 1994, which was continued by letting industry make rent payments in the form of government excise taxes on gas. (Western experts have doubts about real achievement of these price levels)

From the middle of 1993, the industrial gas prices were fixed to an inflation index. Industrial gas prices were uniformly set throughout Russia, not allowing for differentiation according to differences in transportation/distribution cost and value of end-use services. As a consequence, the industrial prices still cross-subsidise residential consumers.

Residential prices were and still are periodically set and changed based on a square metre 'norm' for consumption. However, so far regional differences of consumer (industry and particularly residential) prices are still limited.
Although industrial prices have been increased over the past five years, residential prices have not. One of the main reasons has undoubtedly been the decreasing payment of the gas bill by small consumers. In fact the cost of bill-collection (installing meters etc.) in itself is a barrier to improved billing. And above all, end-users are connected to heat distribution systems with central burning units and thus too low heat prices.

The Russian gas prices are also essential for energy pricing of other fuels in general in the RF regions. In RF gas, rather than crude oil (which generally is price leader in world energy markets), determines other fuel prices such as for coal, residual fuel oil and nuclear because it covers nearly half of the energy production and consumption in the country. This is a different situation than in other countries where prices for crude and refined products are a reference for gas pricing. So in Russia and its neighbouring CIS countries, the gas price is mostly the reference price for other fuel prices and thus for electricity and central heating too. However, note that the absence of inter-fuel pricing makes the reference price of gas a weak starting point.

Consequently gas pricing policy is an essential factor for the RF's competitiveness, domestically and abroad, of the majority of Russian industries (particularly energy-intensive industries) at the moment and in the next decades. But, if Russia is getting more integrated into the world economy, the indigenous prices of crude and light products will have to move closer to world price levels for oil products. Due to the relatively small oil transportation costs, this will produce an upperbound on gas prices. If at the same time the real gas transmission cost must be incorporated in the gas consumer prices in RF, this will lead to pressure on indigenous gas sales prices of producers before transport to the border of RF and lead to much smaller upstream prices than the gas export prices from suppliers outside Russia, which generally face smaller transmission costs to the consumer markets in Western Europe. To maintain its competitiveness - for instance on the West-European gas markets, and to compensate for the large RF transport costs, it is estimated that pipeline gas prices in the Moscow region have to be 25 - 30% lower than in Central Europe, 50% of that in the Ural and southern regions of Western Siberia and only 20% of that in the gas provinces of the Tyumen oblast. After RF gas prices are set, in this way by Gazprom, it also provides a price reference for coal and residual-oil prices in these zones (consequently, also for power and heat prices). As a result Russia has and will keep the lowest energy prices for domestic consumers for most of the energy carriers in the next decades, even if full-cost coverage is realised.

Importance of gas for government

Natural gas accounts for over 50% of the energy consumption in Russia, therefore it is essential for securing RF energy demand. The social and economic developments of its economy is depending on natural gas, because its share in GDP is more than (40-45 $bn) 6%.

Important for Russia is also that natural gas is the most environmentally clean fuel in Russia and compensates for the relatively high pollution rate of other energy carriers, like coal and heavy oil.

Furthermore revenues from the gas industry are a major contribution to the Russian economy and, most important, the social governmental expenses. Gas industry taxes and excises yielded 5% of national governmental revenues in 1995, while gas exports amounted for 16.4% of the country's cumulative foreign currency revenues. These earnings are critical for meeting public spending on e.g. medicine, education, arts and sciences, defense and most important domestic and international payment obligations of RF. In 1997 Gazprom revenues were about 23 billion US $ and 25% of the federal tax revenues.

In this way, the industry that employs only 0.4% of all workers in the country and that yield 6% (share rises to 15%, if the 40% non-payment of taxes is resolved) of GDP has become a key sector to handle a wide spectrum of expectations and strategic objectives, particularly because of its impacts on the social and economic development of Russia. For this reason, a strategy for future development of the gas industry must provide solutions for numerous domestic problems rather than be a strategy isolated and solely focused on energy aspects.

Wide-scale gas utilisation can open broad opportunities for the introduction of highly efficient technologies in all branches of the national economy. Among the most promising technologies is the gas turbine and CCCG (steam-gas) units for combined heat- and power generation, particularly in industries and for gas-pipeline compressors. Another important technology is the combustion of compressed air, liquefied gas for cars, locomotives, aircraft engines and car fuel using methane. Depending on relative costs these and other technology improvements will promote the efficiency of the national economy in the long run.

Non-payment issue

The increased and widespread non-payment by industries of their gas bills that frequently appeared to be more than 40% of the total gas sales revenue today. Nearly the same percentage of non-payment also occurs in a number of other CIS states, particularly in Ukraine, which is the largest consumer of Russian gas at the moment. Although several governments have tried to solve this issue, it kept an increasing burden for companies and government and particularly sensitive issue.

In fact the non-payment of the gas bill by industry and residential consumers is crucial deterrence towards increasing prices, toward economic cost levels. Probably about 40% of the decline in gas demand might be explained by non-payment. Figures are difficult to obtain, but according to some estimates 65% of gas deliveries by Gazprom were not paid for in 1994. Clearly this figure has increased in the last four years, probably to 60% or more. This would imply that about more than 250 BCM has not been paid for.

Solutions are not easy to find, disconnecting consumers is an increasingly sensitive issue. Furthermore, individual consumer disconnections are sometimes not possible due to technical reasons given the centralised heat production in the majority of cities.

In 1994 and later it was forbidden by government to disconnect strategic customers. Nowadays, due to the rising unemployment, probably almost every relatively large consumer is considered to be a strategic consumer. However, Gazprom has started in some cases with disconnecting

consumers and offering discounts on official selling prices for prompt payers. Already during the year 1998 this non-payment to Gazprom led to limiting company funds for investments, which in turn led to a non-payment of Gazprom of their taxes to the government. This circle of non-payment has to stop and reverse, because it will eventually lead to a complete inefficient barter trade type of economy also more or less experienced in the past of the RF.

3.3.2 Current organisation gas market

Domestic production of natural and associated petroleum gas is controlled by RAO 'Gazprom', AO Norilskgazprom, Yakutgazprom and a number of oil producers. Gazprom meets production and transmission of 94% of total gas supplied to domestic consumers within coverage of the Unified Gas Supply System. Gazprom is vertically and horizontally integrated. Gazprom also incorporates numerous subsidiaries involved in exploration and production operations, logistics, engineering services, equipment as well as several gas industry and auxiliary applications. Despite the economic recession, the company's framework has continued its normal industry operations of security gas supply and generated significant exports (hard currency) revenues for the federal budget.

However, a large number of issues are still not resolved:

- 'Natural' Monopolistic and commercial activities have been inadequately separated in Gazprom; this hampers a clear definition and assessment of costs of the company operations, and makes it impossible to control expenditures in the area of monopolistic activities (unbundling of accounts and allocation of costs).
- State regulatory control mechanisms in the gas industry were very simple until recently, whereby Gazprom was entitled to change gas wholesale prices in accordance with the growth of industrial-output price index; it was impossible to consider Gazprom's fiscal status and running costs (lack of transparency of accounts).
- There is no realistic natural gas price mechanism that accounts for shipment costs, seasonal consumption variations, facility loading and gas supply security in the final sales price to consumers and above all has no relation with inter-fuel substitution.
- Substantial cross-subsidisation between different consumers still exists.

Clearly a more efficient functioning of the Russian gas industry would be promoted by opening up access to Gazprom's gas transmission system by other companies. Therefore GAZPROM has recently become a holding structure with separate share holdings for 'independent' functions, like transport, production, storage, etc., which is more transparent with respect to 'cost' and management responsibilities. Consequently for reforms restructuring of the domestic gas industry should focus on achieving the following objectives:

- First non-payment issue should be resolved gradually and gas prices should be based on inter-fuel competition.
- More stringent regulatory control of gas transmission operations of Gazprom.
- Promotion of competition in potentially competitive operating areas, in line with gradual smoothing of regulatory control.
- More transparent and fair contracting framework between gas suppliers and consumers in terms of commercial accounting, including cost factors like load, seasonal variations, etc.

Initially gas industry reforms were targeted on developing a gas price system that should comply with the following requirements:

- Securing commercial conditions for Gazprom operations, through sales pricing by including justifiable (real) economic costs at various gas supply volumes and including company's running (variable costs), capital investments and an adequate rate of profitability for sales pricing.
- Promotion of reliable services through price flexibility in contracts, to enable consumers to make free choices between different gas services based on the notion of inter-fuel competition.
- At the end gas prices should result from demand and supply equilibrium, in order to mitigate gas demand shortage and/or large oversupply in the gas market (avoiding gas storage).

In the long run, however, the introduction of a market oriented pricing mechanism must be in agreement with taxation policies and effective revenue/bill collection methods, Gazprom's investment policies and allowing for reasonable shareholders' dividends must be the objective. This can only be achieved if new gas pricing systems are established, which secure stable conditions for fair competition between different fuels and promotion of energy conservation.

3.3.3 Gas market policies

According to Russian experts the government has the intention that rules and mechanisms for gas price control in 'natural monopoly' operating areas will be identified, and will be translated into adequate gas transmission tariffs. Normative documents and methodologies should be applied by governmental regulatory control agencies to achieve this goal. This in close co-operation with Gazprom.

Gas production costs will be regulated in accordance with anti-monopoly laws. More distinctive demarcation of fiscal results has been introduced for individual Gazprom's divisions, depending on category of their activity. Furthermore, by this 'transparency' of cost estimates, is hoped to be ensured across the entire 'gas chain', and be based on an economic sound framework. These measures are in preparation, but not operational yet.

Promotion of competition in the gas industry and efficient gas-conservation technologies focuses on non-discriminatory access of independent Russian producers to under-utilised capacity of the gas transmission system.

Commercial operations of independent Russian gas producers will be based on around supply contracts with gas consumers. Importantly, gas prices for end-users shall be withdrawn from regulatory control.

For restructuring of the gas industry a phased implementation of the following main actions were envisaged in 1997:
- differentiation of natural gas prices depending on costs of shipment from production sites to consumers,
- a unified gas shipment tariff system was developed for transmission gas pipelines; it equally applies to Gazprom divisions and independent suppliers,
- proposals were prepared, that can enable 'transparency' of Gazprom's production and transmission costs,
- formats and methods were designed for federal supervision of gas industry statistics and Gazprom's reporting to natural monopoly control authorities and federal administrations,

- a trading company was set up for the development of indigenous natural gas market and to oversee trade deals based on direct consumer sale contracts,
- rules for gas consumer services in the Russian Federation were amended, to establish a procedure for direct agreements between gas suppliers and consumers,
- normative documents were completed that enforce procedures for a control of natural gas prices,
- provisions for all independent gas producers to have access to gas transmission system (of Gazprom) were developed and approved by the Russian Federation government. An interdepartmental commission was set up to address independent suppliers' rights for access to the transmission network operated by Gazprom,
- compliance was achieved between Gazprom and government on a federal law on joint-stock companies.

The following actions have been planned for 1998 - 2000:

- termination of cross-subsidising between various gas consumer groups,
- growth of wholesale gas prices for households to match Gazprom's wholesale price for distributors (re-sellers) and the industry (without excise duties),
- transfer of authority and responsibilities for the control of local gas transmission tariff to regional energy commissions that will be overseen by, and will use methodologies of, federal administrations,
- separation of Gazprom's transmission divisions from production subsidiaries within the company,
- launching and testing market mechanisms that govern direct natural gas supply agreements,
- transition to tariff control in Gazprom's shipment services.

3.3.4 Gazprom

Company structure

On 1 June 1992 two Presidential Decrees were published underlying the role of the gas industry in the economic development of RF and its precise status, which stipulated that Gazprom would become a joint stock company with RF holding 40% of the shares, 15% to be sold to workers and 20% to public by vendor. The Gazprom reform procedure was laid down in the presidential decree No. 1333 of November 5th, 1992. As a result of different actions last year, currently the situation is as follows. The Gazprom concern turned into RSC Gazprom. The RSC Gazprom authorised capital stock is made up of:

- 100% of enterprise assets consisting of the property of the Unified Gas Supply System owned by the federal government (36 enterprises engaged in the core business),
- controlling shares (51%) in the stock companies formed by enterprises conducting non-core activities,
- Gazprom's equity stakes (portfolios) in Russian and foreign companies, and other property belonging to Gazprom is not being privatised.

The corporation issues ordinary shares. The volume of at par emission is R236.7 bill. The number of issued shares amounts to 236,735,129, with the face value of each share at R1,000. Note, however, that 40% of the RSC Gazprom equities will, for three years after the date of establishment, remain property of the Russian Federation. The remaining 60% of the first issue, must be distributed by the RF Federal Property Foundation (FPF) as follows:

- 15% of the stock is to be sold on closed subscription to the rank and file and managerial employees of the RF Unified Gas Supply System,

- 5.2% of the total stock will be sold for privatisation vouchers to locals and developers of natural gas deposits, at closed voucher auctions to be held in the Yamal-Nenetsk autonomous district. Shares are to be distributed by the Gazprom bank, within the framework of an agency agreement with the FPF, jointly with the administration of the Yamal-Nenetsk district and RSC Gazprom,
- 28.7% of the stock shall be sold for vouchers at closed voucher auctions to the population of other regions, except for Yamal-Nenetsk district residents, where gas-producing and pipeline companies of the corporation operate,
- 1.1% of the shares will go as a contribution to the authorised capital of the Rosgasifikatsiya stock company in exchange for privatisation vouchers.

The corporation itself, for subsequent floating in the securities market shall acquire at face value and in exchange for vouchers, 10% of stock within the time period ending June 1st, 1993. Thus, the raised cash will be invested in the development of natural gas deposits on the Yamal peninsula and other prospects.

Pursuant to the Corporation Charter, the dividend yield on one share is set by the shareholders' meeting as suggested by the Board of Directors, and may not exceed the amount recommended by the Board. Dividends are paid in cash or, on shareholders' consent, in shares.

The total share of the Corporation's foreign investors and their affiliated legal entities and natural persons, may not exceed 9% of the entire voting stock. The Corporation's foreign partners and affiliated entities may buy ordinary (voting) stock only upon prior written consent of the Board.

Gazprom's strategic alliances/new business strategy

On February 12, 1998 the Italian company Eni signed a strategic alliance with RAO 'Gazprom', as a first step to making a direct investment of at least $1bn in the Russian company. The deal is similar in structure to the alliance announced last November between RAO 'Gazprom' and the Royal Dutch/Shell group.

The Italian group intended to acquire an equity stake in RAO 'Gazprom'. Eni was considering to follow Shell's example of investing about $1bn in a RAO 'Gazprom' convertible bonds for which no launch date has yet been set but which would eventually give it an equity stake.

Officials said the latest link could form part of a broader tripartite alliance between RAO 'Gazprom', Shell and Eni, to develop and exploit the substantial reserves of oil and natural gas liquids held by RAO 'Gazprom'. For RAO 'Gazprom' the deals with Shell and Eni also give it a special relationship with the most powerful gas companies in northern and southern Europe respectively. The new alliance will create a separate joint venture company to focus on the exploration and development of promising fields in Astrakhan in southern Russia, while the Shell joint venture will focus on RAO 'Gazprom' fields in northern Russia. Eni and RAO 'Gazprom' may also engage in joint exploration, production and marketing projects in other countries, as well as projects involving pipelines and power generation. The potential oil and gas reserves of the Astrakhan fields are estimated at about 5bn barrels of oil equivalent, of which three-fifths is oil and two-fifths gas.

Gasunie and Gazprom signed a ‘supplier-co-operation’ in 1996, in order to have synergy from combining the ‘limited’ EU supplier Gasunie with long distance supplier Gazprom in order to optimise the use of the transmission system.

At 22 May 1998 Ruhrgas announced a long-term ‘strategic alliance’ with RAO ‘Gazprom by signing contracts for the supply of up to 13bn cubic metres of Russian natural gas per year from 2008. The deal of extending existing contracts to at least 2020, is worth about DM25bn ($13.7 Bn) at current market prices. As for Ruhrgas, the deal would help ensure continuing supplies from RAO ‘Gazprom’. Ruhrgas and RAO ‘Gazprom’ are also stepping up co-operation in the transmission of Russian gas through Germany, which might lead to the construction of new pipelines. By opinion of Ruhrgas officials the closer co-operation would allow RAO ‘Gazprom’ ‘to use our well developed pipeline system to reach markets to the west of Germany, such as France and the Netherlands, in a more cost effective way.’ RAO ‘Gazprom’ indicted supplies to the UK were also a long term possibility. Other collaborative projects between Ruhrgas and RAO ‘Gazprom’ are expected in the Baltic region as well as on technological development.

Finally Gazprom recently started co-operation with Shell by establishing a strategic alliance to co-operate on a wide range of projects for development of oil, gas, liquid gas and other related (electricity production) projects.

3.4 Conclusions

3.4.1 Russian energy supply

Russia has a strong energy resource base particularly in oil, gas and coal, and has traditionally not only met its own energy requirements but has also performed significant exports. While production of gas is increasing, oil production has declined sharply in the past few years, and major investments and technological improvements, which are necessary to maintain and later increase oil production, were postponed. Off-shore development in deep waters will pose particular technological problems.

On the other hand, both oil and coal production make a significant contribution to the domestic energy supply, but productivity is low, and capital investments in more advanced technology and new management techniques as applied in Western economies are hardly introduced in the RF with exception in some oil companies and Joint Ventures. Consequently the oil and coal sectors are still not efficient and polluting supply sectors with abundant reserves, needing enormous investments for upgrading and restructuring of their activities.

With regard to energy efficiency, it is clear that over a long period of time efficiency in the energy sector could be significantly increased. This dramatic improvement will crucially depend on progress in industrial restructuring, introduction of new industrial processes, widespread use of metering and control systems, and, in particular, the driving force of market prices. But first the trend of increasing non-payment of energy bills must be reversed and thereafter a gradual implementation of reforms, e.g. (energy legislation, cost-based pricing, etc.) should be introduced. The need for action is increasingly recognised, but priority continues to lie on reducing the adverse economic and social impacts of market energy prices.

The commercial environment of energy industries in Russia is not stable enough and should be improved in order to attract foreign investors. Competition is still lacking in the gas markets, governments and non separate production, transmission, distribution. Companies do not compete in offering services to energy consumers and competing producers and suppliers do not have access to transmission and distribution facilities on a non-discriminatory basis. Ideally, buyers and sellers of gas (and similarly electricity) services should be free to negotiate the price, terms and conditions of those services without government approval. EU markets are evolving to full competition, including securing the necessary action by governments to protect energy consumers. In the EU liberalisation policies for the natural gas sectors, also take into consideration public policy goals such as continuity of supply, long-term security of supply, safety and environmental protection. Such public policy goals should be pursued through measures that are compatible with development of competitive energy markets. It should also be recognised that foreign direct investment provides one of the most rapid routes to introduce these advanced technologies and management practices, as well as providing the capital to make required capital investments.

Furthermore it is observed in Russia that internal transport costs (coal, oil, gas) are relatively high due to inefficient site location choices and investment decisions in the past. Furthermore, governmental managers must make decisions in a quite different context than before. Thus policy makers' knowledge of the role of economics in decision-making is critical. Basically there seems scope for more transfer of knowledge of how to cope with economic and social problems involved in energy decisions in an emerging market system. Although formal training programs are already underway in banking, accounting and manufacturing. In the energy sector, a number of programs providing exposure to Western operating practices have already been successfully established through EU programs and projects. In spite of these efforts, there is still a great scope for further improvement of energy industry management capabilities in this field in the RF.

3.4.2 Russian gas markets

In the RF, the gas share in domestic energy consumption is already very high (over 50%), but will probably increase further in all regions, particularly rural areas and industry sectors, due to the so-called 'Gasification programme' of Gazprom. It is unclear, however, if natural gas will expand its market share in the power (presently about 33%) and heat sector too.

It is observed that the economic reform process in the RF has made significant progress in the past seven years, but is now more or less halted. Serious socio-economic impacts of reforms resulted in an increasing non-payment of gas and other energy bills by large and small consumers both domestically and in other CIS countries like Belarus, Moldavia and Ukraine, which are largely depending on Russian gas exports. This and other factors have lead to political controversy and continuous debates on delays of and declining support for the reform process. This is unfortunate, because it is hampering the establishment of a well-functioning socially acceptable market economy in the RF and consequently the improvement of the economy in the long run.

The agreement between the government and Gazprom, announced in June 1998, to break it up into separate production, transmission and distribution companies is postponed. There is strong evidence that the level of efficiency, both in production and transport as well as in end-use of gas, is below the EU level. This is mainly due to lack of commercialisation of operations and

management, undertaking the necessary investments in advanced technologies in the gas industry and introduction of cost based prices for consumers in the past years. But even worse, current non-payments of consumers will lead to a further decrease of efficiency of the gas industry. Despite the fact that Gazprom claims that it complied with government decrees to open up 15% of transport capacity to independent producers, it is observed that the access of independent gas producers to Gazproms gas transmission system is in practice still restricted, thereby limiting competition and incentives to higher efficiency. In fact a recovery of the economy and thus a successful reform process highly depends on the tax and foreign currency revenues of the consumption and particularly export of natural gas (in 1997 Gazprom revenues were $ 23 billion, which is about 25% of the federal government tax revenues).

Although several important alliances between Gazprom and foreign companies exist, the Russian gas industry must look for more participation of foreign gas industry in order to invest in necessary improvements (the pipeline network needs repair, reinsulation and for a large part is being operated at reduced pressure) and expansion of upstream activities and infrastructure of the gas market. A reliable and competitive gas industry is an important prerequisite for the recovery of the Russian economy.

4. TRADE BETWEEN EU AND RUSSIA

4.1 Review of current oil and gas exports

4.1.1 RF oil exports - an overview

After reaching 4.9 million barrels per day (mbd) in 1990, Russian net oil exports fell before bottoming out at 3.2 mbd during 1993 - 1995. Net oil exports have since increased to 3.5 mdb in 1997, an increase of 0.2 mbd from 1996 levels. This turnaround occurred despite continued production declines in Russia, because oil consumption fell even faster than production. Russian oil production declined from 7.0 mdb in 1993 to 6.1 mdb in 1997, while consumption declined from 3.8 mdb to 2.6 mdb during the same period.

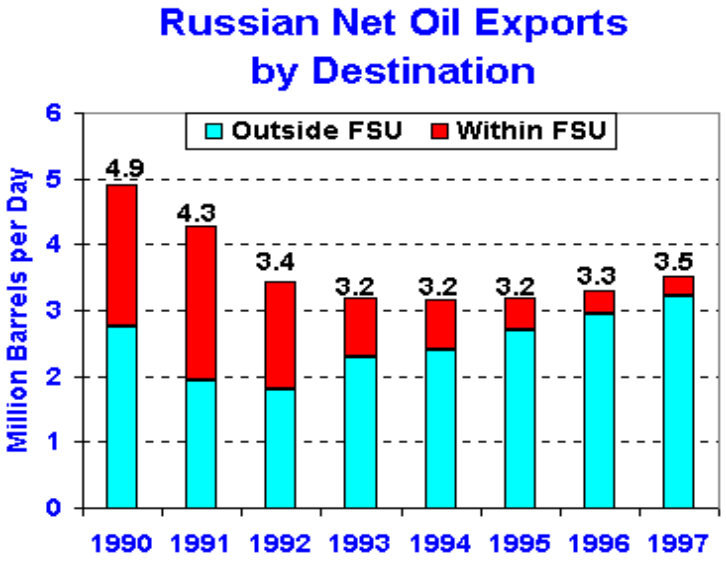

Figure 4.1 *Russian Net Oil Exports, Source: Energy Information Administration, 1998*

Russian net oil exports to countries outside the former Soviet Union (FSU) averaged 3.2 mdb in 1997, up 0.2 mdb from 1996 (See Figure 4.1). The share of net exports to countries outside the FSU has risen from 53% in 1992 to 91% in 1997. Net petroleum exports to the United States, which had averaged 25,000 barrels per day (bbl/d) in 1995-1996, fell to 13,000 bbl/d in 1997.

Eastern European countries imported 0.9 mdb via the Druzhba (Friendship) crude oil pipeline which passes through Ukraine on the way to Slovakia, the Czech Republic, Poland ,Hungary, and Germany. Throughput via the Druzhba pipeline has been below capacity, as pipeline utilisation rates ranged from 70%-75% during the past 3 years.

Over 1.1 mdb of Russian oil exports in 1997 went via Black Sea ports, over 0.8 mdb through Baltic ports, 0.9 mdb through the Druzhba pipeline, and the rest via rail and smaller ports and pipelines. These ports are operating at over 90% capacity utilisation on average, with utilisation rates greatest at the Black Sea ports. Exports from Black Sea ports in 1996/1997 increased to

their highest level since 1990, and have become a concern to Turkey because they must pass through the increasingly crowded Bosporus. Turkey has expressed strong environmental concerns about any increased shipping traffic through the narrow Turkish channel between the Black Sea and the Mediterranean through which many Russian oil supertankers now pass on their way to export markets.

Table 4.1 *Russian Oil Exports [1000 barrels/day]*

Year	Druzhba Pipeline	Novorissisk (Russia)	Tuapse (Russia)	Odessa (Ukraine)	Klaipeda (Lithuania)	Talin (Estonia)	Ventspils (Latvia)	RF Exports outside FSU
1990	890	590	187	360	130	0	438	2748
1991	686	338	89	319	153	0	386	1948
1992	728	497	121	245	93	0	308	1812
1993	716	591	160	259	136	0	333	2278
1994	776	551	133	212	91	30	382	2406
1995	829	669	178	218	55	47	360	2709
1996	874	680	208	212	72	95	464	2956
1997	895	679	187	206	45	157	496	3228

Source: Energy Information Administration, 1998.

* All exports are Russian except for 0.1 mdb by Kazakhstan, and smaller amounts by Azerbaijan, Belarus, Georgia, Lithuania, and Turkmenistan.

About half of the Russian oil joint venture exports went via the Druzhba pipeline, with smaller amounts exported through the port of Ventspils (Latvia), as well as Black Sea ports. Russian joint ventures exported over 170,000 barrels/day in 1997, compared with 1996 joint venture exports of 130,000 barrels/day. Joint ventures and other oil producers have been hampered by the lack of pipeline access to export their oil. The following table depicts RF oil exports in 1000 barrels/day.

There is also some trade in crude oil among the former Soviet Republics, but only a very small share of this involves transit. The only well known examples are crude oil exports from Kazakhstan to Ukraine (1.9 Mt in 1996) which involves transit through Russia and exports to Lithuania (1.8 Mt in 1996) which involves transit through Belarus and Russia.

Some of the other former Soviet Republics have also substantial oil reserves. Kazakhstan, Azerbaijan and Turkmenistan, all countries located around the Caspian Sea, belong to this category. The oil exports from today are modest (about 15 Mt in 1996), however there is a potential for exports of more than 100 Mt around 2010. Today these countries are entirely dependent on Russia for their exports by pipelines. Therefore efforts are needed to diversify routes in order to reach new oil markets. Transportation of oil from this area has already raised a number of transit issues and transit is expected to continue to have major strategic importance over the next few years. In terms of transit growth, this is probably the part of the world which will see the strongest development. The following table (Table IV.2) lists some of the pipeline projects that have been planned or are proposed to transport the oil from this region to market.

Table 4.2 *Pipelines under construction or proposed pipelines from Central Asia/Transcaucasus,.*

Name of pipeline	Exporter	Importer	Transit countries	Capacity	Cost
AIOC	Azerbaijan	Various	Russia	5 Mt	US$ 1.0 billion
AIOC	Azerbaijan	Various	Georgia	5 Mt	US$ 1.3-1.6 billion
CPC	Kazakhstan	Various	Russia	28 Mt	US$ 4-5 billion
CAOP	Turkmenistan	Various	Afghanistan, Pakistan	50 Mt	US$ 2.5 billion

Source: EC Secretariat [3]

All these pipelines are expected to reach ports from which the oil can be shipped by tankers. In the case of the CPC project in Kazakhstan alternative routes have been proposed that could result in transit through Iran, Pakistan and China.

4.1.2 RF natural gas exports - an overview

The 1997 RF natural gas net exports were the highest ever, exceeding the previous 1996 record by 0.849 bcm. Net exports outside the former Soviet Union (FSU) in 1997 were also a record, exceeding the previous high in 1996 by 0.85 bcm (See Figure 4.2).

These high export levels were achieved despite a decline in gas production by 10.6% in 1997. Increased gas exports were made possible by a decline in domestic consumption.

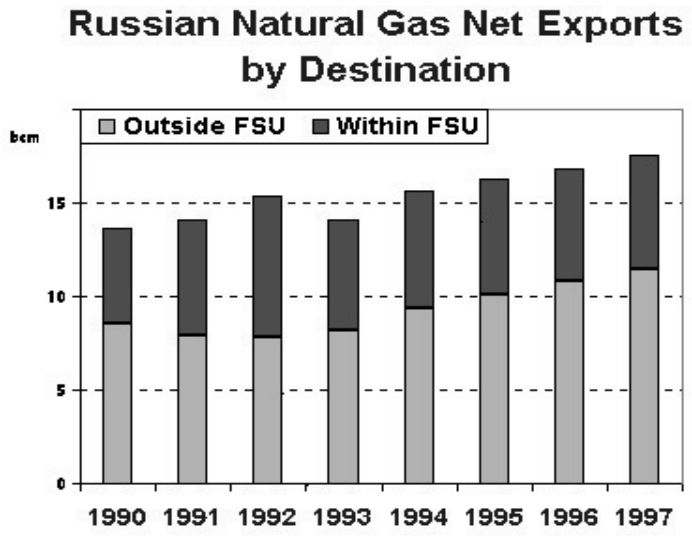

Figure 4.2 *Russian Natural Gas Net Exports by Destination*
Source: Energy Information Administration, 1998

While total natural gas net exports in 1997 reached new highs, the destination of exports has changed over the past few years. The share of net exports to countries outside the FSU has increased from 51% in 1992 to 65% in 1997. The gas is exported westwards via several very large pipelines that pass through Ukraine to Europe - Brotherhood (Bratstvo), Progress, Northern Lights, and Union (Soyuz) - and the smaller Volga/Urals-Vybord pipeline to Finland. Exports are expected to increase in the next decade with the completion of the Yamal gas pipeline to Europe as is explained in the following section.

The EU-RF energy trade relationship

Russia plays one of the leading roles in the structure of the world energy trading. Russian energy exports in 1995 covered about 20% of European region total primary energy requirements and 40% of total amount of energy consumption in the CIS countries. The role of the Russian Federation in the structure of the EU countries' energy imports during the last several years is constantly growing. Within the period 1990-1994 the annual growth rates of EU countries gas imports from Russia accounted for almost 4% and the total amount of imports achieved was 68,9 bln.m3 in 1995. Central Europe is the largest importer of the Russian fuels. Its share in the total amount of the Russian energy exports was 73,6% in 1995.

Russia is a traditional oil supplier to the European market. The volume of oil exports from Russia to this region are however mostly determined by the level of oil price.

The natural gas market is going to be the most actively growing sector of the European energy scene. Russia is one of the largest gas suppliers of the European gas market and it will strive to maintain its position in the future.

The present contribution of RF to the energy balances of the countries of Western Europe is considerable, and it has all the prerequisites for further growth in the future, given Russia's aspirations for closer co-operation with the EU countries.

Of exceptionally great significance in the formation and development of a coherent European natural gas market, is the active participation of the European Commission. In the guidelines for the creation of the Trans-European energy network, as drafted by the Commission and submitted to the Council of Ministers and the Parliament of the EU, the project 'Russia-European Union' gas pipeline system has been named as one of the top priorities.

Exports to the CIS region

According to the volumes of domestic energy reserves the CIS countries (excluding Russia) can be divided into three main groups:

- Countries-importers, unable to meet their internal energy needs by means of their own energy reserves. Armenia, Belarus, Georgia, Kirghizstan, Moldova, Tajikistan and Ukraine can be included in this group.
- Self-sufficient countries from the viewpoint of energy resources availability. Kazakhstan and Uzbekistan can be mentioned among them.
- Countries, entirely meeting their internal energy requirements by own energy reserves and carrying out a wide-scale energy export policy. Azerbaijan and Turkmenistan might be considered as representatives of this group.

The Russian Federation has a leading position in the structure of energy reserves of the CIS countries, proven by its share of fuel reserves in the CIS structure. Nevertheless not all of the countries representing the first group can be considered as potential importers of the Russian energy resources. Kirghizstan and Tajikistan will probably be oriented at the other exporters taking into account their geographical location. Economic and political reasons will make Georgia import energy carriers from Azerbaijan.

In this connection Ukraine, Belarus and Moldova can be identified as the most probable importers of the Russian energy resources. According to the forecasting estimates the share of

Russia in the total amount of energy import of these countries will remain high in the prospect up to 2020.

Relations with Asia and Middle East

The Asian energy markets as well as the energy markets of Middle East and Far East are considered as a very promising for the penetration of Russian fuel and energy resources. As far as Middle East is concerned, more should be said for investment and technologies transfer than about energy export. Lukoil is participating in the development of oil fields in Iraq, Gazprom is developing the largest gas-producing field in Iran. Minatomenergo is involved in the construction of the nuclear power plant in Iran.

According to the results of the planning process for the development of oil and gas reserves of the Sakhalin shelf, it is estimated that the level of gas production can reach 20 billion m3 and oil - 24 million tones by 2010. The major part of the produced oil and gas will be oriented at export, in particular on the most actively growing energy market of China.

Natural gas exports to China (and Korea and probably Japan) is expected to be an economically viable option for Russia. These gas exports can be realised from Kovytkinsk gas-producing field (Irkutsk region) and Yakutia. The total volume of gas exports from these regions can reach 30 billion m^3 by 2010.

Oil products export to Mongolia and China from the new oil fields of Eastern Siberia also seems very promising. These oil fields are able to ensure annual exports at the level of 15-20 million tons by 2010 in China. One more direction of energy trade between the Russian Federation and China is the Russian export of electricity. The routes of electricity networks potentially connecting Russia and China are under consideration.

4.2 Export routes from Russia

4.2.1 Oil transportation pipelines projects

Development of very rich oil fields of Kazakhstan and the entire Caspian Sea Region (including Caspian Sea) necessitated a search for reliable ways of transportation of locally produced oil to the world markets.

The major ongoing projects include the Caspian Pipeline Consortium project which ensures transportation of oil from Kazakhstan and Russian fields to the Black Sea ports. The project is based on a 1500 km transit Tenghiz-Novorossisk oil pipeline whose carrying capacity is up to 67 million tons of oil per year. This project is to be implemented by the year 2014.

Taking into account supraregional aspects in view of world market trends, a Trans-Balkan pipeline would particularly become subject of Western European interests as well as Russian and Trans-Caucasian supply interests. This is already clearly visible in the case of the proposed interconnection from Bulgaria to Greece (Burgas-Alexandroupolis), or Bulgaria to FYROM and Albania (Burgas-Skopje-Vlosl), thus bypassing the Bosporus and the Dardanelles from the Black Sea to Mediterranean, due to environmental reasons.

The project of the Baltic Pipeline System is developed to transport oil from Timan- Pechora province oil fields in the north of the European part of Russia to the European markets. The total length of the pipeline, which is to connect Timan-Pechora oil fields with the Baltic ports, will be 2400 km. The pipeline's carrying capacity will enable transportation of up to 40 million tons of oil per year. The estimated total cost of the project is US$2.4-3.4 billion.

There are also plans to build a Khariaga-Usinsk oil pipeline, oil terminal in the city of Primorsk and Kirishi-Gulf of Finland (Primorsk or Primorsk-Porvoo) oil pipeline.

In figure 4.3 the major oil product flows outside the Russian Federation are presented.

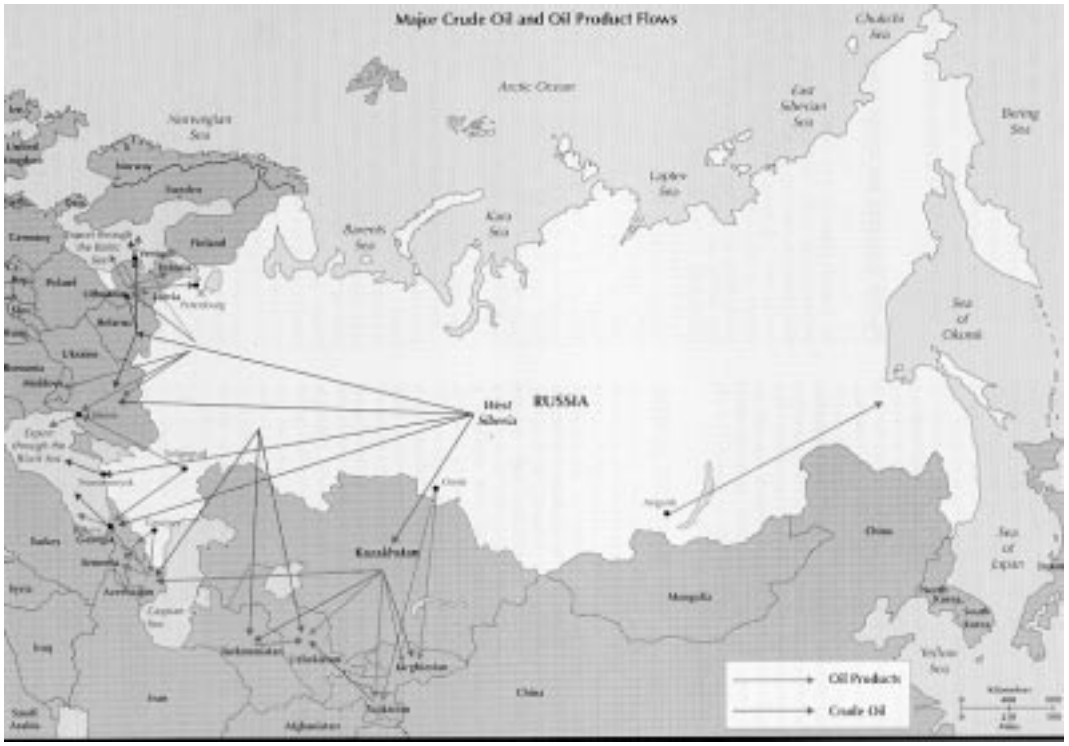

Figure 4.3 *Major RF Oil Flows. Source: Energy Policies of Russian Federation, IEA*

4.2.2 Coal transportation

Most of the existing mines in Russia, accounting for almost 80% of the total production, are located in Siberia. Therefore, most of the coal has to be travelled over long distances to reach the consuming areas in the west of the country or to the north and south-west (Black Sea) parts for export. The major coal flows from Russia are presented in figure 4.4.

There is significant uncertainty in rail freight rates which are of the most crucial elements in setting the export price of Russian coal and in the outlook of the volume of experts.

Existing sea-port capacity in the European part of Russia is about 18 Mt, thus being the upper limit of any potential exports, at least for the short term. In order to increase that capacity significant new investments are required.

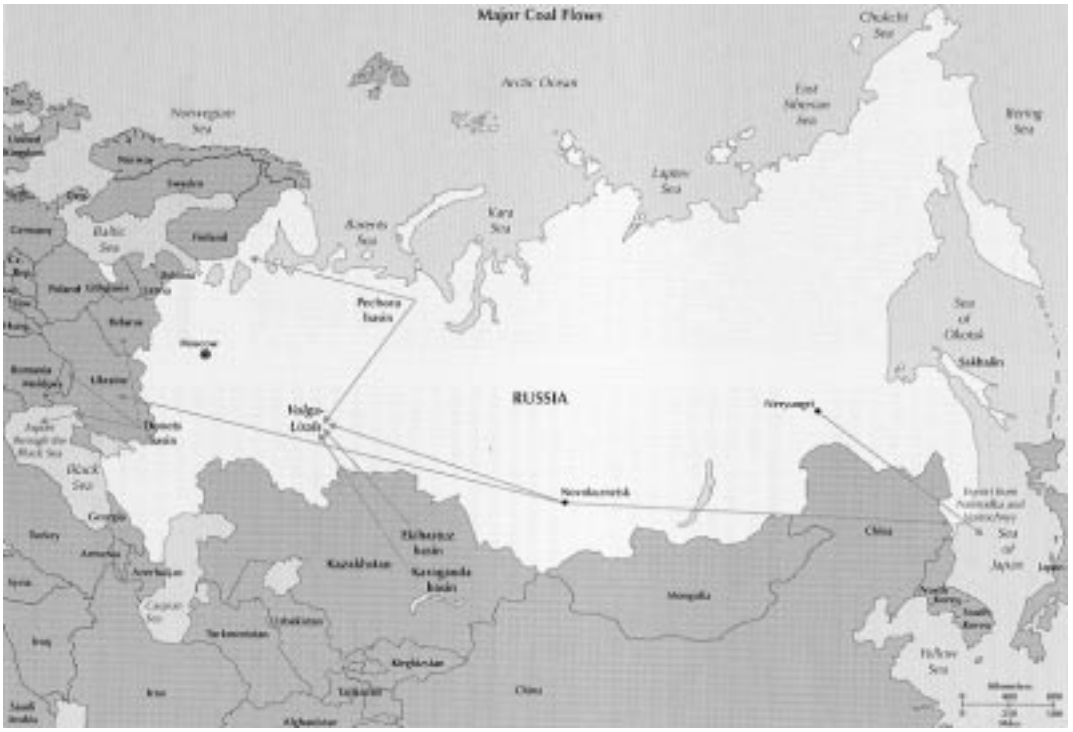

Figure 4.4 *Major RF Coal Flows. Source: Energy Policies of Russian Federation, IEA*

4.2.3 Electric power projects

Trade in electricity accounts for a much lower share than from oil and gas. Only a small share of the traded electricity involves transit.

It is nevertheless important to stress that within the UCPTE interconnected system in Europe, for example, there were total electricity exchanges of 137.4 TWh in 1996. If exchanges with other European non-UCPTE countries are taken into account, the exchanges reach 185 TWh. Intra-UCPTE exchanges represented approximately 8% of total UCPTE generation in 1996, whereas exchanges with the third countries added another 3% for a total of 11% of exchanges. It is estimated that up to 2% of the total amount of electricity produced in UCPTE countries (up to 35 TWh) may be transited through at least two borders.

The European electric power industry seems to be most exposed to integration factors. Such major interstate and interregional power systems as UCPTE/CENTREL, NORDEL and United Power System of Russia are already in operation.

Inside the FSU, transmission of electricity over long distances from generating stations to the consumption centres is more widespread than in Western Europe. Most of this trade, however, takes place between neighbouring countries. In 1996 transit of electricity took place from Lithuania to Russia (the Kaliningrad region) through Latvia and from Turkmenistan to Tajikistan through Uzbekistan.

New East-West Interconnections in Europe

There are a number of interconnection projects that are currently under discussion. The objective of these projects is to increase the interconnection capacity between TESIS and UPS via a

combination of High Voltage Direct Current (HVDC) and AC links. It should be noted that the synchronous interconnection of grids such as TESIS and UPS is a technically complex operation that requires significant technical and operational adjustments (with relatively high conversion costs) before the grids could operate in a synchronous mode.

East-West Multi Terminal HVDC Interconnection

The project is to link Smolensk in Russia with Frankfurt a M. (Borken) via Belarus, Lithuania, Kaliningrad and Poland. The line will have an approximate length of 2,000 km, will operate at 500 kV DC, will have a capacity of about 2 000 MW and is expected to cost over 2 billion Deutschmark. The completion time of the project has a 10 year time horizon.

The purpose of the Baltic Ring project is to set up a powerful electric power network to connect the power systems of 11 coastal countries of the Baltic Sea - the Nordic countries, Baltic republics, Russia, Belarus, Poland and Germany. The DC cable power transmission lines between Sweden and Germany, Denmark and Germany (and in the future between Norway and Germany) close the Baltic Ring in the west; power transmission lines of Russia, Belarussia and Baltic republics close it in the east; a DC link in the city of Vyborg and PTLs of the Nordic countries close it in the north. In this context Russia-Belarussia-Poland-Germany DC power supply system (East-West energy bridge project) is considered to be a part of the Baltic Ring which closes the latter in the south. It is assumed that the Baltic Ring will allow Russia, Belarus, Poland, Lithuania, Latvia and Estonia to improve operation efficiency of their power systems and will generally facilitate economic development of the countries of the Baltic Sea Region.

Implementation of the project of United Power System of the Black Sea and Caspian Sea coastal countries may produce a great impact on the development of power industry integration processes in the southern regions of Europe; the purpose of the project is to unite the power systems of this region via powerful electric power networks, some of which are already in operation. Such unification could allow to develop the power generation industry of the whole region in an optimal way; to conserve energy resources; to enhance reliability of power supply to the consumers; to implement mutually beneficial exchanges of power generation capacities and electric power, and to a produce in general a positive effect on the economy of all countries of the region. The high-voltage electric power networks, which have been set up by the former COMECON member-states, should be the basis of the UPS of the Black Sea - Caspian Sea Region. In the north-west these are 450 and 750 kV networks which link Russia, Ukraine, Moldova, Bulgaria and Romania, and in the south-east - 350 and 500 kV networks, which link Russia, Georgia, Armenia and Azerbaijan as well as 250 kV aerial line with Turkey.

A number of new global projects are at different stages of preparation and implementation, which projects will allow to unite power generation capacities of different countries of the continent as well as to enhance reliability and efficiency of power supply to the consumers.

To conclude, it should be noted that before envisaging the feasibility of a synchronous interconnection of both large power systems of UCPTE and IPS/CIS in Europe, there is a need to define a global strategy for realising power economic co-ordination and for managing the non-synchronous operation between the extended West-European power system and the East-European network of Belarus, Estonia, Latvia, Lithuania, Moldova, Ukraine and of course the power system of Russia.

The synchronous interconnection of the whole IPS/CIS and the West European Power systems is a complex matter which needs further in-depth studies.

In the South-European area, the future development will envisage the synchronous operation of the networks of Romania and Bulgaria and UCPTE/CENTREL. The plan depends on the elective conditions in the related areas, especially in West Ukraine and in the region of Albania, Greece and former Yugoslavia.

4.3 Gas trade with Russia

4.3.1 Gas supply potential for export

Russia was and continues to be the principal natural gas supplier to the republics of the former Soviet Union and elsewhere. In 1990, Russia exported 212 bcm of gas; the total gas exports for 1996 stand at 196.5 bcm. Gas exports for foreign exchange (hard currency) were 100 bcm in 1990 and 123.5 bcm in 1996.

The traditional importers of Russian gas (within the borders of the former Soviet Union) are Belarus, the Ukraine, Moldova, the Baltic Republics and Kazakhstan. In 1996, Belarus received 13.7 bcm, the Baltic Republics 4.5 bcm, Moldova 3.2 bcm, Kazakhstan 0.4 bcm, Georgia 0.2 bcm and the Ukraine 51 bcm of gas.

In 1990, Russia imported gas from Turkmenistan (20.2 bcm) and Kazakhstan (5.3 bcm), and in 1992 figures these imports were equal to 14.6 and 5.1 bcm respectively. In 1996 import was practically stopped. The Turkmen gas traditionally was transported through a gas pipeline network called Central Asia - Center. This pipeline is 3,070 km long and serves to deliver gas to the European part of Russia, Caucasus and the Ukraine. West Siberian gas deliveries to the central and western areas of Russia are carried out in three directions: northern, via Uhta-Vologda-Torzhok; central, via Punga-Perm-Kazan; and southern, via Urengoi-Surgut Chelyabinsk-Ufa.

The gas pipelines Orenburg-State border (2,750 km) feed the southern areas of the Ukraine. They are also used for export deliveries to the West. Gas exports are transported through the Urengoi-Pomary-Uzhgorod pipeline, which is 4,000 km long. It delivers gas to the East European countries, Austria, Germany, France and Italy.

In 1996 GAZPROM signed new additional contracts for 54.2 bcm deliveries to Western and Central Europe, which increased its export contract portfolio by 51%.

4.3.2 Costs of gas supply from RF

The costs of gas supply play a crucial role in EU strategic gas policy. In contrast to the oil market, gas supply costs differ strongly between the different suppliers as a result of the strong dependence of transportation costs on mode and distance. Moreover, in the previous section, it is illustrated the dependence of gas supply on more distant resources will probably increase in the future. As a result, in supply planning, transport costs, and above all the financing of new infrastructure, will gain importance. Furthermore, in this chapter, an overview is given of current gas prices, and selected scenarios for future development are presented.

Production costs

The total costs of gas production typically comprise the following components: search, exploration, and fixed and variable production costs. No extensive assessment of production costs will be presented in this section. As an example only, an estimation of the drilling exploration costs in the main perspective Russian gas provinces, and a structure of estimated costs of gas production for Nadym - Pur - Taz gas province is given.

The variant estimation costs of exploration drilling on main perspective Russian gas provinces (West Siberia) are shown in Table 4.3 Gas fields are different by size and depth of drilling. The Gydan gas province has most expensive exploration drilling because of difficult climate and transportation conditions as well as more complicated scope of works compare with Nadym-Pur-Taz and Yamal gas provinces.

Table 4.3 *Variant estimation of exploration drilling costs for gas fields with different size and depth [mln. USD]*

	Depth	Size of the fields [bcm]			
Gas Province	km	less than 10	10-30	30-100	more, than 100
Nadym-Pur-Taz	from 1.5 to 3	10.4-23	10.4-33	12.5-23	23-110
	more than 3	18-40	18-58	22-40	40-190
Yamal	from 1.5 to 3	11-25	11-35	13-25	25-120
	more than 3	19-43	19-60	23-40	40-210
Gydan	from 1.5 to 3	12-26	12-37	14-26	26-125
	more than 3	21-46	21-65	25-46	46-230

In table 4.12 the structure of estimated costs of gas production for Nadym - Pur - Taz gas province is shown. It is evident that small gas fields with a capacity up to 10 bcm are not considered to be economically efficient, since the share of exploration costs is too high. This share is calculated to be as much as 16 - 20%, which is considerably higher than the normative share of 10%.

Table 4.4 *Structure of estimated costs of gas production for Nadym-Pur-Taz province, depending on depth and size of reserves [%]*

	Fields with reserves, bcm			
	to 10	10-30	30-100	more than 100
Depth from: 1.5 to 3 km				
Search	16	3	1	1
Exploration	12	5	2	2
Production	51	71	76	76
Cost for subsoil	6	6	6	6
Gross Profit	15	15	15	15
more than 3 km				
Search	20	5	2	1
Exploration	15	7	2	4
Production	44	67	75	74
Cost for subsoil	6	6	6	6
Gross Profit	15	15	15	15

Transportation costs

The following factors are principal in the determination of the construction costs of pipeline for gas transportation [2]:

- the length of the pipeline,
- the maximum peak flow (capacity),
- the trade off between pipeline diameter and the number of compressor stations,
- mode (onshore/offshore pipelines), terrain conditions, rights of way etc.

For onshore pipelines, both material costs and labour costs account for about one third of the total pipeline construction costs. The remaining share covers, among other things, surveying and rights of way. Construction costs for offshore pipelines depend in particular on capacity and depth of water [2].

The fixed costs (operation and maintenance) are estimated at an annual proportion of construction costs of 2% onshore and 1% offshore. Fuel costs are the principal variable costs and correspond to 0.3% of total throughput [2]. The economic life of a pipeline, which will determine the depreciation period of the investment, can be much shorter than the economic lifetime (typically about 50 years) [2].

The long distance transport of gas in liquefied form as LNG is cheaper than pipeline transportation. However, additional costs arise as a result of the required compression. A full LNG chain consists of a liquefaction plant with at least two trains, transport ships and a regasification terminal including storage. The total costs are less sensitive to transport distance compared to transport of gas with pipelines. Cost reduction can be achieved through economy of scale of the liquefaction plants [2].

Total supply costs

The total border supply costs comprise the following cost main categories: production costs, transport costs and transit costs to the EU border. Within the framework of this project no full overview and assessment of current cost estimates for the different supply options is given. To illustrate the range of estimates however, a summary of selected sources for supply costs is presented (sources: IEA).

Estimates of supply costs

Below, in Table 4.13, an estimation of the total supply costs for a selection of gas fields is listed (large fields only).

Table 4.5 *Total supply costs of gas delivered at European Union border [1993 USD/Mbtu]*

Country of origin	Total cost at EU-12 border	Transport costs IRR=10%	Transit costs	Production costs	Deposit size	Production type	Transport type
EU fields							
Netherlands: Groningen	0.25	0.15	0.00	0.10	giant	onshore	onshore pipeline
Norway: Ekofisk-Emden	1.34	0.34	0.00	1.00	large	offshore	offshore pipeline
Norway: Troll-Emden	1.96	0.76	0.00	1.20	large	deep offshore	offshore pipeline
Norway: Troll-Zeebrugge	2.29	1.09	0.00	1.20	large	deep offshore	offshore pipeline
UK: Interconnector-Zeebrugge	2.10	0.60	0.00	1.50	small & medium	offshore	offshore pipeline
Russian fields							
Russia: Western Siberia to EU-12	3.22	1.88	0.84	0.50	super giant	onshore (permafrost)	onshore pipeline
Russia: Yamal - EU-12	3.37	1.98	0.84	0.75	super giant	onshore (permafrost)	onshore pipeline
Russia: new gas Barentssea - EU12	4.65	3.15	0.00	1.50	giant	offshore	LNG
Other fields (selection)							
Qatar pipeline Ashkelon - LNG Italy	3.28	2.78	0.00	0.50	super giant	offshore (low depth)	offshore + onshore pipeline + LNG
Qatar: pipeline Turkey-Italy	4.70	1.85	2.35	0.50	super giant	offshore (low depth)	offshore and onshore pipeline
Algeria: Transmed-Italy	1.06	0.45	0.11	0.50	giant	onshore	onshore and offshore pipeline
Turkmenistan: Pipeline Turkey-Italy	4.38	1.88	2.00	0.50	large	onshore	onshore pipeline

Source: [1]

Gas from the offshore fields and the outside EU fields are assumed to be delivered to the nearest EU border. Gas from the Groningen field in the Netherlands is delivered at the neighbour country border. Both existing and new projects are listed.

Total supply costs vary significantly from 0.25 USD/Mbtu for the Groningen field to 20 times as much for pipeline supply from Qatar. Except from gas coming from the North Sea basin, transportation and transit costs largely exceed production costs [1].

The reader must note that the differences between the supply costs for the Russian and Norwegian fields could be partly explained by differences in methodology and are therefore difficult to compare.

Diversity in cost estimates

The reader must also note that in literature cost estimates show a fair amount of diversity.

Among other things, this is a result of:

- The use of different depreciation periods and/or discount rates for investments, which determine the cost of capital.
- Allocation between gas and other co-produced energy carriers. This is for instance an issue for the Norwegian fields, which are also used for oil production.
- New infrastructure or use of excess infrastructure. Often, in cost calculations, it is assumed, for reasons of comparison, that completely new infrastructure is to be built. This can lead to significantly higher costs, although in reality (partly) excess capacity can be used.
- Overstatement of costs by regulated transmission and distribution monopolies [4].
- The allocation of costs for infrastructure that is used to transport gas from different sources to different buyers.
- The use of marginal costs versus integral costs.

4.3.3 Major gas transportation projects

Today's largest gas transportation project is the construction of the system of Yamal-Europe gas mains. The stages of Yamal-Europe project implementation are determined in such a way as to enable most flexible and economically efficient reaction to possible changes on the gas markets both in Russia and foreign countries.

The new Yamal-Europe gas pipeline from Siberia through Belarus will be 5340 km long (up to the German border) and will have an annual carrying capacity of about 65 billion m3 by the year 2010 and a total cost of US$25-US$30 billion. New gas supplies to EU could also be transported through Finland, Sweden and Denmark (probable volume - 10-20 bln.m3). The chosen configuration of the gas pipeline envisages not only the construction of the pipeline in the common energy corridors with the pipelines of the United Gas Supply System of Russia but also the connection to a number of large West-European gas markets which will expand the capability to manoeuvre gas flows and will enhance the overall reliability of the system.

There are also plans to build the South-European gas pipeline to increase and improve reliability of Russian gas supply to Italy as well as additional supplies of gas to Hungary, Slovenia and Croatia.

The purpose of the North-European project, which is being studied now, is to supply gas to the countries of north-western Europe from Russia through Finland, Sweden and Denmark to Western Europe. If this project proves to be economically sound then measures will be taken to design, finance and build the North-European gas pipeline.

The Interconnector project, in which RAO Gasprom joint stock company is involved, is important for the establishment of a united gas supply system of Europe. The implementation of this project will allow to integrate gas transportation and distribution pipelines of the European mainland countries and those from Great Britain into a united system which will assure high reliability and flexibility of gas supply to the consumers. It is assumed that after the years 2010-2015 gas will be transported through the Interconnector system in the opposite direction which will ensure gas supply to Great Britain from the mainland.

In some countries new infrastructure has already been built or is presently under construction and will shortly start transferring gas. Greece receives Russian gas through Bulgaria and may transit gas to Albania. One of the gas pipelines, which is in the planning process with carrying capacity of 16 billion m3/y, will connect Russia and Turkey through the Black Sea which will allow the direct connection of the two countries.

Apart from the gas routes connecting EU and RF, it should be noted that Portugal has contracted for Algerian gas and will take it through Spain. Italy has recently contracted for Norwegian gas and will transit it through France and Switzerland.

Existing and expected new natural gas pipelines to Europe are presented in Figure 4.5, also including LNG terminals from where natural gas can be imported to Europe. They represent the external dimension of the European gas network, and include transit routes, see below.

Table 4.3 *Existing and Planned gas routes between EU-RF*

Code	Route	Project Description
h3	Norway-Denmark-Sweden-Finland-Russia-Baltic States	Development of connections between the networks of these countries, with a view to setting up an integrated gas network.
h6	Russia-Ukraine-EU	Increasing transport capacity to the European Union from Russian resources via the main existing axis through the Ukraine, Slovakia and the Czech Republic.
h7	Russia-Belarus-Poland-EU	Creation of a second transport axis from Russian gas resources to the EU vi Belarus and Poland.
h11	Bulgaria-Greece	Improvements to the gas transportation network in Bulgaria to ensure supplies from Russian resources to the new gas network in Greece
h14	Russia-Ukraine-Slovakia-Hungary-Slovenia-Italy	Construction of a new gas pipeline, from Russian gas resources, to Italy.

Source: Transeuropean Energy Networks- The External Dimension, E.C.-DGXVII, 1997

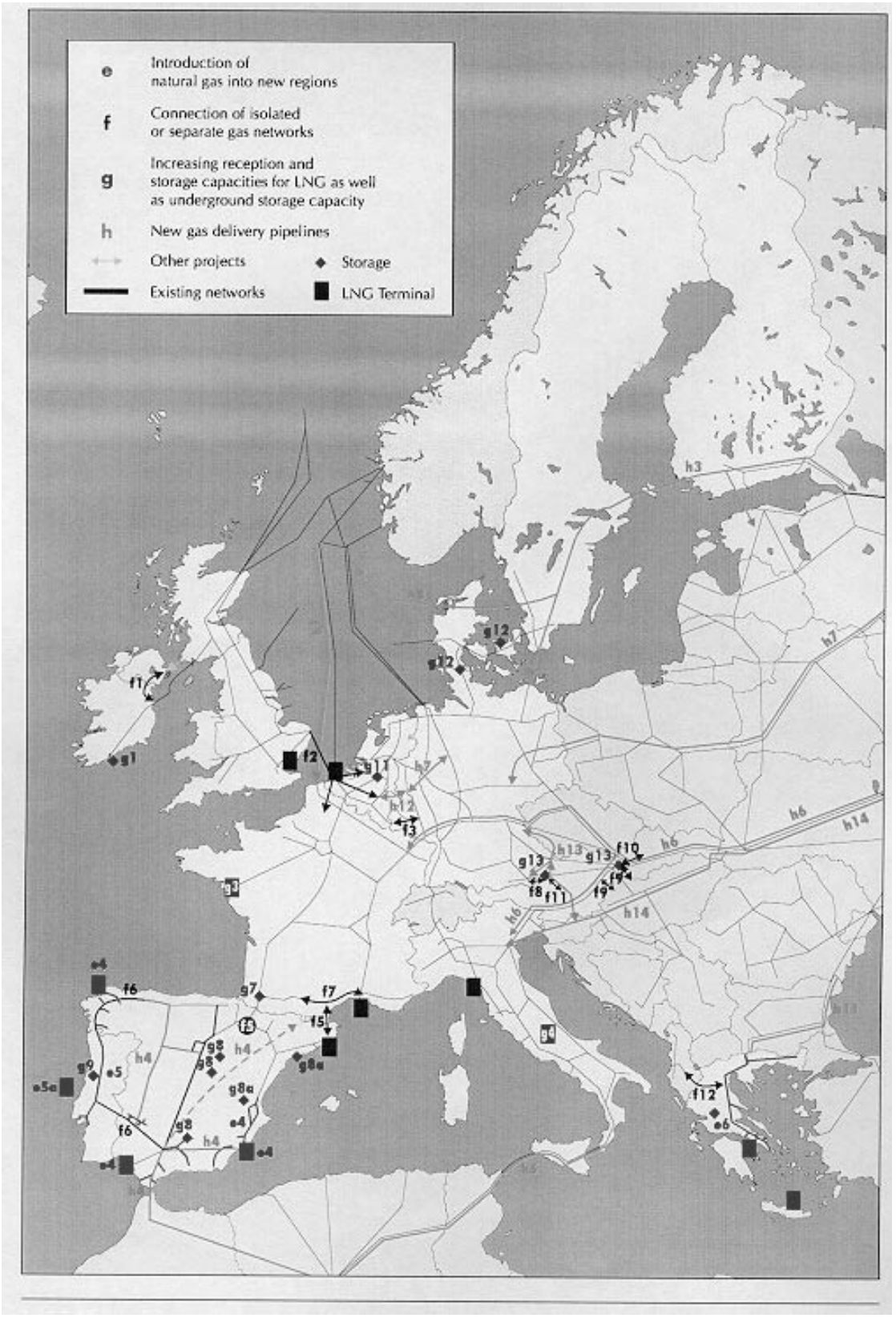

Figure 4.5 *Natural Gas Flows to EU. Source: EC 1997 Transeuropean Energy Networks*

Gas trade between EU and RF should also be treated within the overall regional gas trade framework. Table 4.5 provides an overview of the main gas exporters and importers in the region, as well as transit countries.

Table 4.5 *Gas exports and transit by country of origin in 1996 [bcm]*

Exporter	Importer	Volume	Transit countries
Russia	Austria	6.10	Ukraine, Slovakia
	Italy	13.75	Ukraine, Slovakia, Austria
	France	11.97	Ukraine, Slovakia, Czech Republic, Germany
	Germany	32.77	Ukraine, Slovakia, Czech Republic, Belarus, Poland
	Switzerland	0.43	Ukraine, Slovakia, Czech Republic, Germany
	Turkey	5.70	Ukraine, Moldova, Romania, Bulgaria
	Bosnia Herzegovina & F.R. of Yugoslavia		
	Bulgaria	6.15	Ukraine, Moldova, Romania
	Croatia	0.70	Ukraine, Slovakia, Austria, Slovenia
	Czech Republic	9.40	Ukraine, Slovakia
	Hungary	7.70	Ukraine
	Poland	7.20	Ukraine, Belarus
	Slovakia	7.20	Ukraine
	Georgia	0.2	Ukraine
	Lithuania	2.60	Belarus, Latvia, Estonia
	Moldova	3.20	Ukraine
	Slovenia	0.80	Ukraine, Slovakia, Austria
Turkmenistan	Ukraine	19.0	Uzbekistan, Kazakhstan, Russia
	Kyrgyzstan	0.20	Uzbekistan, Tadjikistan
	Kazakhstan	4.10	Uzbekistan
	Armenia	1.0	Kazakhstan, Georgia
Algeria	Italy	18.65	Tunisia
	Slovenia	0.80	Tunisia, Italy
	Spain	0.46	Morocco
Norway	Austria	0.23	Germany
	France	10.8	Germany, Netherlands, Belgium
	Netherlands	4.31	Germany
	Spain	1.32	Belgium, France
Netherlands	France	5.50	Belgium
	Italy	4.5	Germany, Switzerland
	Switzerland	0.73	Germany
	Luxembourg	0.73	Belgium

Source: [14]

The major gas transit countries in the region are Ukraine, transferring about 116 bcm in 1996, with a total capacity of about 130 bcm, Slovakia transferring 81.4 bcm in 1996, which is close to maximum transit capacity, and the Czech Republic transferring 41.9 bcm in 1996 with a maximum transit capacity of about 50 bcm.

Regarding new pipeline projects, most of the new potential pipelines will come out of the Middle East and the area around the Caspian Sea. In addition to the traditional gas suppliers (Rus-

sia, the Netherlands, Algeria and Norway) there is a number of new states with significant gas deposits that are also expected to enter the market. A brief overview of already planned or proposed gas pipeline projects involving transit, is provided in Table 4.6.

For a preview of proposed or planned gas pipeline projects involving transit see table below.

Table 4.6 *Proposed or planned gas pipeline projects involving transit*

Origin	Transit countries/areas	Destination
Turkmenistan	Iran, Turkey	Europe
Turkmenistan	Caspian Sea, Turkey	Europe
Turkmenistan	Russia, Ukraine	Europe
Turkmenistan	Afghanistan	Pakistan
Turkmenistan	Uzbekistan, Kazakhstan	China
Turkmenistan	Uzbekistan, Kazakhstan, China	Japan
Iran	Turkey	Europe
Iran	Caucasus	Europe
Iraq	Turkey	Europe
Qatar	North Africa	Europe
Saudi Arabia	North Africa	Europe
Libya	Tunisia	Europe
Russia	Korea	Mongolia, China

Source: [3]

It should be noted however that only few, if any, of these pipelines have a determined commissioning date as yet. A common feature is that they are intended to transport large volumes of gas over long distances and consequently have a high cost.

4.3.4 New supply options

As a result of the expanding gas markets and the developments in gas production, gas infrastructure is being expanded with speed, increasing the options for gas supply and trade. Below, an overview is given of the major projects that were implemented in recent or are at the moment in an advanced state of development or planning [15].

Links between Eastern and Western Europe

- The 74 mile Hungary-Austria pipeline was completed in 1996. It will be able to ship about 6 bcm/year from eastern suppliers to Western Europe, diversifying gas supplies in countries that at the moment almost exclusively depend on Russian imports.
- The Trans - Austrian - Gasline (TAG) runs 380 km across Austria from the Slovak border. In 1995 it carries 13.3 bcm of gas, of which over 90% to Italy. The capacity of the TAG is being expanded to 23 bcm by the end of 1998.
- The West - Austria - Gasline (WAG) runs 245 km across Austria, from the Slovak border to the German border. The WAG supplies Russian gas to Germany and France. Total capacity in 1995 was 6 bcm.
- The Megal pipeline, operated by the German company Ruhrgas, carries Russian gas through the Czech Republic and Germany to France.
- The Stegal pipeline, operated by the German company Wingas, carries Russian gas to Germany.

- The German company Wintershall is currently expanding its pipeline system with the Jagal pipeline, to carry Russian gas to Germany.
- The Volta pipeline is planned to carry Russian gas via Slovakia, Hungary and Slovenia to Northern Italy.
- Initial additional deliveries from Russia to Germany and Poland can be provided from fields with existing infrastructure. In Russia, significant pipeline expansion aimed at bringing Russian gas to European markets is currently being investigated. The Yamal pipeline across Belarus and Poland could be developed to deliver up to 25 bcm, however current agreements with Poland and Germany plan a peak of 75 bcm in 2004. The economics of such a huge investment is unclear, in particular in competition with a Nordic route through Finland, Sweden and Germany.

Other links

- Sales agreements from Norway's Troll field, Europe's largest offshore field, became official in 1996. Through a new offshore pipeline from Norway to Belgium gas will be exported to Germany, the Netherlands, France, Austria, and Spain. Peak supply will be 0.1 bcm /day.
- Norway secured 1997 a long term contract to supply gas to France through the NorFra pipeline (Dunkirk).
- Greece was first supplied with Russian gas in 1997 through Bulgaria. The national infrastructure is to be expanded significantly.
- Gas infrastructure is currently being developed in Northern Ireland. Gas is supplied from Scotland.
- Construction of the Interconnector pipeline from Bacton, UK to Zeebrugge, Belgium, has begun in 1996 and is expected to be completed in October 1998. The German gas utilities Wingas, Ruhrgas and Thyssengas already signed contracts for gas from the Interconnector. The connection is planned to transport up to 25 bcm/year.
- Italy plans to increase the amount of imported LNG from Algeria.
- The Maghreb-Europe pipeline from Algeria to Spain was completed. Capacity is planned to be expanded to from 10 bcm/year at the moment to 25 bcm/year in the year 2000 with delivery to Spain, Portugal (through a newly developed gas infrastructure), France en Germany.
- Italy plans to diversify gas imports by buying Libyan gas, to be transport to Sicily through a 320 mile offshore pipeline.
- Turkey has plans to import gas from Turkmenistan through a pipeline under construction across Iran.

4.3.5 Transit countries

Table 4.9 *List of current European transit countries*

Transit country	Origin	Destination
Austria	Russia	Germany, France, Italy, Switzerland, Slovenia and Croatia
Belgium	Norway	France, Germany, Netherlands, Austria, Spain.
Belgium	The Netherlands	France
Belgium	UK	Germany and others
France	Norway	Spain
Germany	Norway	Netherlands, Belgium and France
Germany	Russia	France and Switzerland
Italy	Algeria	Slovenia
the Netherlands	Norway	Belgium and France
Spain	Algeria	Portugal
Switzerland	the Netherlands	Italy
Bulgaria	Russia	Turkey, Greece, FYROM
Czech Republic	Russia	Germany, Austria, France, Italy, Slovenia and Croatia
Hungary	Russia	former Yugoslav republics and Austria.
Latvia	Russia	Estonia and Lithuania
Poland (since Dec. 96)	Russia	Germany
Romania	Russia	Bulgaria, Turkey
Slovakia	Russia	Czech Republic, Germany, Austria, Hungary, Slovenia, Italy, France
Slovenia	Russia	Croatia

Source: [3]

In future gas supply, transit issues will gain importance. A large number of European countries are transit countries of Norwegian, Russian, Dutch and Algerian gas. Table 4.9 lists these transit countries.

Albania, Denmark, Finland, Greece, Ireland, Luxembourg, Norway, Sweden and the UK do not transit gas originating from the four main supplying countries.

Regarding transit rights and fees, the European Natural Gas Directive will provide a framework for the EU, although the implementation will probably differ strongly between the countries (cf. chapter two). Transit policy of non-EU countries will remain a divers and complex subject. This will increase in the future as more distant suppliers will need new transit countries. Often politics will play an important role in a country's transit policy.

4.3.6 Scenario for future supply

Given the expected growth of demand in time, the development of domestic resources and the available import options, a so-called gas balance can be drawn up for the EU and CEE. Table

5.5 shows the gas balance for the EU-15 and CEE-10 for 1995 and an exemplary scenario for future supply.

Table 4.10 *Gas balance for the EU-15 and CEE-10 [bcm/year]*

	1995	2005	2010
Gas demand			
EU-15	353	476	513
CEE-10	79	104	118
Domestic supply			
EU-15	210	250	209
CEE-15	25	26	26
Volume to be imported			
EU-15	143	226	304
CEE-15	54	78	92
Total volume to be imported (EU and CEE)	197	304	about 400
Contracted volume	200	206	210
To be signed in near future from North Sea, Russia, Algeria, LNG		70	70
Gas gap (demand minus short term secured supply)	0	about 30	about 120
Potential new supplies using existing transport capacity		30	30
Potential long distance supplies requiring new transport capacity			90

Source: [7]

The reader should note that the size of the gap depends on the assumptions on demand development and the development of domestic resources. In addition, the split-up between potential new supplies using existing infrastructure on the one hand and new infrastructure on the other depends on the assumptions on availability and costs of new supply options. However, the overall tendencies in the gas balance are believed to be robust for these assumptions.

From table 4.10 we may conclude the following for the EU-15 and the CEE-10 gas market [1, 6]:

- Domestic production (not for export) will remain stable or increase slightly, but less than demand resulting in an increased dependency on external supplies in the future.
- Contracted import volumes will level off and contract extensions are necessary (e.g. from Russia).
- The unsecured supply on the short term (2005) is very small. Unsecured supply on a longer term (2010) can probably be covered without problems. For the larger part, the existing infrastructure with excess capacity can be used. The remaining could be covered by the scheduled new supply routes.

4.4 Conclusions

The share of imports of gas and oil sources from outside the EU will increase. International trade in oil and gas between the EU and RF will expand in the future. In the short term, the share of contracted gas supplies seems sufficient. However, in the longer term (2010 and onwards), an important share of not yet contracted new supplies will probably have to come from Russia, and also the Caspian Sea area. Consequently the EU dependence on long distance gas supplies will increase (in 2020 almost 70% of gas supplies from outside the EU is expected to be 'long distance gas sales') after 2015. Already after 2010 the EU's dependence on Russia will, according to the presented scenarios, increase substantially. This asks for growth of transit capacity between EU and RF, requiring large investments in expansion of transit capacity after 2005 for facilitating gas trade between EU and RF. However, energy transit to facilitate and allow for competitive trading between EU and RF is observed to face many challenges. Next to issues of finances, many other barriers exist, of which the wide range of laws and regulations in all transition countries involved and covering the energy transport (transit) routes are most important.

The EU requirements for additional oil imports will be in the order of 23% to 33% in 2020, depending on the scenarios. The additional quantities of oil will be imported in EU from the existing oil-trading partners, such as Middle East, Russia, Africa etc. Each one's share in the overall EU oil imports is expected to be retained to the same levels. This is due to the foreseen low production cost of oil in the Middle East and Africa, combined with the expected large variations of the future oil production in RF which create much uncertainty over the future EU-RF oil trade volumes. In this respect, the estimated EU imports of RF oil are expected to be in order of *71-82 Mtoe* for 2020 compared to *75 Mtoe* in 1995.

The coal industry in Russia with its high transportation costs is not particularly competitive in the European market, mould the future coal-trade potential between EU and RF. EU's major coal-trade partners will continue to be Australia and US as well as other regions of the world. Therefore the potential trade of coal between EU and RF in the time horizon up to 2020 is expected to be trivial.

The European Union will continue to import a large part of its energy requirement over the next three decades, from RF and even at a higher level than today's quantities. Nevertheless, given that the specifics of EU's future energy supply options are also surrounded by uncertainties usually in the area of economics, politics, technology and the environment, the following factors should be taken into serious consideration when assessing the energy trade between EU and RF:

- the signing and implementation of the Energy Charter Treaty and its provisions by Russia (Doema),
- the impact of integration of EU and other Central European countries, creating an enlarged area of energy co-operation,
- the recovery of the Russian economy from the present crises and progress of reforms,
- further integration of Russia into the world economy.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

5.1.1 Energy demand projections and policies

It is obvious that in general, reliable energy demand projections are a fundamental input for formulating effective energy policies. The information provided by the energy demand scenarios for Russia is also highly important for EU energy analysis and policy preparation and vice versa. The conclusion is that notable differences exist between methodologies applied in the EU and Russia for developing long run energy demand projections. The Russian approach departs from the existing physical production structure, which implies that final energy demand is stripped down departing from existing consumption and production patterns, taking into account determining factors such as energy conservation, substitutability, prices and the financial status of consumers. Economic developments, including sector growth rates, are included and projected based on the existing consumption and production patterns. In contrast, the EU is departing from a set of differing but consistent basic philosophies, reflecting different world developments which are realistic and which can not be influenced by policy makers in the EU themselves. In this manner the EU tries to cope with the many uncertainties inherent to the unpredictability of several key long term developments in the world and create a background of the EU scenarios. In short, the Russian practice is to project energy demand on the basis of most likely expected developments, while the EU-scenarios provide a framework for deriving these 'expected developments' from a set of different but internally consistent scenarios in an assumed long run world context.

Furthermore we must conclude that the available data, applied methodology and models in Russia cannot fully cope with current important 'transition' issues in the energy sector and economy of Russia, particularly the crucial interaction in and between economy and energy sector in the Russian Federation. Consequently the policy makers lack sufficient reliable information (data) and demand projections from these studies to prepare effective energy policy measures (as is the practice in the EU and its member states). Finally there seems to exist insufficient priority for an effective implementation of energy conservation programmes and policies in Russia. This is partly due to insufficient insight in effects and benefits of energy demand efficiency and conservation in end-use sectors, and insufficient reliable data and insights in real demand due to the non-payment of consumers and positive effects of efficiency measures, programmes, etc. Stimulating energy conservation first requires solving the non-payment of energy bills and thus must have the highest priority in Russia. Experiences in the EU in developing and implementing energy conservation programmes can be used in the RF. It should be noted that this is the only way to reduce the high energy costs and low efficiency of the energy sector of Russia.

5.1.2 Energy suppply

The commercial environment of energy industries in Russia is not stable enough and should be improved in order to attract foreign investors. Competition is still lacking in the gas markets, governments and non separate production, transmission, distribution. Companies do not compete in offering services to energy consumers and competing producers and suppliers do not

have access to transmission and distribution facilities on a non-discriminatory basis. Ideally, buyers and sellers of gas (and similarly electricity) services should be free to negotiate the price, terms and conditions of those services without government approval. EU markets are evolving to full competition, including securing the necessary action by governments to protect energy consumers. In the EU liberalisation policies for the natural gas sectors, also take into consideration public policy goals such as continuity of supply, long-term security of supply, safety and environmental protection. Such public policy goals should be pursued through measures that are compatible with development of competitive energy markets. It should also be recognised that foreign direct investment provides one of the most rapid routes to introduce these advanced technologies and management practices, as well as providing the capital to make required capital investments.

Furthermore it is observed in Russia that internal transport costs (coal, oil, gas) are relatively high due to inefficient site location choices and investment decisions in the past. Furthermore, governmental managers must make decisions in a quite different context than before. Thus policy makers' knowledge of the role of economics in decision-making is critical. Basically there seems scope for more transfer of knowledge of how to cope with economic and social problems involved in energy decisions in an emerging market system. Although formal training programs are already underway in banking, accounting and manufacturing. In the energy sector, a number of programs providing exposure to Western operating practices have already been successfully established through EU programs and projects. In spite of these efforts, there is still a great scope for further improvement of energy industry management capabilities in this field in the RF.

5.1.3 Gas market

The agreement between the government and Gazprom, announced in June 1998, to break it up into separate production, transmission and distribution companies is postponed. There is strong evidence that the level of efficiency, both in production and transport as well as in end-use of gas, is below the EU level. This is mainly due to lack of commercialisation of operations and management, undertaking the necessary investments in advanced technologies in the gas industry and introduction of cost based prices for consumers in the past years. But even worse, current non-payments of consumers will lead to a further decrease of efficiency of the gas industry. Despite the fact that Gazprom claims that it complied with government decrees to open up 15% of transport capacity to independent producers, it is observed that the access of independent gas producers to Gazprom's gas transmission system is in practice still restricted, thereby limiting competition and incentives to higher efficiency. In fact a recovery of the economy and thus a successful reform process highly depends on the tax and foreign currency revenues of the consumption and particularly export of natural gas (in 1997 Gazprom revenues were $ 23 billion, which is about 25% of the federal government tax revenues).

Although several important alliances between Gazprom and foreign companies exist, the Russian gas industry must look for more participation of foreign gas industry in order to invest in necessary improvements (the pipeline network needs repair, reinsulation and for a large part is being operated at reduced pressure) and expansion of upstream activities and infrastructure of RF gas market. A reliable and competitive gas industry is an important prerequisite for the recovery of the RF economy.

Gas prices to consumers are not reflecting full economic costs of deliveries despite in February 1998 announced changes in the pricing structure, in which households would have had to pay higher gas prices. On top of this, the increasing unwillingness of gas consumers (domestic and foreign) to pay the gas bills will lead to great difficulties in achieving viable and commercially sound operations and will hamper urgent investments in rehabilitation of existing networks and facilities, but also might in the long run jeopardise supply security of deliveries to domestic and particularly foreign consumers in the CEECs and EU.

5.1.4 Trade between EU and Russia

As a consequence of the expected increase in EU gas and oil trade, the transfer pricing issue between transit countries is highly important. At the moment, gas transit policy calculation methods of national governments and gas industries are very diverse. Often, domestic political issues play an overriding role. Therefore, in order to maintain the required gas supply security level in the EU, more co-operation on transit pricing, investment in infrastructure, networks, interconnections and storage is of great importance. International regulation and guidelines for transit can be based on Energy Charter Treaty provisions. Consequently it is crucial that the ECT is ratified and implemented as soon as possible in all transit countries in order to create a stable investment climate (reducing risks) for the energy industries to invest and gas companies to negotiate contracts for trade.

It is concluded that in order to develop new projects for improvement or expansion of the gas and oil production and infrastructure in Russia and the transit countries between EU and RF huge investments are required. This can probably only partly be financed by domestic entities in RF and transit countries. The willingness of foreign investors however is conditional with regard to political, financial stability, and subsequently their perceived risks. Therefore the RF government and Duma should promote the ratification and implementation of the Energy Charter Treaty and try to create a stable political economic climate for investors.

5.2 Recommendations

At the moment three structures exist to support EU-RF co-operation with a view to improving the functioning of European energy markets and issues of mutual interest. First is the Partnership and Co-operation Agreement between the EU and Russia, where there is a specific sub-committee for Energy, Nuclear issues and Environment. Secondly, there are the various European Community programmes, such as the Tacis, Synergy and THERMIE programmes, and thirdly, the Initiative of DGIII for an EU-RF Industrial Round Table, which aims to bring together key EU and Russian enterprises to discuss issues of common concern and includes a separate working group for energy sector specific issues. Together these frameworks provide a solid basis for the enhancement of co-operation between the EU and RF.

5.2.1 Improvements of energy efficiency and demand policy

The following issues deserve immediate attention in Russia as they would increase the effectiveness of their energy efficiency policy:

- Solving the non-payment of energy bills is and should be one of the highest priorities of the policy makers in Russia, as this issue, which depends also on external factors to the energy sector, contributes towards an inefficient energy use and jeopardises the economic

sustainability of energy companies. EU and Russian co-operation should be enhanced to explore the possible development of financial methods to overcome this problem.

- Energy conservation in the industrial, building and transport sectors have the greatest attention of policy makers in Russia. However, despite the apparently abundant availability of energy supplies in Russia, policies directed towards increasing energy efficiency must be pursued to decrease pollution, and reduce the cost of energy to the consumer. The EU could provide useful support with its experience in this field, which could result in great benefits to the economy and consumers in Russia. End use energy conservation would also enhance security of supply and environmental safety in both the EU and RF in the long term. More concretely it is recommended that the following activities should be intensified between the EU and Russia:
  - development of demand analysis and effective energy saving programmes,
  - training and support of Russian experts in the area of development and the implementation of energy conservation programmes,
  - EU transfer of energy technologies and experience to the RF.
- Methods for implementation of policy (legislation, standards, taxation etc.) for the effective enhancement of the efficient use of energy in Russia.
- Exchange of information on policy, priorities and plans for network rehabilitation, capacity expansion and new transit/trade routes and capacities in Europe.

5.2.2 Capacity building for improvement of policy preparation

Capacity building is recommended for the following areas:

- The improvement of the availability and the quality of energy and economic statistics for supporting, analysing and monitoring energy market (demand, supply, trade resources) developments and forecasting in the RF.
- Transfer (including training) of experts' knowledge of methods and models which can be used to enhance capabilities in the analysis, preparation and implementation of energy policies and measures.
- More concretely it is recommended that the EU promotes join EU and Russian studies on the following topics:
  - energy demand and energy saving policies and programmes in the RF,
  - the development of integrated energy environment scenarios for the RF,
  - EU-RF energy inter-dependence.
- In general, access to results and the dissemination of know-how and information reported from different existing international co-operation frameworks, such as the Energy Charter Treaty (ECT), Trans-European Energy Networks (TEEN), Balkan and Baltic Task Forces etc., on the above issues is of the utmost importance to EU and RF experts and policy makers.

5.2.3 Institutional improvements

The enhancement of the institutional framework in Russia should focus on:

- Establish a stable (political, economic and legal) framework for encouraging domestic and foreign investors and foreign companies to enter into joint ventures for the development of hydro-carbon fields, pipeline networks and upstream activities, and also energy conservation projects.

- The Energy Charter Treaty (ECT), which is now in force, will contribute to the creation of more favourable conditions for foreign investors and promote technology transfer. The ECT should play an important role in creating a level playing field for investment and trade in the energy sector. It is highly recommended that the RF (Duma) ratifies this Treaty as soon as possible.
- Develop a pricing system for gas prices to consumers taking into account on inter-fuel substitution.
- Establish clear, equitable and stable taxation rules, which take full account of the need to encourage long-term investments.
- Further enhancement of the exchange of information and views on policies and sector developments in the gas sector. In this way, a level of understanding can be built up, which should lead to the establishment of common rules on pricing and an equal playing field in both EU and RF gas markets. This information exchange between the RF and EU can be promoted through the PCA. Relevant areas are: legal aspects of access to grids and gas transit pricing (costs methods of calculation; ways of contracting), the removal of non-financial barriers to the development and integration of gas market networks, investments in gas production, transport, pipeline and storage capacity etc.

It should be noted that the programming and implementation of European Community studies/projects (i.e. Tacis, Synergy etc.) should be flexible to cope more effectively and immediately with developments which have an impact on policy. So far there exists a delaying period of about two or more years between the adoption of the programme of projects nad the start of the execution of such a project.

5.3 Epilogue

After the world wide collapse of the communist systems in 1990, the West has decided firmly and quite unanimously that the proper way to respond was to assist these states with their transition to market economic structures and democratic political systems. Self interest was a prevailing motivation for that decision, rather than altruism. The embrace and integration of the Russian economies into the World economy would foster the socio-economic balance in these countries, and open up new markets and thus new profitable opportunities for Western enterprises. In particular with respect to Russia, also access to the rich natural energy resources would mean a more diversified energy supply structure to Western economies and less vulnerability for import from other areas and an improved prospect of securing energy supply in the next century.

Therefore it remains of eminent importance to continue and enhance the co-operation between the EU and Russia. As a consequence, Russia should continue to promote the difficult and painful transition process of the Russian political and economic system. Despite the numerous factors of uncertainty, currently causing foreign companies to hesitate to enter and develop the Russian markets, and causing foreign governments and official organisations to be more reluctant to enter into agreements with Russian authorities and companies it is of the utmost importance to continue and enhance the co-operation between EU and Russia. Because the ultimate objective of this co-operation, namely that both Western countries and Russia will in the long run gain substantially from a stable development and progress of trade relationships and the economic reforms in Russia, should not be forgotten.

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