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Keskusteluaiheita – Discussion papers

No. 664

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ENERGY SECTOR IN RUSSIA

Economic and Business Outlook

The paper is a sub report of the FINENTEC project (The Competitive Edge of the Finnish Energy Technology). Given its huge investment needs, the Russian energy sector is very promising, and from the Finnish perspective a nearby market for energy technology. This market is analysed in this paper by independent Russian experts.

ISSN 0781-6847 15.01.1999

DUDAREV, Grigori - **ZVEREV,** Michael**, ENERGY SECTOR IN RUSSIA. ECONOMIC AND BUSINESS OUTLOOK,** Helsinki, ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 1999, 49 p. (Keskusteluaiheita, Discussion Papers, ISSN, 0781-6847; no. 664).

ABSTRACT: The energy sector is the cornerstone of the Russian economy. On an international scale, the Russian energy sector makes up an exceptionally large share of that country's output and exports. Since Russia has very significant energy reserves, the energy sector will be important for the country in the future, too.

This study presents Russia's energy sector: raw material resources, energy raw material production and trade, energy consumption and the potential for energy conservation. This study focuses mainly on electricity production. We examine electricity production from various basic raw materials and other production methods. The structure and operating principles of electricity transfer and distribution are also investigated. In doing so, we look at technology, investment, and usage of production equipment. Investments, basic improvements and even maintenance operations are badly neglected in practice, and, therefore, the country will eventually need new energy technology.

The study also introduces the energy sector's leading companies and main regulatory authorities. The energy sector has undergone sweeping privatization. Regulatory deficiencies, especially the barriers blocking foreigners from benefiting from the sources of raw materials, and the lack of investment protection have thus far prevented foreign companies from participating in the Russian energy sector. Different levels of competition have been allowed. Oil companies already compete in a western fashion. On the other hand, Gasprom has monopoly power in gas production. It is possible that competition in the production and sale of electricity will be allowed in the next decade. Foreign companies and investors will be allowed to act as independent power producers (IPP), as well as provide electricity to wholesale and retail markets.

KEY WORDS: Russia, energy sector, electricity production, transfer and distribution

DUDAREV, Grigori - **ZVEREV,** Michael**, VENÄJÄN ENERGIASEKTORI - KOKONAIS- JA YRITYSTALOUDELLINEN KATSAUS,** Helsinki, ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 1999, 49 s. (Keskusteluaiheita, Discussion Papers, ISSN, 0781-6847; no. 664).

TIIVISTELMÄ: Energiasektori on Venäjän kansantalouden kulmakivi. Kansainvälisesti verraten energiasektori Venäjällä vastaa poikkeuksellisen suuresta osasta maan tuotannosta ja viennistä. Koska maan energiavarat ovat erittäin merkittävät, energiasektori on jatkossakin tärkeä Venäjälle.

Tässä tutkimuksessa esitellään Venäjän energiasektori: raaka-ainevarat, energiaraaka-aineiden tuotanto ja ulkomaankauppa, energian kulutus ja energiansäästöpotentiaali. Erityisesti keskitytään sähkön tuotantoon. Sähkön tuotanto eri perusraaka-aineista ja eri sähköntuotantotavat käydään läpi. Samoin selvitetään sähkönsiirto- ja jakelujärjestelmän rakenne ja toimintaperiaatteet. Molempien yhteydessä tarkastellaan teknologiaa, investointeja ja tuotantovälineiden kulumista. Investoinnit, perusparannukset ja jopa huoltotoimenpiteet on käytännössä pahasti laiminlyöty, joten ennen pitkään maa tarvitsee kipeästi uutta energiateknologiaa.

Työssä esitellään myös energiasektorin keskeiset yritykset ja energiasektorin hallintoviranomaiset. Energiasektoria on voimakkaasti yksityistetty. Lainsäädännön puutteet, erityisesti ulkomaalaisten esteet osallistua raaka-ainelähteiden hyödyntämiseen ja sijoitusten huono suoja ovat toistaiseksi tehokkaasti estäneet ulkomaalaisen ulkomaisten yritysten toiminnan Venäjän energiasektorilla. Kilpailua on vapautettu eritasoisesti. Öljy-yhtiöt kilpailevat jo länsimaiseen tapaan. Kaasun tuotannossa puolestaan Gaspromilla on monopoliasema. On mahdollista, että sähkön tuotantoon ja myyntiin kilpailu on tulossa ensi vuosikymmenellä. Ulkomaalaisille yhtiöille ja sijoittajille avautuu mahdollisuus toimia itsenäisinä voimantuottajina (IPP) ja myös sähkön myyjinä tukku- ja vähittäismarkkinoilla.

AVAINSANAT: Venäjä, energiasektori, sähkön tuotanto, siirto- ja jakelu

YHTEENVETO

Tämä tutkielma on laadittu aikana, joka on vaikea ja ratkaisevan tärkeä Venäjän elinkeinoelämälle. Valtaisa, noin kymmenen vuotta jatkunut talouden muutosprosessi ja äskeinen finanssikriisi ovat ajaneet Venäjän talouden ahtaalle, niin teollisuustuotannon kuin kulutuksen suhteen.

Energiasektori on maan talouden kulmakivi, joka edustaa suurta osaa tuotannosta ja viennistä. On hyvin tärkeä ymmärtää, millä tavoin tämä sektori vastaa talouselämän muutoksiin ja miten se itse vaikuttaa Venäjän talouden kehitykseen. Nämä ovat aiheita, joita käsitellään tässä tutkielmassa.

Tutkielman päätarkoitus on tarkastella energiasektorin tämän päivän taloudellista tilannetta ja rahoitustilannetta Venäjällä. Raportti on rajattu lähinnä sähköalan analyysiin. Energiasektoria kokonaisuutena kuvataan siinä määrin, että se riittää antamaan käsityksen energiasektorin eri osien keskinäisestä riippuvuudesta ja vaikutuksesta toistensa kehitykseen. Ongelmakentän kuvausta täydentää myös luonnonvarojen ja raaka-ainetuotannon analyysi.

Tutkielman luku 2 sisältää Venäjän luonnonvarojen kartoituksen. Energiasektorin talousnäkymät ja siihen liittyvät indikaattorit esitellään luvussa 3. Viime vuosien tilastoihin perustuvan ennusteemme mukaan energiankulutus Venäjän teollisuudessa pysyy vuosien 1997-1998 tasolla vuoteen 2000 mennessä, kun taas muilla aloilla ennustetaan energiankulutuksen kasvua. Energiantuotannon lasku on pysähtynyt, mutta paluu entiselle tasolle on mahdollista vasta vuosien päästä. Energiasektorin restrukturointi on tärkeä. Muutoksia voidaan helpottaa energiasäästöillä ja tehokkuuden parantamisella.

Luvussa 4 tarkastellaan Venäjän sähköalaa ja sen erikoispiirteitä, jotka liittyvät mm. tekniikkaan, lainsäädäntöön ja talouteen. Samalla kuvataan käytössä olevia voimaloita ja energiatuotannon koneita ja laitteita sekä polttoaineita.

Luku 5 sisältää johtopäätöksiä, jotka perustuvat edellä esitetyn aineiston analyysiin. Venäjältä puuttuu energiasektorin kehitysstrategia. Alan toimintaa säätelevä lainsäädäntö ei tue investointeja. Kehitysstrategiaa tarvitaan tukemaan myös uuden tekniikan kehitystä ja ympäristöasioiden hoitoa.

Tässä tutkielmassa on käytetty tilastotietoja eri lähteistä. Mahdollisten ristiriitojen välttämiseksi olemme tarkastaneet kaikki tilastotiedot ja valinneet tähän ainoastaan luotettavimmat tilastot.

SUMMARY[1]

The present discussion paper is prepared at the very difficult and decisive time for the whole Russian economy. Tremendous economic transformation that has been going on for nearly a decade and the recent financial crisis have pushed Russian economy to its bottom line in terms of decrease in industrial output and consumption. It is a well known, that the energy sector is a core of the Russian economy representing a major part of its industrial output and exports. It is very important to understand, how this sector responds to the overall economic change and what is its own impact on the economic development of Russia. These are the issues we have addressed in this paper.

The main purpose of this report is to present an economic and financial outlook for the energy sector of Russia as it is seen today. The scope of this report is limited mostly to an analysis of the electricity sector. The energy sector as a whole is described to an extent, that is useful for understanding of the inter-dependence and impact of its sub-sectors on the development of each other. An analysis of the natural resources and raw materials production also contributes to the understanding of the problems.

Chapter 2 of the present paper is devoted to the description of the natural energy resources of Russia. Russia possesses one of the world's largest deposits of natural gas, most of which is located in the Western Siberia and in the long term is the most economically attractive and sustainable energy reserve in Russia. The oil and solid fuel resources in Russia are sufficient, although their quality will decrease already in the short term. Any significant improvement in the productivity of solid fuel and oil production in Russia can be achieved only through large investments in the new equipment and construction. Further exploration of the natural reserves, located in the remote regions with harsh climate, will also require substantial infrastructure investments.

The nuclear resources of Russia are not great , but due to a large existing stock they will be sufficient to support the current level of production with minor gradual increase in the medium term. Although, any notable technological breakthrough, that would increase productivity per unit of fuel, can allow to extend the lifetime of these resources.

The hydropower resources in Russia are significantly underutilised in comparison to the international standards. This is mostly due to the over-centralisation of production, that was carried out in the 1950's and led to closing down many small hydropower plants as well as because of a large amount of on-going construction, that has been put on hold or is moving slowly as a consequence of investment availability problems. As soon as the investment obstacles will be overcome, the hydropower will increase its proportion in the total energy production.

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[1] Most of the paper was prepared by Grigory Dudarev. The energy consumption chapter 3.1. and electricity chapters 4.2.-4.4. were prepared by Michael Zverev. The authors would like to express their acknowledgement for help and valuable support that was provided in technical issues by Mr. Michael Nerovny Chief Engineer of the SolidEnergoProject, St. Petersburg and by the Pavel Filipov in stock and financial market reviews.

The renewable and other energy resources are also briefly described in the chapter. Unfortunately, these resources have not received appropriate attention in Russia due to the investment constraints and are rarely exploited.

The issues related to the economic development of the Russian energy sector and corresponding indicators are presented in Chapter 3 of the present paper. An overall decrease in the industrial output has lead to a decrease in the electricity demand. Relatively low decrease in the demand has been observed only in export oriented sectors. Statistics for 1997 showed some stabilisation in the demand. The forecast for 2000 is based on the assumption, that industrial consumption will stay on the 1997-1998 level and consumption in the non-industrial sectors will continue to grow.

As to the energy production, it must be mentioned, that although some stabilisation was seen in the last years, the total recovery of energy generation would not happen soon. Different estimates are given in this respect. All of them, nevertheless, assume, that a return to the 1990 level of production will not happen until 2010 or even after that. The estimates are based on the current state of the industry, which is in desperate need of investments. The installed equipment is largely worn-out and out-dated.

One of the factors, that can potentially make the transformation and restructuring of the energy sector easier is the energy saving potential. It is enormous. Notwithstanding this fact, the estimation of the total energy efficiency gains is still a very difficult issue due to various institutional reasons.

The present organisational and functional structure of the energy sector demonstrates the role of federal and regional governments in its management.

Chapter 4 concentrates on the electric energy sector, discussing technical, regulation and business issues, which are special of this sector in Russia. The overview of the installed equipment and fuels is also presented. The most urgent issues are the quality of the installed machinery, outdated technologies and, again, tremendous investment needs and current difficulties related to the attraction of the investments. A most viable alternative to generate financing for energy utilities seems to lie in the stock market. Transparency and reliability of reporting are the crucial issues in this respect.

An analysis of the regulation of the sector, that overviews the major legislative acts, shows that the regulation practices are still undergoing transformation, although a sound basis appears to have been formed amidst the struggle between the President and Parliament of Russia.

Finally, Chapter 5 represents conclusions, that are drawn from the analysis of the information presented. It is stated, that a national policy will be the most important for the future development of the energy sector as a wide gap in the investment and business regulation spheres persists. A national policy will also be needed to support innovation and technology development as well as to take into account and control the environmental aspects of the energy sector development.

In this paper we have used statistics available from different Russian sources. Our analysis revealed, that those sources often contradict each other. To avoid discrepancies we have processed all the statistical data carefully and chosen to present only the reliable one.

Views presented in this paper may contradict the official ones. Nevertheless, we trust our conclusions and believe that further development of the energy sector in Russia will prove them right.

TABLE OF CONTENTS

1 INTRODUCTION. On the Cross-roads. A Road to Success or Deterioration

The energy sector is a core of the Russian economy. In 1997 it provided 28,5% of Russia's total industrial output and 46 % of total exports. It is the main source of hard currency revenues for Russia.

Russian energy is of strategic importance also for many other countries. More then 80% of energy demand in Ukraine, nearly 85% of that in the Baltic countries and more then 50% of energy demand in the Eastern Europe is covered by supplies from Russia. Russia also provides up to 20% of total gas consumption of the OECD countries. In some countries and in some specific products imports from Russia cover up to 100% of the total demand. All this makes it technically impossible to substitute those imports in short or medium term. Thus, the state and development of the energy sector in Russia will to a great extent determine not only Russia's but also many other countries' economies.

There is also another factor that makes Russian energy sector development important in a global sense. That is Russia's natural resources. Russia has approximately 40% of the world natural gas reserves, 13% of the oil reserves and approximately 30% of the coal reserves. The speed and the way of their exploration and extraction will significantly influence global energy market and pricing trends. That is why the world keenly follows the recent developments of Russian economy and the energy sector.

This period of time is truly a turning point for the energy sector and the total Russian economy. Russia faces a very dramatic challenge. Will it be able to handle the problems of its energy sector in a way that will lead it to a rise in the output or will its energy sector become an obstacle for further development of the whole economy?

The prerequisites for the good outcome are outstanding. Nevertheless, the years of economic transformation have proved it to be a very difficult task. Slow down of production and reduction of investment have been most visible in the energy sector.

Some of the factors, that have outlined the energy sector development in Russia in the transition period are as follows:

- a critical financial standing of Russian energy companies,
- a continuing decrease in the total industrial production,
- a lack of investment that incurred the uncompensated decrease in the production capacity,
- a decrease in accessibility and quality of raw materials,
- a sharp decrease in exploration of the new reserves,
- an unstable pricing policy, inflation and decrease of the real value of the domestic currency,
- an extraordinarily high power-intensity in industry and other consumption,
- falling exports caused by the decrease in production,
- technical limitations of transportation facilities of exports (ports, pipelines etc.),
- a sharp rise in energy transportation costs, on one side, and price regulations for energy production and transportation, imposed by the government, on the other side, have made energy deliveries to some regions unprofitable,

- a growing dependence of some regions on energy imports from the neighbouring countries. Collapse of the Soviet Union affected its unified energy system and caused sever distortions in energy supplies in parts of Russia and the neighbouring CIS countries,
- seasonal difficulties in energy and fuel supplies in remote some regions of Russia due to financing and storage capacity limitations,
- worn-out and outdated equipment and inefficient technologies,
- a low professional level of research and engineering,
- a substantial decrease in Russian power equipment production,
- an urgent need to increase investment in safety of the nuclear power plants,
- a very high level of environmental pollution and lack of investment for its control and reduction,
- a poor, old Soviet style management of many energy companies,
- constant changes in the legislation and operation regulations in the energy sector.

To summarise this list, we can say that all the drawbacks and problems of the old Soviet command economy were combined in the energy sector with the usual troubles of economic transformation, such as decrease in the industrial output and financial instability. This troublesome combination was multiplied by the lack of professional managerial resources. Thus, an initially reasonably good standing of the energy sector started to deteriorate.

The situation is certainly changing for the better in terms of management and use of resources. The trouble is, that a change in the positive direction is much slower than the decrease in the output and deterioration of the installed equipment. In fact, nobody knows when this trend will be reversed.

To make things worse, there is no generally accepted program of measures to revive the energy sector in Russia. A Chairman of the Management Board of the Unified Energy System of Russia Mr. Anatoly Tchubais has recently presented his views on those issues. Mr Tchubais's position is described in detail in Chapter 4. We hope that his extraordinary ability to make things happen in Russia will make wonders in the energy sector as well.

Nevertheless, we know that for such a profound change to occur, a political consensus has to be achieved between different interest groups. One thing, though, is clear from the beginning - it will be a long, long process.

There are some hidden reserves that may ease these changes. One of them is the potential for energy savings in Russia. It is enormous. More then 40% of all energy consumed in Russia is used inefficiently. In other words, it is either lost or used for production of useless goods. Average energy consumption per unit of industrial production in Russia is 2,5-3 times higher then in the industrially developed countries. This is partially caused by the decrease of the industrial output , which has increased the portion of the fixed energy consumption in the total production costs per unit. The other reason of high energy consumption in the industry is an old Soviet tradition of irresponsible energy over-consumption created at the time when resources were artificially under-priced and easily available. This is still a heavy burden for the whole Russia because this attitude is reflected in nearly all plant, equipment and housing design solutions made in the former Soviet Union.

The other reserves are in the governmental tariff and bankruptcy policy, in the accuracy of payments and in the operations of the financial sector. Current situation, when energy production

seemingly exceeds the demand is determined by the inability of many consumers to pay for it. Energy suppliers are often forced to provide heat and electricity to such municipal or state-owned consumers as hospitals and schools without corresponding remuneration, which makes energy companies commercially ineffective. In this sense, the energy sector of Russia nowadays is a finance donor that against its will provides purchase credits to the consumers. The government stimulates these credits through its tariff policy. Removal of these obstacles must undoubtedly be done by the government of Russia. This will enable the energy companies to invest in their production capacity.

Among the main obstacles and future difficulties for the Russian energy sector on has to mention the fact that easily accessible natural resources are quickly coming to an end. Thus, any future new production will require marginally higher investment per unit. This will make the current problem of investment resources scarcity even more acute.

The other specific problem of energy sector in Russia is that the total majority of its vast natural resources is located in the remote regions of Siberia that are underdeveloped, lack infrastructure and, due to harsh weather conditions, will require marginally higher investment to develop them in the future. There are also very high transportation costs and losses that will add significantly to the overall energy costs.

Among the other critical issues are industry lobbies, poor management skills and low levels of new equipment production and technology development. This will make the introduction of the new effective technologies difficult and will prolong the process of transformation of the sector.

2 ENERGY RESOURCE AVAILABILITY

2.1 General Data

Total amount and location of natural energy resources are the key factors that characterise the energy sector potential of a country. The existence of the resources is only a pre-requisite for successful development of the energy sector. Its real success will depend on the ability of the country to handle the natural energy resources in the most efficient way in all the stages, including extraction, processing and transportation. This will in turn require investments, a wise governmental policy and effective operation of the institutional structure of the society as a whole.. This chapter is devoted to the description of the main characteristics of the natural energy resources of the Russian Federation. The further chapters of this paper will describe the energy sector of Russia with the emphasis on the electricity sector and present an outlook of the use of the natural resources in the Russian economy.

Russia is one of the few countries in the world that is fully self-sufficient in all major energy resources. The Russian Federation occupies about 10% of the world's territory. At the same time approximately 40% of gas, 13% of oil, 30% of solid fuels and 14% of uranium reserves of the world are located in Russia.

Table 2.1.1 Geographic Distribution of Energy Reserves, % of total

Region	Oil	Gas	Solid Fuels
North of the European Part of Russia	7	1,3	4,1
Northern Caucasus	0,9	0,7	3,3
The Volga region	6,2	5,8	0
The Ural mountains	8,9	2,8	1
Western Siberia	73,4	79,9	46,5
Eastern Siberia	1,6	2	33,4
Far East	1	2,2	9,8
Continental Shelf	0,8	5,3	0

Source: GosKomStat of Russia (1997).

Exploitation of the natural resources in Russia faces several problems. One of the major difficulties is the remote location of the explored reserves. Approximately 80% of them can be found in the Western Siberia. Other regions either lack sufficient resources or they are not yet explored. The most promising regions for the future development are the Timano-Pechorsky Region, the Eastern Siberia and the continental shelf of the Arctic Sea. It is estimated, that those remote and undeveloped regions with extremely harsh climate have up to 50% of the virgin oil reserves and up to 80% of the virgin gas reserves of Russia.

Table 2.1.2 Annual Increase in Resource Due to Exploration

Natural Energy Resources	1996-2000	2001-2005	2006-2010
Oil, M tons	857	860	890
Condensed Gas, M tons	85	90	102
Gas, Bcm	1550	1640	1750
Solid Fuels, M tons	470	480	500

Source: MinTopEnergo (1995).

2.2 Hydrocarbon Resources

Oil

A substantial decrease in oil extraction in Russia is caused by technical and qualitative deterioration of oil fields as well as by the fact that the presently operating equipment can no longer meet the increasing requirements for the exploitation of the lower quality fields. A sharp decrease in the exploration of the new reserves has only aggravated these problems.

The other reasons for the fall in production output are:

- **The rising degree of oil fields exhaustion**

  By now majority of oil fields are exhausted to more than 50% and for some key fields this figure exceeds 70%. Total exhaustion of the fields leads to the decrease of the wells discharge flows, increase in water encroachment and thus lows the speed of extraction.

- **"Take the easiest first" principle**

  In the Soviet era, the fields with higher discharge flows were exploited in the first place. That increased dramatically the share of the low discharge flow wells in the total structure of oil reserves. This explains why more then 50% of the oil reserves in Russia are presently considered to be so called problem fields. Exploitation of these fields will require higher then average investment and the cost of the extracted oil will be much higher then average.

Only very substantial amounts of the immediate investment in oil production can stabilise it on the present level of output. However, long term sustainability can be reached only by the multiple increase in the speed of the exploration of new fields. There are objective possibilities for that. Only one third of the total oil reserves in Russia is already explored. More then half of unexplored resources is located in the Western Siberia. Other prospective locations include, among others, the continental shelf of the Arctic Sea, the Eastern Siberia, the Yakutia (Sakha) region.

The main obstacle in the oil production development lies not only with the deterioration of the current resources. To enable industrial use of the new fields, tremendous amount of investment will be required.

Gas

Stabilisation and small decrease in the amount of gas production in the recent years has been caused by the decrease of the Russian market demand and is not related neither has led to any changes in the quality of gas fields and resources. The present available gas resources in Russia can ensure stable levels of production up to the year 2020.

There are more then 750 explored gas, gas condensate and combined oil and gas fields in Russia. Current explored gas resources exceed 50 000 Bcm. More then 50% of these resources is already in use, 30% is prepared and ready for use, 20% is under exploration and only 1% is conserved for the feasibility reasons.

A major advantage of Russian gas resources is their concentrated location in a small number of large, easily exploitable fields. More then 75% of them are located in 21 field with more 500 Bcm

capacity each. These fields constitute the main resource base of the gas production representing 93% of total extraction volume. The other large fields (30 to 500 Bcm) represent 22% of the total explored resources and smaller fields constitute only tiny 2,4% of the total. Geographic location is presented in Table 2.1.1.

The degree of exhaustion is not that high as in the oil production. It is 14% of the total resources and 29% of the total currently exploited fields.

More then half of the total explored resources are not exploited and constitute the immediately available resource for gas production in the future. They are located mostly in the North of the Tyumen region including Jamal peninsula. According to the Gasprom estimates, these resources will provide the main part of the gas production increase in the nearest ten years. Two other gas rich regions are the Eastern Siberia and the Republic of Yakutia (Sakha).

In the recent years more and more attention has been paid to the Arctic Sea shelf resources. The largest known field is the Shtockman Field on the Barents Sea shelf. It contains 2 800 Bcm of gas. The best explored sea shelf reserves are located on the Sakhalin Island and amount totally to 828 Bcm.

There are huge unexplored gas resources in Russia. They are estimated to amount to approximately to 160 000 Bcm. About 2/3 of them is located inland and 1/3 on the sea shelf. The most prospective regions are the Western Siberia, the Eastern Siberia and the Far East of Russia. Large amounts of unexplored resources make it possible to increase substantially the amount of gas production in the nearest 10 - 20 years and provide high long term sustainability for the industry.

However, in the nearest future gas production will be hindered by the following factors:

- enormous investment needs,
- limitations imposed by the availability of technology and equipment, especially for gas field exploration on the continental sea shelf.

A reserve, which has been neglected so far, is the condensed gas, that is now left in the wells. Nowadays Russia extracts only 0,6% of the condensed gas, while the world average is 3% and in the industrialised countries the figure reaches 6-8%.

The speed and pattern of the further oil and gas industry development are closely connected to the environmental pollution problems. There are no pollution controls nor environmental protection systems in place at the moment. The accident on an oil pipeline in 1996 in the Komi region was the largest single environmental damage where an oil leak of more then 200 000 tons has contaminated a vast area of soil, forest and water. To deal with the problem, international help was needed, because Russia did not have neither technical ability nor equipment to combat oil spills. The list of accidents is long. The many years of “barbaric” approach to the oil and gas production in the Soviet times has caused substantial environmental damage. Remediation of this damage will be a tremendous challenge for the new generations of the Russian people. In the nearest future, the risk of environmental pollution will be aggravated by the use of worn out equipment and low level of investment for modernisation in this field. In the longer term, however, public pressure and overall change in the environmental conditions in the key areas of operation of the Russian oil and gas industries may alter their financial and operational considerations in the field if environment.

2.3 Solid Fuel Resources

Solid fuel resources of the Russian Federation constitute 30% of the world total and amount to 4 500 billion tons. There are 22 large and 105 medium size deposits. Only 201,8 billion tons of these resources are classified as feasible for the extraction, which represents only 4% of the potential resources.

The structure of solid fuel resources is presented in Tables 2.1.1. and 2.3.1. From the 201,8 billion tons mentioned above, only 28 billion tons, i.e. 13,9%, is currently in use. In case one also takes into account the on-going construction and other prepared resources, total solid fuel resources available for extraction will amount to 80% of all the explored resources.

Solid fuel resources include 51% of lignite (102,9 billion tons) and 49% of coal and anthracite (98,8 billion tons). The coking coals constitute 20,5% of the total amount (41,4 billion tons).

Table 2.3.1 The Structure of the Solid Fuel Resources in the Russian Federation

	Number of mines	Total identified	
		amount, billion tons	% of total in Russia
Operating enterprises:			
- mines	274	15,9	
- open-cast colliery	96	12,1	
Total	370	28	13,9
On-going construction:			
- mines	7	0,7	
- open-cast colliery	3	0,4	
Total	10	1,1	0,5
Reserve for the new construction:			
- mines	54	11,5	
- open-cast colliery	73	57,8	
Total	127	69,3	34,4
Reserve for extension of the operating companies lifetime			
- mines	69	4	
- open-cast colliery	47	2,3	
Total	116	6,3	3,1
Exploration, total	99	18,5	9,2
Prospective exploration areas, total	313	37,9	18,8
Other Resources	542	40,7	20,2
Total in the Russian Federation	1577	201,7	100

Source: MinTopEnergo (1997).

The coal extraction is carried out in seven regions of Russia. These regions may be classified in three groups according to their self-sufficiency. They are the following:

1. Net exporting regions are the Northern parts of Russia, the Northern Caucasus, the Western Siberia, the Eastern Siberia and the Far Eastern parts of Russia.

2. Net importing regions with extraction of solid fuels are the Central parts of Russia and the Urals.

3. Regions with no coal extraction, where the total coal demand is covered by imports from the other regions, are the North West of Russia, the Volgo-Vyatsky Region, the Volga Region and the Central regions of the European Part of Russia.

Facilities under construction have total extraction capacity of only 16,3 million tons of coal and will not be able to fully compensate the worn out ones.

The solid fuel extraction is carried out by open-cast and under-earth mining methods. The open-cast mining is much cheaper and safer. 58% of the total resources (118,4 billion tons) are suitable for the open-cast mining.

Further development of the coal mining industry is based on the solid fuel resources that are already explored and prepared for the operation. These reserves amount to 69,3 billion tons. The main problem for the mining industry is that the resources are located in the remote regions with no proper infrastructure and transport connections. The quality of these resources is also lower then of the presently used ones. 73% of them are brown coals or lignite. The moisture content of these coals may exceed 40%, hence the need to dry coal before transportation and use.

2.4 Hydropower Resources

The estimated hydropower potential resources of the Russian Federation are 850 TWh. At the moment, 17,7 % of them is utilised. Completion of the on-going new construction projects will rise this figure up to 23,4% (approximately 200 TWh). Nevertheless, the degree of utilisation of the hydropower resources is still much lower than in the industrially developed countries. The location of the hydropower potential of the Russian Federation by regions is presented in the Table 2.4.1.

Table 2.4.1 Hydropower potential of Russia

Economic Region	Hydropower potential, TWh	Capacity in use or under construction, TWh	Degree of utilisation, %
The Northern Region	37	9,3	2,5
The North Western Region	6	3,6	60
The Central Region	6	1,5	25
The Centre of the European Part of Russia	-	-	-
The Volgo-Vyatsky Region	7	4,8	68
The Volga Region	41	30,5	74
The Northern Caucasus	25	8,5	34
The Urals	9	4,4	49
The Western Siberia	77	1,7	2
The Eastern Siberia	350	116,6	33
The Far East of Russia	294	19	6
Total in the Russian Federation	852	199,8	23,4

Source: MinTopEnergo (1998).

The largest hydropower plants are located in Siberia on the Rivers of Yenisey and Angara. They are namely:

- the Krasnoyarskaya Hydropower Plant - installed capacity 6,0 GWe,
- the Sayano-Shushenskaya Hydropower Plant - installed capacity 6,4 GWe,
- the Bratskaya Hydropower Plant - installed capacity 4,4 GWe.

Quality, safety and efficiency of the hydropower machinery and equipment produced in Russia are good and comparable to those of the other producers in the world. The problem nowadays is that these equipment requires scheduled maintenance and replacement that was not duly carried out for many years. This leads also to a substantial decline in production volumes and overall deterioration of its manufacturing industry in Russia. In a longer term necessary equipment and spare parts availability may arise a serious obstacle for the proper functioning and development of hydropower plants.

The hydropower is of special importance to the energy balance of Russia due to its use to improve electricity characteristics. These improvements include compensation of daily load fluctuations as well as regulation of frequency and voltage. In a unified energy system, hydropower plants switched in parallel with nuclear and steam power plants are important means for increasing safety and reliability of the latter by insuring stability of their operating regimes. Operating capacity of the majority of the regional electricity companies is based on the hydropower plants.

In 1997, installed capacity of the hydropower plants in the Russian Federation was 43,8 GWe, total electricity production - 170 TWh. Installed hydropower capacity constituted 20,3% of the total electricity generation capacity in the Russian Federation.

Hydropower plants have also been a basis for the unification of Russia's grids into an energy system. The extensive flooding of fertile and densely populated land in the European part of Russia since 1930-ies has led to a strong public opposition against construction of the new hydropower plants. Nowadays, due to the new pressure for environmental protection and pollution reduction from the coal-fired power plants, the situation is reconsidered.

One of the key problems of the hydropower sector in Russia is a large number of the unfinished construction projects. Completion of the seven largest unfinished projects in Russia may add 10 TWh to the electricity output starting 2000 and from 25 to 28 TWh in the subsequent period. These projects are:

- the Vilyiskaya Hydropower Station (360 MWe, 1,2 TWh),
- the Nizhnetimanskaya Hydropower Station (600 MWe, 1,8 TWh),
- the Dalnerechinskaya Hydropower Station (740 MWe, 1,8 TWh),
- the Bureiskaya Hydropower Station (2000 MWe, 7,1 TWh),
- the Ust-Srednekanskaya Hydropower Station(550 MWe, 2,48 TWh),
- the Boguchanskaya Hydropower Station (3000 MWe, 17,2 TWh),
- the Irganaiskaya Hydropower Station (800 MWe, 1,3 TWh).

A source of additional energy are Water Storage Hydropower Plants. Experience gained at the first Zagorskaya Hydropower Plant has already proved its high effectiveness.

Despite the decrease of the total electricity production in Russia, the peak loads on many steam and nuclear power plants remain intensive and very hard to sustain in the long term. This fact

has motivated regional electricity companies to pay special attention to the rehabilitation and construction of the new hydropower plants. Location of the new hydropower plants is shown in Table 2.4.2.

Table 2.4.2 Location of the New Power Plants

Region	Installed Capacity, GWe	Annual Electricity Production, TWh
Total Hydropower Plants, including	24,8	102,7
The European Part of Russia, including	4,9	13,5
The Northern Caucasus	4,5	12,3
Siberia	10,9	53
The Far East	9	36,2
Hydroelectric Pumped Storage Power Plant in the European Part of Russia	4,5	9
Total Hydropower and Storage Plants	29,3	111,7

Source: MinTopEnergo (1998).

The other crucial issue for the hydropower generation in Russia is the fact that its equipment is already old and outdated. The lack of investment resources will delay the rehabilitation and construction of the new capacities and thus will put an additional pressure on the existing equipment and machinery.

According to the new state standards (5616-81, 26945-86), norms for the operation time of the machinery were extended from 25-30 to 40 years. This, however, has not changed the overall situation much. Table 2.4.3. presents a distribution of the installed hydropower plant equipment by its operation time.

Table 2.4.3 Installed Hydropower Equipment by Operation Time

Operation time, years	Number of Power Plants	Number of Turbines	Installed Capacity, MWe	Average Annual Electricity Production, TWh
55 and more	6	31	470	3
45-54	6	25	775	2,8
35-44	16	125	8140	23
Less than 35	38	333	34060	139,2
Total	66	514	43445	168

Source: MinTopEnergo (1998).

Most of small hydropower plants with total capacity of approximately 60 TWh have been put out operation in Russia. In the 1950-ies, when the centralisation and unification of the electricity supply in Russia was carried out by the Soviet government, nearly 5 000 hydropower plants were shut down and their consumers were switched to the Unified Energy System's grid. It was argued, that in the small power plants electricity production costs were much higher than in the large ones. Of course, no one considered transmission costs and investments as well as other issues that would have cast doubt on these decisions.

A number of attempts to revive some of the small plants were made recently. Unfortunately, they have proved, that investments needed for the rehabilitation of these plants often exceed costs of the new construction.

Development of the hydropower industry is a very capital intensive process and thus requires a favourable investment climate in the country. Unfortunately recent years of economic development in Russia were characterised by unstable financial policy by the government, inflation, budget deficit, collapse of industry, scarcity of cash and investment resources. Recent financial crisis has crashed down foreign investors' plans to finance capital intensive projects in Russia. Russian stock market as a source of equity financing has proved to be very volatile and is now ruined. All this has put on hold only new construction projects but also slowed down the ongoing hydropower projects in all parts of Russia.

2.5 Nuclear Power

In 1997, the share of the nuclear power in the total electricity production in Russia was 13%. Uranium fuel resources in Russia are limited. The main nuclear fuel resources of the Soviet Union were located in Kazakhstan, in the Central Asia and the Ukraine. After the disintegration of the Soviet Union, Russia was left with its own uranium resources of 600 000 tons. In the future, this will allow only a minor increase in the nuclear power production.

On one hand, improvement of the overall efficiency of reactors of the new generation due to technological breakthrough and development may lead to a multiple increase in electricity production per unit of nuclear fuel. This will, of course, support the durability and sufficiency of the nuclear resources. On the other hand, this will require tremendous investments in technology, equipment and construction.

Taking into account the present state of financial markets in Russia, it is hard to believe that a nuclear scenario of electricity production development can be sustainable. Nevertheless, a powerful industrial lobby of nuclear power plant equipment producers is actively lobbying state budget investments and an increase of the nuclear power in the total electricity production in Russia.

2.6 Other Energy Resources

Productive use of the renewable energy sources is a world wide trend that gains momentum in the industrialised world. The main motivation to introduce these sources is that their use is considered to cause less damage to the environment and thus benefit the image of energy producers. All this fits well into sustainable development strategies.

However, production of the "environmentally friendly" energy is expensive. In many countries, it is significantly subsidised. Due to the hardships of economic transition, this sector has not been actively developed in Russia in the recent years and any sufficient investments and subsidies for its development in the nearest future are hardly feasible.

Despite all odds, some environmentally friendly projects have been implemented. At the moment, the following power plants are in operation:

- the Pauzhetskaya Geothermal Power Plant (11 MWe),
- the Kislogubskaya Tidal Power Plant (400 kWe),
- up to 1500 wind-power plants (0,1-16 kWe),
- solar panels (total capacity up to 100 kWe).

There are totally 3 000 installed thermal power compressors with capacity that varies between 10 kWe and 8 MWe, solar thermal-electric facilities with 100 000 sq.m. of sun light collectors, 20 biomass power generation facilities that process farms waste, geothermal heat supply facilities in Dagestan, Stavropol and Krasnodar regions with annual capacity of 3 million Gcal, 7 operating (out of 20 constructed) waste incineration plants that produce 300 000 Gcal/a, 4 combined gas generators as part of municipal waste water treatment plants.

In is estimated, that 270 Mtoe a year or 22% of annual energy demand can be covered by the environmentally friendly energy.

Geothermal Power

There are 56 deposits of geothermal resources and 9 deposits of steam-water mixture with the estimated capacity of 300 000 m^3/day of thermal waters and 112 000 t/day of steam-water mixture.

Steam-water mixture deposits in the Kamchatsky Peninsula and in the Kuril Islands can provide resources for a 1000 MWe power plant. The most prospective regions for this source of energy are the Northern Caucasus, the West Siberia and the Far East of Russia.

Biomass

Total energy potential of the biomass resources comprising waste from cattle farming, agricultural production, pulp and paper production, wood processing and municipal waste water treatment is estimated to be approximately 10 Mtoe a year.

Wind Energy

According to the recently made estimates, the most suitable regions for wind power production in Russia are:

- the Arctic Sea coastline,
- the Bering Sea and the Okhotsk Sea coastlines,
- the Far East,
- the East Siberia,
- the West Siberia
- the Northern region of Russia (the Murmansk oblast).

Solar Energy

The most favourable regions for the utilisation of solar energy in electricity and heat generation are:

- the Astrakhan oblast, the Volgograd oblast and the Chita oblast
- the Sochy region
- Kalmykia
- Dagestan
- Tuva
- Buryatia
- the Primorsk region.

Low-grade Heat Energy Sources

Total potential of the low-grade heat resources in Russia is estimated to be 35 Mtoe.

3 ENERGY SECTOR OF RUSSIA

3.1 Overview

Energy Consumption

The structure of energy consumption in Russia is the following:

- **Industry -** 40% of the total primary energy and 60% of the total electricity consumption,
- **Transport** - 15% of the total primary energy and 10% of the total electricity consumption,
- **Agriculture** - 5% of the total primary energy and 10% the total electricity consumption,
- **Other domestic consumers**, including municipal - 20% of the total primary energy and the total electricity consumption.

As a key economic sector, the energy sector is closely linked with the overall performance of the Russian economy. The installed energy production capacity has become excessive in comparison with the actual consumption level, which has been consistently decreasing due to the economic decline. The overall reduction of energy demand and consumption due to the economic crisis and fall of the production output have certainly eased pressure to increase productivity in the energy sector. Nevertheless, primary energy and electricity shortages and cut-offs were observed all over the country in the recent years. The problem of stability of energy supplies has become very urgent, especially in such regions of Russia as the Far East, the surroundings of the Lake Baikal, the Northern Caucasus.

Analysis shows that:

- The decline of the industrial and agricultural output has caused the decrease of electricity consumption. In 1991-1997, the overall decrease was 27,6 %, including 38,6% decrease in the industry, 41,6% decrease in the agriculture, 43,9% in the construction and 38% decrease in the transportation.
- Relatively low decrease of energy consumption was observed in the metallurgy as well as in the oil and gas industry. The decrease of energy consumption was minimal only in the Siberian energy system, which can be explained by the large share of aluminum production in the region – an industry with almost no decrease in the consumption levels.
- Contrarily to the industry, in the non-industrial sector energy consumption has grown, driven by the increased public consumption due to the wider use of household electric appliances, delimitation of the public energy consumption, private housing development, small businesses and the service sector.
- The biggest fall of consumption was observed in 1992-1994 (24% compared to the 1990 level). In 1995-1997, annual consumption fall stayed around 3%. In the recent years, insignificant decline or even growth of consumption can be attributed to export-oriented industries with positive market trends (oil and gas industry, metallurgy, fertilizers, pulp and paper, etc.). In the machinery sector, the most significant factor for the stability of energy consumption has been the development of the automotive industry.

Total consumption level in 1997 and its share in comparison to the 1990 and 1996 levels in major industries are given in the table below.

Table 3.1.1 Recent Dynamics of the Energy Consumption

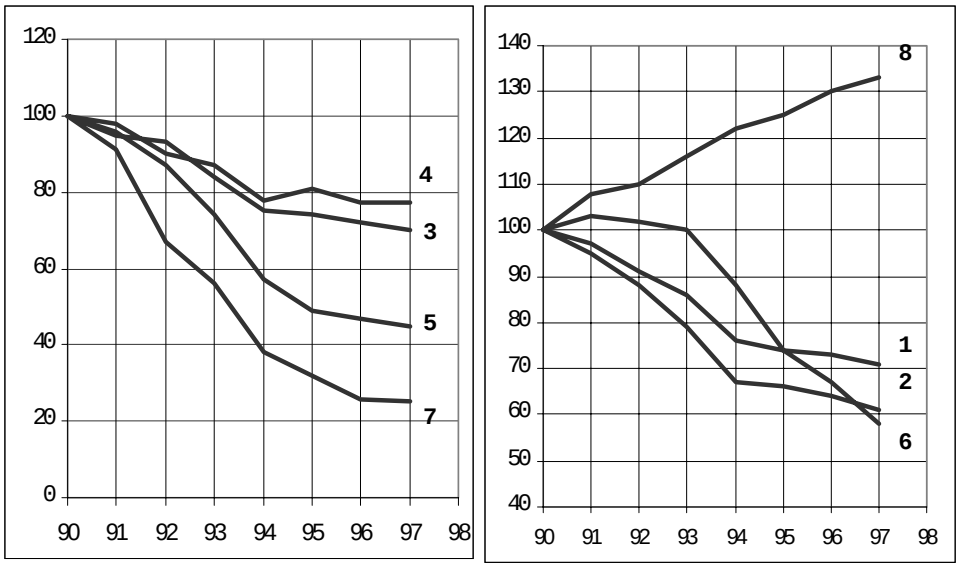
Industry, consumers	1997, TWh	1997/1990, %	1997/1996, %
Total consumption (used output)	641,6	72,4	98,1
Total, the industrial sector	325,1	61,4	98,9
Fuel production	63,3	70,3	98,7
Including:			
Oil extraction industry	34,58	70,1	99,95
Oil processing industry	10,58	70,6	97,8
Gas industry	7,79	70,9	100,5
Coal industry	10,08	72,1	94,1
Ferrous metallurgy	51,35	68,7	99,5
Non-ferrous metallurgy	73,04	84,1	101,3
Machinery and metal processing industry	44,56	44,8	98,1
Wood processing, pulp and paper industry	15,44	52,5	93,0
Chemical and petrochemical industry	36,50	52,8	99,4
Construction materials industry	12,33	48,0	94,8
Light industry	4,14	25,9	98,6
Construction industry	8,19	56,1	90,4
Transport and telecommunications	61,1	62,0	92,9
Agriculture	41,7	58,4	86,6
Non-industrial sector	104,24	109,4	103,1
Public consumption	101,07	131,0	99,7

Source: RAO UES (1998).

The following graphs show the dynamics of consumption (used output) in 1990-1997 in the major sectors of Russian economy in percentage to the 1990 level. It can be clearly seen, that acceleration of the consumption decline in 1992-1995 changed towards stabilisation and first signs of growth in 1997. The exception was public consumption, which grew consistently during those years.

The crisis of 1998 has changed the trend. Alongside with the substantial fall of production in some industries, it has also led to the substitution of imported goods by the domestic ones and thus facilited growth in the other industries. This will also alter the energy consumption structure for the future.

Graph 3.1.1 Consumption dynamics in 1990-1997 by economic sectors, %



1 - Total consumption
2 - Total industrial consumption
3 - Fuel industry consumption
4 - Metallurgy consumption
5 - Machine building industry consumption
6 - Agricultural consumption
7 - Light industry consumption
8 - Public consumption

Source: RAO UES (1998).

Energy consumption decline in the United Energy System of Russia is shown in the following table.

Table 3.1.2 Energy consumption decline

Energy System	1997/1990 %	1997/1996 %
The North West System	71,0	99,75
The Central System	71,0	98,7
The Northern Caucasus System	68,1	96,9
The Middle Volga System	70,2	98,0
The Ural System	70,2	99,3
The Siberian System	79,3	96,1
The East System	71,8	94,6

Source: RAO UES (1998).

Comparative indicators of the major industrial outputs in 1997 to 1990 and 1996 are given in the table below:

Table 3.1.3 Comparative industrial output

Categories	1990	1997	1997/1990, %	1997/1996, %
Electricity, TWh				
Total production	1076	834	77,5	98,5
Used output	885,4	641,4	72,4	98,05
Crude oil, Mtons	552	297	53,8	101,3
Natural Gas, Bcm	616	544	88,3	94,5
Coal, Mtons	410	244	59,5	95,2
Iron ore, Mtons	107	70,8	66,2	98,2
Steel, Mtons	89,6	46,0	51,3	93,4
Aluminium, thousand tons	-	2900	>90	102,5
Mineral fertilizers, Mtons	16,0	9,5	59,4	105,2
Plastics, thousand tons	3400	15,63	46,0	111,4
Wood exports, M m^3	303,8	78,7	25,9	85,9
Paper, thousand tons	5240	22,29	42,5	96,9
Construction bricks, billion	24,5	9,9	40,4	91,3
Cars, thousand	1200	985	82,1	113,5
Tractors, thousand	235	12,6	5,4	89,9
Railroad cargo transportation, billion t*km.	2600	1096	42,2	96,9

Source: GosKomStat (1998).

Consumption forecasts

Aforementioned allows to make a forecast for 1999-2000, assuming that energy consuming industries will develop following the trends of the last three years.

Table 3.1.4 Consumption forecast

Industry, consumers	1999, scenarios				2000	
	Maximum		Minimum			
	TWh	% to 1997[2]	TWh	% to 1997	TWh	% to 1997
Total economy	639,6	99,7	622,6	97,1	650,1	100,6
Industry	325,0	100	308,8	97,0	325,0	100
Transport/telecom	59,0	96,5	59,0	96,5	59,0	100
Construction	7,5	91,0	7,5	91,0	7,5	100
Agriculture	36,7	88,0	36,7	88,0	41,7	100
Non-industrial sector	108	103,5	108,0	103,5	111,2	106,7

[2] The economic crisis of 1998 followed by the respective changes in the structure of the domestic production in Russia, may, to some extent, alter the shares of industries in this forecast.

Public	103,4	102,2	103,4	102,2	105,7	104,6

Source: RAO UES (1998).

A forecast for 1999 assumes two scenarios:

- "Maximum", assuming stable industrial consumption on the 1997-1998 level with continuing trends of growth or decline in other sectors of the economy.
- "Minimum", assuming a price drop in exports (oil, aluminium and other), resulting from the global and Russian economic crisis, energy consumption will decrease 5% to the 1997-1998 levels.

The forecast for 2000 assumes industrial consumption on the 1997-1998 level and continuation of growth in the non-industrial sectors observed in 1995-1998.

Energy consumption may differ significantly by energy systems and regions. This is explained by the differences in the industrial structure and different influences that economic conditions may have on the consumption levels in various industries. This will define the used output of the total energy system.

Table 3.1.5 Consumption structure in energy systems

Industry, consumers	Share in total system consumption, %						
	North-West	Central	Northern Caucasus	Middle Volga	Urals	Siberia	East
Oil extraction industry	1,5	0,1	0,8	7,6	17,2	0,6	0,8
Oil processing industry	1,4	1,7	0,3	2,2	1,8	1,9	0,6
Natural gas industry	0,2	0,4	0,1	0,4	4,3	-	-
Coal industry	1,5	0,1	4,0	-	0,6	4,0	4,0
Ferrous metallurgy	3,9	12,8	1,0	0,1	12,9	5,2	1,2
Non-ferrous metallurgy	12,3	1,6	2,4	0,6	7,1	36,4	1,0
Machine building	7,3	9,2	3,6	13,6	6,5	3,2	3,1
Chemical industry	4,8	6,1	3,5	13,0	5,4	4,2	0,7
Pulp and paper industry	11,6	1,3	0,6	0,7	1,4	2,2	1,1
Transportation	7,6	11,0	7,6	12,8	9,4	7,3	12,6
Public	15,4	18,0	29,0	16,4	10,7	13,0	27,5
Other consumption*	32,5	37,7	47,1	32,6	22,7	22,0	47,4

Source: RAO UES (1998).

* Other consumption includes miror industries and consumption groups.

It's reasonable to assume, that prices changes in the oil market can influence electricity consumption mainly in the Urals and the Middle Volga energy systems, changes in the metals market will influence consumption in the Ural, the Siberian and the Central energy systems, and changes in the pulp and paper market will affect consumption in the North West energy system.

In some regional energy utilities ("the energos") the share of industry-specific consumption can be very large. This leads to a greater sensitivity of the "energos" to the performance of specific industries and markets. Thus, in the Belgorodenergo, the Kurskenergo and the Lipetskenergo the metallurgy sector consumes 60% of the total energy output, in the Tyumenenergo the oil extraction industry consumes 55% of the total output, in the Irkutskenergo and the Krasnoyarskenergo the aluminum industry consumes 50% etc.

An important factor for energy forecast is a share of exports in the total output of energy consuming industries.

In 1997, energy resources (oil, oil products, natural gas, coal, electricity) constituted 46,7% of the Russian exports, with metals amounting to 16,7% and machinery and equipment amounting to 8,9% of the total.
Estimated amount of energy, consumed for production and transportation of the exported merchandise, was about 170 TWh, i.e. 26% of the total used output. If inclusive of a 10% premium in the industrial tariff over average, and added with a retail margin, the value of this consumption was 33% of total the electricity market in 1997. In cash sales, export segment of the consumption had even a larger share.

Overall, this demonstrates a substantial dependance of the energy sector on the conditions of the world commodity market.

The outlook of the world commodity market in 1998 was pessimistic for the Russian exporters. By the end of 1998, the world prices for oil, natural gas, fertilizers, wood, copper and nickel have fallen significantly. Expected anti-dumping ban on the Russian steel exports to the USA, Canada and the EU, combined with the drop in steel demand in the Asian markets, also promise to negatively impact the exporting industries. This leads to the following conclusions:

- Actual market conditions in Russia and worldwide will not lead to a substantial consumption growth in the Russian industry in the 3-5 years to come. In the non-industrial sector, current growth trend is likely to continue.
- More than half of the energy consumption is attributable to the export-oriented industries – oil and gas, metallurgy, chemical, wood processing and pulp and paper industries.

The state authorities will be pressed to conduct an energy tariff policy aimed mainly to support export-oriented industry and preserve its competitiveness on the domestic and international markets.

Energy Production

Before 1988-1990, Russia was constantly increasing its energy resource production reaching the peak of 13% of the world total. In 1997, Russia still managed to produce approximately 10% of the world's total energy resource output even though it was much more difficult and costly than before, because of the impact of the economic transformation and substantial decrease in the overall industrial production.

Thus, with Russia's population amounting to 3% of the world total, the per capita production of energy was one of the highest in the world. On the other hand, energy consumption per capita in Russia was 1,5 times less, than in the industrialised countries. The reason for this was a high energy intensity of the industrial production, which consumed most the of energy. This trend is being reversed now as described above.

The energy sector of Russia has the following distinguishing characteristics:

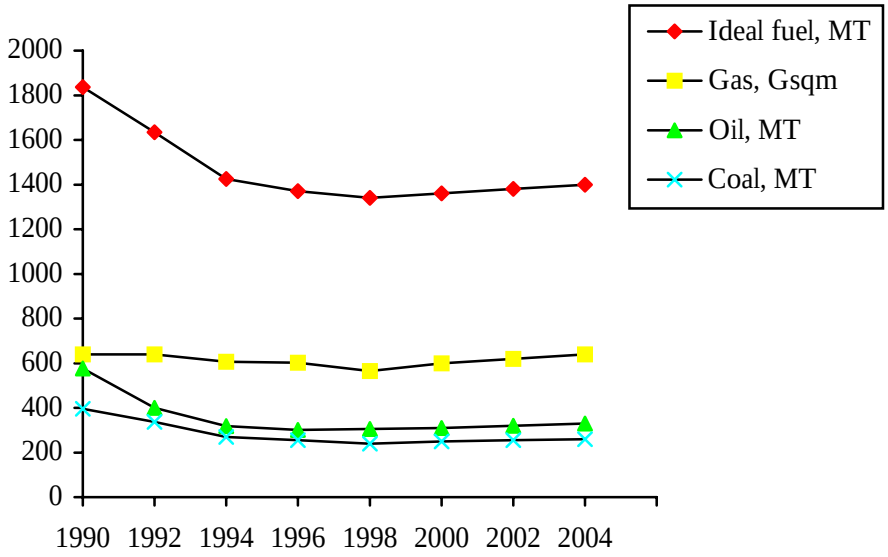
- harsh climate conditions in the most of the Russian territory,
- traditionally high share of energy exports,

- low domestic prices for energy,

- a heavy burden of outdated large industrial conglomerates that have very high energy intensity per unit of production.

The energy sector of Russia also plays an important role as a donor of indirect financing and resources for the other sectors of the Russian economy that works through barter exchange, delayed payments or consumers debt paper payments for energy purchases. Those practices motivate high energy consumption and energy intensity of production.

Graph 3.1.2 Energy Production Dynamics



Source: RAO EES (1998).

In 1997 Russia produced 1 364 Mtoe of energy; that corresponds to 10% of the total world production. That included

- **Exports** of 481 Mtoe.
- **Oil** production of 305,6 Mtoe, from which exports were 3,5%.
- **Gas** 571 Bcm (25% of world total production, exports - 35% of total production),
- **Solid Fuels** of 244,4 Mtoe (5% of world total production),
- **Electricity** production 834 TWh, total installed capacity of 215,2 GWe and full length of transmission lines (voltage 35kV and higher) of 3018 million km.

Total employment in 1997 in the energy sector was 2,9 million from which employed directly in production - 1,5 million or 13,8% of the total labour force. Share in the total production output was 28,5% and in total export - 46%.

The persistent shortage of investment has led to a substantial decrease in the production capacity. In the oil industry the total annual production has fallen more than 200 million tons. In coal mining more than 60 million ton capacity has been decomposed. In the electricity generation, the amount of annually decomposed equipment exceeds the amount of the new installations 5-7 times. Dire financial constraints of the energy companies have limited rehabilitation activities, repair and scheduled maintenance of the equipment as well as reduced investments in the ongoing and new construction.

The situation becomes even more dramatic if we take into consideration, that the quality of resources in the primary energy production is constantly deteriorating. This rises the costs of further production and increases the investment needs per unit of the new production. This fact has a special importance for oil and solid fuel based primary energy production. The lack of investment in the exploration of the new resources has not compensated annual decay of the resources.

For example, the best, high capacity deposits for gas production located in the West Siberia are already exploited at the full speed. Compensation of these deposits will require large investments in exploration, preparation for the production, infrastructure and transportation networks development.

The only energy resource in Russia that will not require investments for exploration and production is the nuclear fuel. Large deposits of uranium are already available in the stocks and will provide for the safe development of the nuclear power industry up to the year 2010. This is partly the outcome of the international disarmament treaties and dismantling of the nuclear missiles in Russia. According to the appropriate international treaties, these resources must be utilised for the civil purposes or scrapped. A heavy investment required for the incineration of the nuclear waste add motivation for the Russian Government to use these nuclear resources for the electricity generation purposes.

The other big strategic drawback of the Russian energy sector is its outdated equipment and machinery. The general state of the installed equipment in the energy sector remains very critical. Approximately 40% of the equipment is worn out completely. Over 50% of the coal mining equipment, 30% of gas pumping units, over 50% of equipment in the oil production, over 30% in the gas production are completely worn out. In oil refining this percentage is even higher and is estimated to be around 80%. It is also estimated, that till 2000 more than 50% of power plants in the electricity production will be worn out. Over 50% of the oil pipe lines have been in use for 20 to 30 years. More than 50% of the nuclear power plants demand urgent improvement in accordance with the modern safety requirements. Very high capital intensity of these investments makes the whole situation very difficult if possible to handle.

Energy Saving

A high potential for stabilisation of the Russian energy sector lies with the energy saving. The total energy saving potential of Russia is estimated to be between 460 and 540 Mtoe. It comprises savings of 150-180 Mtoe inside the energy sector, up to 100 Mtoe in the municipal sector, 30 Mtoe in the agriculture, 45-50 Mtoe in the transportation, 150-160 Mtoe in the industry.

A good example of the saving potential is the gas sector, where approximately 60 Bcm of gas is lost in the process of gas transportation. An average efficiency of the gas pumping unit in Russia is currently 23%, in comparison that of 33-36% in the industrialised countries. An increase in the efficiency of gas pumping can save up to 8-9 Bcm of gas annually. The use of combined cycle compressor units will increase the efficiency up to 47-52%. Implementation of all these improvements will, however, require heavy long term investments.

Table 3.1.6 Energy Saving Potential

Energy Consumers	Gas, Bcm	Oil products, million tons	Coal, coke million tons	Electr., TWh	Heat, million Gcal	Total, Mtoe
Energy Sector, incl.	45-60	15-17	33-39	38-46	160-180	150- 180
• oil production	5-10					6-12
• coal production				8-10		2,5-3,5
• transportation	8-9		7-8	30-36	150-170	52-59
• electricity and heat generation	32-42	10-12	26-31			80-97
• oil refining		4,5-5			9-10	8-9
Municipal sector	10	0,6-0,8	21-23	65-70	120-145	75-83
Agriculture	1,4-1,5	14-15	1,5-1,7	8-10	4	27-29
Transport		29-34				42-50
Industry, including	34-42	6-7	12-14	220-265	167-205	158-190
• industry infrastructure	10-13	0,5		150-185	75-100	73-92
• metallurgy	12-15	2	10-11	20-24	5-6	34-39
• machine building	-(3,4)	0,5		55-60		15-16
• construction materials	10-11,5	1,7-2	2-2,5	-(8,5-10)	40-45	20-23
• chemical products	5-6				12-15	9-10
• pulp and paper	0,3-0,7	1-2		4-5	35-40	8-10
Total:	100-110	65-75	70-80	330-390	450-540	460-540

Source: GosKomStat (1998).

In the oil industry main saving potential is in the following:

- a decrease of casing-head gas losses that will provide up to 2-4 Bcm of gas savings annually, oil in transportation and storage 8 up to 3,2 million tons annually,
- a reduction of energy losses in the oil heating,
- an increase of the oil pumping efficiency that will save about 3-4 TWh.
- investment in waste incineration and processing. There is more then 1 million ton of oil production waste that can not be processed because the industry has not invested in the appropriate technologies and equipment.

Oil refining in Russia consumes 40 % more energy than that in the industrialised countries. Energy-efficiency can be improved by 5 Mtoe a year (19% of total annual consumption).

In the electricity and heat production the main energy saving reserves are in the wider introduction of the combined heat and electricity production as well as in the increase of the share of electricity, produced in the combined cycle gas turbine units. The transfer of steam based on the combined cycle electricity production will save 30-35 Mtoe a year, including 14-18 Bcm of gas.

The actual trend to intensify energy consumption needs to be monitored closely as it is the major source of the net energy savings. If energy savings will fail to produce sufficient gains, this could mean a radically different scenario for the development of the energy sector.

3.2 Organisational Structure of the Energy Sector

The gas sector in Russia is the least decentralised: the Gasprom is the largest energy producer in the world and has a virtual monopoly over Russian gas market. The Gasprom produces more hydrocarbons than Saudi Aramco.

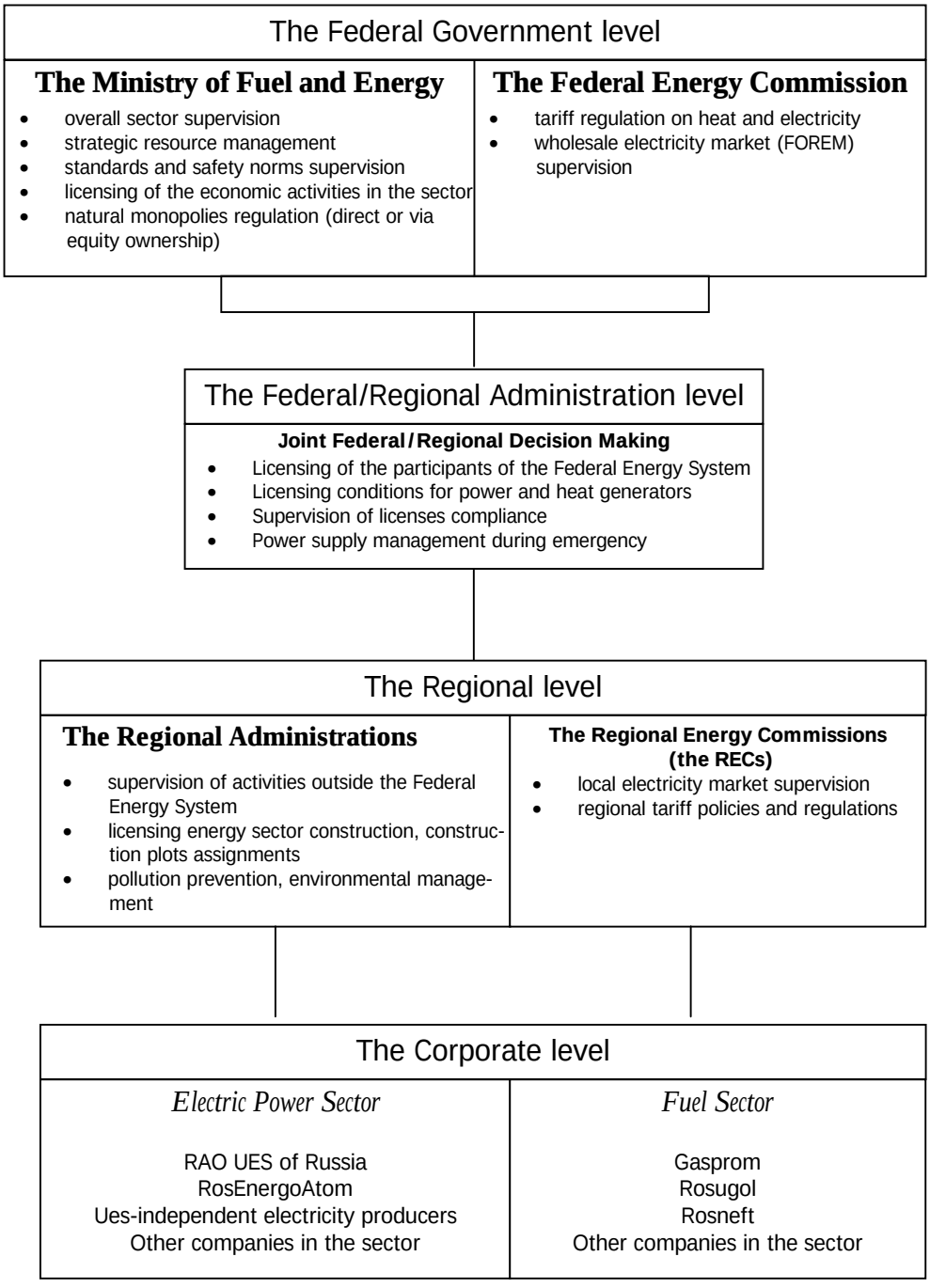
On the contrary to the gas sector, the oil sector is mainly privately owned. Private ownership was created through famous equity pledge auctions in the oil companies in 1995-1996. At that time, the Russian government decided to raise extra funding for the state budget expenses by pledging Russian oil companies equities and borrowing against them from the major Russian banks, including the Uneximbank, the Menatep Bank and the others. Now the control over the oil sector is in the hands of the largest Russian banking institutions. The recent financial crisis has laid a basis for a rearrangement of the oil sector ownership in the future.

The solid fuel production is managed effectively by the state company RosUgol. Private ownership and management of the mines has proved to be very ineffective, mostly due to the payment crisis and poor management skills. The famous political unrest and numerous strikes by the miners do not add to the reliability of the coal supplies.

The Unified Energy System of Russia (the RAO UES) has an effective monopoly over the domestic electricity transmission. Even though the Russian legislation allows independent private electricity production, very few activity has been seen in this area so far. Investment constraints are probably the most serious obstacle for the development of competition. Another limitation that hinders potential investments lies with the tariff policy.

Excessive political regulation of the electricity prices certainly does not facilitate the development. At the same time, a weak position of the anti-monopoly authorities makes freeing of the electricity tariffs a very dangerous issue as many regional electricity utilities (the “energos”) will try to use their almost monopoly positions to charge extraordinarily high prices. In other words, introduction of a free electricity market has to be supported by the institutional development and will probably be a gradual process, that will require a complete renovation of the energy sector governance and legislation.

The following chart outlines the energy sector governance in the Russian Federation:



4 THE ELECTRICITY SECTOR

4.1 Overview

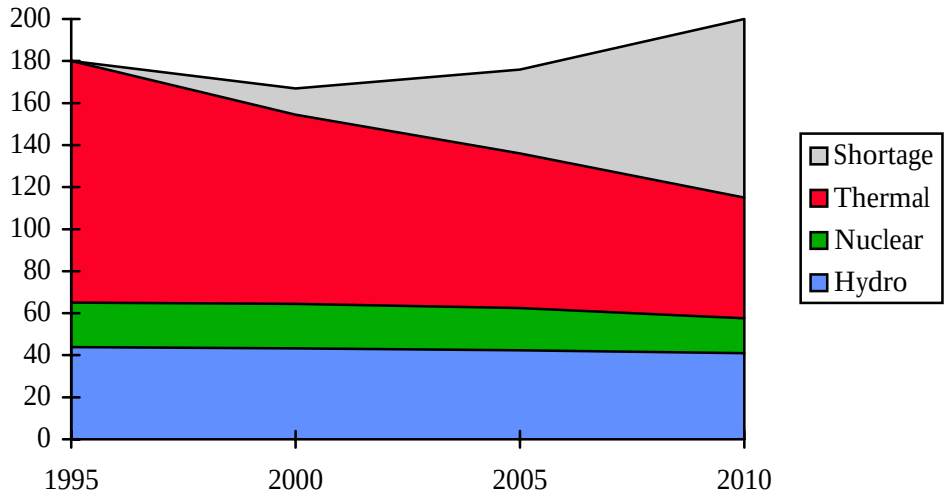
Table 4.1.1 The Electric Energy Installed Capacity and Production in 1997

Type of Power Plant	Installed Capacity		Electricity	Production
	Gwe	%	TWh	%
1. Thermal	150,2	69,8	557,7	66,9
2. Hydropower	43,8	20,3	168	20,1
3. Nuclear	21,2	9,9	108,3	13
Total	215,2	100	834	100

Source: MinTopEnergo (1998).

According to the statistics, in the course of the last seven years the total installed electricity generation capacity in Russia has increased by 3 GWe. However, the total real capacity was constantly decreasing because of the fast decay in the previously installed equipment. In case this trends will not revert in the nearest future, the delayed electricity supply crisis will occur. It is currently delayed by the permanent decrease in demand but any stabilisation on the demand side will inevitably lead to shortages. This development of this trend is easy to follow at the Graph 4.1.1.

Graph 4.1.1 Change in the Installed Electricity Generation Capacity, Gwe.

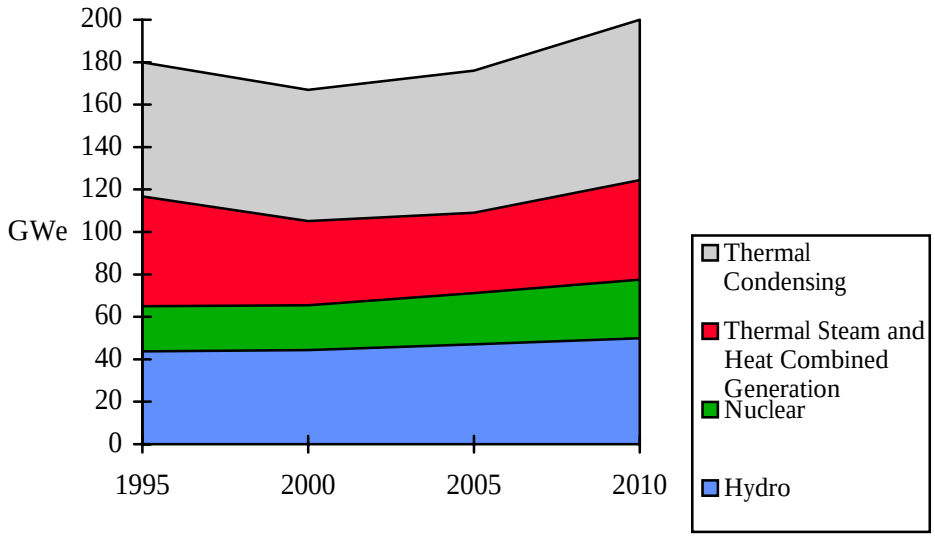


Source: RAO EES (1998)

Insufficiency of the installed generation capacity can be explained by two factors: deterioration of the installed equipment and stabilisation of the demand. To eliminate this problem, an intensive energy saving programme shall be implemented together with the investment for the rehabilitation of the installed capacities as well as for the completion of the on-going and new construction projects.

In 1994-1995, this problem was studied by a Russian-American commission, headed by the Russian Prime Minister Mr Viktor Chernomyrdin and the American Vice President Mr Albert Gore. The commission elaborated recommendations for a rational structure of the electric energy generation, which is presented on the Graph 4.1.2.

Graph 4.1.2 Rational Structure of the Electric Energy Generation



Source: The Report by the Chernomyrdin-Gore commission (1995).

The analysis, made by the Chernomyrdin-Gore commission, has lead to the following conclusions concerning the rational electric energy generation in Russia and its possible development:

- Combined heat and electricity will be more effective than separate heat generation in the boiler houses.
- Rehabilitation of the thermal power plants is more effective than new construction for the forecasted period.
- Construction of the new gas-fired combined cycle power plants is more effective than rehabilitation of the condensing thermal power plants.
- Gas-fired combined cycle power plants are more effective than nuclear and condensing thermal power plants.
- Nuclear power plants with reactors of the third generation are more effective for the European part of Russia and the Far East than condensing thermal power plants, in the Urals they are equally efficient and in Siberia condensing thermal power plants are more efficient.

These outcomes were used as a ground for drafting the energy policy of Russia. Unfortunately, due to political reasons, no common approach to the energy sector development has been accepted so far. This will certainly lead to a substantial delay in investments and cause distortions in the structure of the energy sector in the nearest future.

The electric energy is still beyond the reach of approximately 100 000 people living in remote areas. More than 30 million people live in houses heated by wood and coal. These facts illustrate the scale of the electricity and heat supply problems that are likely to arise in the nearest future.

In the years to come, electric energy export will not influence the overall structure of the electricity production. It is most probable, that exports will be limited by the on-going electricity trade with Finland, Mongolia and China and will have a moderate increase from the present 5,3 TWh to 10 TWh in 2010. It is assumed, that net exports to Ukraine, Belorussia and Kazakhstan will preserve their share in industrial energy consumption of those countries and will moderately increase in physical amounts from 14 TWh to 20 TWh in 2010.

Thermal Power Plants

The electricity generation technologies in Russia are traditionally dominated by the thermal power generation. Thermal power plants represent 67% of the total installed electricity generation capacity. This is further divided between thermoelectric power plants (36%) and condensing thermal power plants (31%).

The share of thermoelectric power plants in the total heat supply in Russia is 45-48%. The rest of the heat is provided by large boiler houses and by a small amount of renewable energy resources supplies.

Table 4.1.2 Heat Demand, million Gcal

	1990	1994	1997	2000	2005	2010
European Part of Russia	1554	1355	1300	1320	1350	1400
Siberia	412	355	340	345	360	365
Far East of Russia	110	90	80	85	90	95
Total heat demand	2076	1800	1720	1750	1800	1860

Source: GosKomStat (1997).

The majority of the thermal power plants in Russia are coal-fired steam -electric power plants. Formally, all the necessary equipment for this sector was designed and produced domestically. There are standard power generation units with 300 MWe, 500 MWe, 800 MWe and 1200 MWe capacity. The most commonly used one is the 300 MWe unit. An average capacity of a standard thermal power station is over 1000 MWe.

An urgent need to reduce environmental pollution and increase efficiency of the power generation creates an opportunity to replace the older technologies by the gas-fired combined cycle power generation. However, marginal electricity production cost in the coal-fired power plants is lower than in the gas-fired combined cycle plants. Given current economic constrain in Russia, it is likely, that in the nearest future the coal-fired power plants will stay in operation despite of the environmental considerations.

Recently, a national programme “The Environmentally Friendly Energy” has been adopted in Russia. The programme is meant to promote elaboration and introduction of new solid fuel combustion technologies in the industry. It is assumed , that lignite, “dirty” coals, waste tip coals, other wastes and even some biomasses could be combusted in the new clean coal systems such as atmospheric and fluidised pressure bed power and/or steam generation power plants. This programme is being financed from the state budget and is currently pursued at a slow pace, due to the scarcity of the available financing.

Another important target for urgent improvements are municipal heat distribution networks. Most of them are in a poor condition. Almost of 20% of heat is lost in transportation, which causes 25 Mtoe losses annually. Insufficient operation of the networks does not only constitute a sever economic burden on the municipal authorities, but also sets limitations to urban development and construction.

Nuclear Power Plants

In 1990, nuclear power generation accounted for about 12% of the total electricity production. Considering some additional investments underway and availability of the cheap uranium fuel, this share will remain quite stable in the long term to represent 14-15% of the total electricity production in 2020.

The installed capacity of the nuclear power plants in 1997 was 21,2 GWe or 9,85% of the total. The nuclear power plant electricity production in 1997 was 108,8 TWh , i.e. 13% of the total. At the moment, nuclear power tariffs are 30% lower than the industry average.

Table 4.1.3 Nuclear Power Plants in Russia

Nuclear Power Plant	Installed Capacity, Gwe	Reactor Type
Leningrad Power Plant	4	RBMK-1000
Kursk Power Plant (Kurchatovskaya)	4	RBMK-1000
Balakovo Power Plant	4	VVER-1000
Smolensk Power Plant	3	VVER-1000
Tver Power Plant (Kalininskaya)	2	VVER-1000
Novo-Voronezh Power Plant	1,834	VVER-1000
Kola Power Plant	1,76	VVER-1000
Belojarsk Power Plant	0,6	BN-600
Bilibino Power Plant	0,048	EGP-6

Source: MinTopEnergo (1997).

According to the "National Programme of the Nuclear Power Generation Development for 1998-2005 and for the Period until 2010", recently adopted by the government of the Russian Federation, the total installed capacity of the nuclear power plants will increase up to 27,6-29,2 GWe and annual electricity production will grow up to 170 TWh. At the first stage, it is planned to finalise construction of the second reactor of the Kalinin Power Plant and the fifth reactor of the Kursk Power Plants as well as to construct the first reactor of a new power plant in Rostov. After these reactors are put into operation, it is planned to start the construction of a new type of reactors (VVER-640, VVER-1000, BN-800). The construction of the following new nuclear power plants is scheduled to start after 2003:

- Novo-Voronezh-2 (two reactors á 1000 MWe),
- Leningrad-2 (one 640 MWe reactor),
- Kola-2 (three reactors á 640 MWe),
- Belojarsk (one 800 MWe reactor),
- Juzhno-Uralsk (three reactors á 640 MWe),
- Voronezh with combined electricity and heat production (electricity capacity of 140 MWe and heat generation capacity of 2500 MWe).

It has been decided, that until 2005 all the operating reactors built in 1971-1975 will continue electricity generation with the assumption that the on-going investments in their safety improvement and maintenance will be duly executed.

An analysis of the financing side of the aforementioned National Programme leaves no doubt that it is a product of a powerful industrial lobby and it will follow the path of the previous nuclear sector programme of 1992 to the full collapse. It is planned, that 50% of the funding will be provided from the state budget and 50% by the Rosenergoatom. However, given huge domestic and international debts of the Russian state, it is highly unlikely, that either of these sources will become practically available in the nearest future.

Hydropower Plants

The electricity generation potential of the hydropower and other renewable resources of Russia was presented in the appropriate section of Chapter 2 of the present paper.

Transmission Grid

At the moment, the electric energy transmission grid connecting 72 regional energy distribution and production companies/utilities in owned and managed by the RAO UES, i.e. the United Energy Systems of Russia. The regional utilities are organised in 7 regional systems. Six of them (the North West, the Central, the Middle Volga, the Urals, the Northern Caucasus, the Siberian) operate in parallel and the Far East Region Energy System operates fully independently. Inside the United Energy Systems 96% of electric energy is produced. The System incorporates 94% of the total installed capacity. Total length of the transmission lines is 3 018 million km. In 1997, the total installed generation capacity of all types of units in the grid was 197 GWe (total in Russia - 215,2 GWe) and annual production was 787 TWh (total in Russia - 834 TWh).

According to the RAO UES, transmission losses are approximately 10% of the total electricity production, which leaves room for optimisation and energy saving.

The transmission grid and the United Energy Systems power generation operation modes are managed by the Central Dispatcher Unit located in Moscow, by the United Dispatcher Units of the Regional Energy Systems and by the Central Dispatcher Units of the regional utilities.

Russian energy authorities believe, that unification of the Energy System on the basis of parallel operation has very important advantages such as:

- Reduction in required reserve capacity. This effect is achieved as a consequence of substantial day time difference in the regions switched into the grid. In other words, the peak load in the system is spread in time, which allows to manage the installed capacities more safely and effectively.
- Optimisation of the resource use for the different regions.
- A full benefit of the hydropower peak load stabilisation effect as well as of the peak water season energy production.
- Optimisation of the power plant operations to allow maintenance and service,
- Increasing security of supplies.

4.2 Sector Incorporation

After the end of Soviet era and consequent privatisation and economic changes, the energy sector retained much of its integrity. By now, the energy system is divided into the following structural parts:

The Unified Energy System of Russia (the RAO UES) is a nation-wide operator , which owns an inter-regional electric transmission grid and manages operation and development of the national energy system.

- 74 regional energy utilities, the "energos", generating and providing heat and electricity to the customers in all the regions of the Russian Federation. The RAO UES possesses control or significant share of equity in the majority of the regional energos.
- 34 large electric power plants, operating as independent actors in the electric power market.

Rosenergoatom

The State Enterprise "Rosenergoatom" is a commercial division of the Ministry for Nuclear Energy of the Russian Federation. It runs all the nuclear power plants of Russia, is responsible for the design of the new ones as well as rehabilitation and maintenance programmes.

Other Electricity Producers

A number of small power stations are owned by industrial enterprises and service mainly their production needs.

There is also a number of technical support units, specialising in construction and maintenance, majority of which is controlled by the RAO UES.

4.3 Regulations and legal framework

Regulation of the Sector

Besides the legislation covering all the major issues of the energy sector functioning, the sector is controlled and regulated by a hierarchy of state organs. The levels of the state control are shown below.

- *The Ministry for Fuel and Energy of the Russian Federation*. The ministry oversees all aspects of the national oil, gas and energy sector, supervises exports and transportation. It is also responsible for tariff policy, but in case of electricity wholesale market this function is delegated to the Federal Energy Commission.
- *Ministry for Atomic Energy of the Russian Federation (Minatom)* is a Federal Ministry responsible for the whole scope of activities related to nuclear energy, materials and weapons. The scope of its activity include development and production of nuclear reactors, construction and maintenance of nuclear power plants, nuclear fuel production, research, development and production of specialised electronics and machinery appliances related to nuclear energy and nuclear weapons etc.

- *The Federal Energy Commission (the FEC).* The FEC supervises functioning of the Federal Wholesale Electric Power Market (FOREM) as well as electricity tariffs on the federal level. Price regulation in the regional energy systems is delegated to the regional commissions.
- *The Regional Energy Commissions (RECs).* The RECs supervise electricity tariffs in the federal units of the Russian Federation.
- *Municipal Authorities.* Municipalities are responsible for overseeing certain issues of tariff policies on the municipal level in accordance with the decision by a respective Regional Energy Commission.

Legal and Legislative Framework

Energy sector as highly monopolised industry of strategic importance falls under strict state regulation. Since restructuring and privatisation of the energy industry in 1992, an extensive legislative base had been developed.

The legal base regulating the sector can be clearly divided into several parts, which cover different aspects of energy production and consumption:

- Management of the energy sector. Establishment of the RAO UES.
- Restructuring of the electric energy complex.
- Shareholdings in the energy companies.
- Consumer relations in the energy sector.
- Tariff regulation.
- Regulation of the Federal Wholesale Market of Electricity.
- Energy Saving.
- Regulation of natural monopolies.

The most significant regulation acts are the following:

The presidential decrees no 922, no 923 and no 1334 of 1992, have established a privatisation procedure for the electric energy sector. Due to the strategic importance of the industry and its organisational specifics, the electric energy sector can only be privatised via separate presidential decrees. The RAO UES was set up, with at least 49% of voting shares of every privatised energy company to be transferred to the RAO UES. The list of these companies was defined. Companies not included into this list can be privatised in accordance with the National Privatisation Programme. For at least 3 years since the RAO UES incorporation, no less than 50% of the RAO UES's voting shares have to remain in the state ownership. 30% of the state shares are to be distributed among regions of the Russian Federation, proportionally to the electricity consumption levels.

The presidential decrees no 472 and no 426 of 1995 and 1995, address the issues of energy sector policy, restructuring and reform. A new system of competitive wholesale market operations is to be implemented everywhere, where it is economically and technically feasible. During the first stage, a non-profit market operator with co-ordination and clearing functions has to be set up as well as independent competing power generators, none of which will possess monopoly in any of the energy zones. Initially, tariffs are to be regulated by the Federal Energy Commission, but further restructuring will establish electricity wholesale market with competitive bidding. The Federal Energy Commission supervises pricing and establishes price limits. Tariffs are to be based on all relevant production expenses and on fair rate of return on assets em-

ployed. Heat and electricity transportation charges are to be economically justified, as well as tariff differentiation by consumer categories. Cross-subsidising is to be eventually stopped.

In those decrees, the national strategic policy is also outlined, with highest priorities being maintaining reliable and sufficient resource base, increasing energy sector efficiency and protection of the environment. These and other objectives are to be achieved through an increase of gas utilisation in the energy sector, wider use of nuclear and hydropower, non-traditional and renewable energy sources, energy saving. State authorities intend to influence the sector through legislation and taxation reforms, measures to increase competitiveness in the sector, address support of significant investment projects and certain groups of consumers.
A sector restructuring program is set for 1997-2000, whereas energy sector policy is planned till 2010.

The federal law no 41-FZ of 1995, outlines the general framework of governmental tariff regulation. The law establishes primary objectives of the tariff regulation by the state, gives legal definitions to all major market participants and practices. It defines functions of the government of the Russian Federation, the regional administrations, the Federal Energy Commission and the Regional Energy Commissions in this respect.

Need for regulation change

At the moment, the energy sector experiences a number of problems, part of which are due to regulation imperfections. Such improvements as industry efficiency, competition, cost saving and accuracy of payment practices are closely linked to further structural changes in the energy sector, which, in their turn, depend on an adequate new regulation.

Regulation development must be targeted to provide legal backing to solve the following major problems:

- Payment debts in the sector
- Scarcity of investment resources for equipment renovation
- Misbalance in the tariff structure
- Overall inefficiency in the sector

The Presidential decree no 426 also identifies the measures, that would fill the legislative gap and ease reforms in the sector:

Measures required to facilitate improvements in the energy sector

Establishing efficient wholesale electricity market, which implies the following:

- Unified energy system only transmits the energy, as independent power generators sell energy to the end-users on the competitive basis.
- Energy consumers are no longer double charged for both installed capacities and energy consumption. A unified tariff is charged, depending on the day time and deficit or excess capacities of the power provider.
- Abolition of cross subsidizing, which has caused excess charges for institutional users to keep charges for private consumers low.

Improving pricing system and profit sharing:

- Shift from the current tariff structure (driven by costs-plus profit definition system) to tariffs that provide fair rate of return on assets
- Changes in the profit distribution regulations, increasing shareholders participation in the earned profits
- Abandonment of the current system of including capital expenditures into customer tariffs, introduction of investment mechanisms oriented to attract investor funding.

Improving accuracy of payment transactions in the energy sector:

- Improving cut-off regulations, effectively allowing energy providers to halt power supplies in case of payment debts
- Improving bankruptcy regulation, allowing energy providers to file for bankruptcy of their debtors.

Energy savings and accountability:

- Introduction of commercially feasible energy saving motivation schemes
- Introduction of exact and transparent accounting of energy consumption, which will lead to the transparency of the energy sector as a whole.

In addition to the major legislation, the regulation framework includes a number of regulating acts ranking from the federal laws and presidential decrees to the decisions by the government and special committees on various issues of the energy sector.

Electric Energy Sector Strategy by the RAO UES

The present management board of the RAO UES, headed by Mr Anatoly Chubais, has outlined the prospects of the industry and company restructuring at the annual shareholders meeting. The process of reforms is divided into three stages with projected timetable as follows:

the end of 1998

Introduction of a competitive power dispatching system without changing tariff regulations. Increase of control and metering of the power generation and consumption. Decrease of double charging for installed capacities and consumption.

the end of 2000

Improvement of tariff regulations to reflect actual production costs. Liberalisation of end-users' access to the wholesale market. Introduction of a pilot competitive market for electric energy and development of the respective technology.

2003

Creation of the wholesale market for electric power, based on competitive bids. Full customers' access to the wholesale market. Introduction of competition in the power generation.

In July 1998, the government of the Russian Federation issued a programme, defining the set of planned measures of structural and economic policy. Some of these measures address energy sector restructuring, such as:

- To improve accounting and reporting system for natural monopolies, including the RAO UES, and to improve transparency of receivable accounts
- To decrease the number of energy consumers not eligible for energy cut-offs in case of payment debts
- To impose limitations on accounts payable to the energy companies and to link these limitations to monthly sales, thus increasing liquidity in the energy sector
- To develop a federal law allowing direct access of end-users to the federal and regional electricity transmission grids with economically justified pricing

The above statements made by both state institutions and company management imply gradual actions leading to significant structural reform in the industry. However, this reform does not promise to be a matter of the nearest future.

Current energy production is excessive for the current consumption levels. Introduction of stricter payment supervision as well as energy saving measures will inevitably lead to further decline in demand for the electric power.

The forecasts for economic growth are also modest for the nearest future, promising no increase in energy consumption.

Current tariffs are high enough to finance maintenance of the existing assets, which are sufficient to service the demand.

Reasonable functioning of the system as it is now, provides no pressing challenges for improvements and restructuring. The unwillingness of the regulators to fully commit themselves to the free market and competition also does not facilitate promotion of liberal reforms in the energy sector. This leads to a conclusion, that significant structural reforms can be seriously considered only in the middle of the next decade.

4.4 Business and Financial Structure of the Energy Sector

Sector structure

After the end of the Soviet era and consequent privatisation and economic changes the energy sector has retained much of it integrity. By now, the energy system is divided into the following structural parts:

- The Unified Energy System of Russia (the RAO UES) is a nation-wide operator, which possesses the inter-regional electric transmission grids and manages operation and development of the national energy system.
- 72 regional energy utilities, the "energos", which generate and provide heat and electricity to customers in all regions of the Russian Federation. The RAO UES has control or significant share of equity in the majority of the regional energos.
- 3 regional energy utilities are independent from the RAO UES, namely the Tatenergo, the Irkutskenergo (no shares owned by the RAO UES) and the Bashkirenergo (the RAO UES owns 17% of votes).
- 34 large electric power stations, operating as independent units in the electric power market.
- A number of smaller power stations owned by industrial enterprises and serving mainly their production needs.

- A number of technical support units specialising in construction and maintenance, majority of which is controlled by the RAO UES.

THE RAO UES

Role

The company was established by a presidential decree in 1992 in the process of privatisation of the energy sector. The RAO UES owns inter and intra-regional high-voltage transmission lines with voltage over 330 kV. It also controls 24 specialised construction and maintenance companies and 61 research and development companies.

The RAO UES owns the Main Computer Centre and the Central Dispatch Unit (the CDU). The main task of the CDU is to dispatch power supply into the system by distributing capacity load between independent power stations and surplus regional energos. At the moment 12 energos are in surplus, whereas the rest is experiencing constant deficit of capacity.

The RAO UES also holds shares in 72 energos and 34 large federal-level power stations. The RAO UES implements a coordinated nation-wide policy in the electric energy sector by managing its subsidiaries or participating in boards of directors in the controlled or dependent companies.

Assets

As of 01.01.98, RAO UES's total assets were RUR 98.012 billions (here and elsewhere roubles after denomination), with RUR 90,5b equity and RUR 7.5b debt.

As of January 1998, the RAO UES assets had following structure:

Table 4.4.1 UES assets structure

Asset category	Share in total assets
Fixed assets, construction in progress	44.4%
Shareholdings (stakes over 25%)	40.2%
Accounts receivable	12.4%
Shareholdings (stakes below 25%)	1.2%
Other long-term financial investments	0.6%
Other assets	0.8%

Source: RAO UES (1998).

Shareholders and management

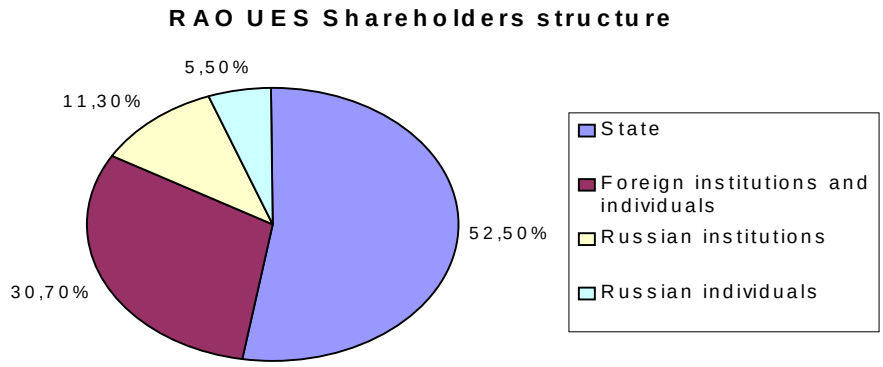
The RAO UES has 43,116 million of outstanding stocks, including 41,042 millions of common stocks and 2,075 millions of preferred stocks.

As of 01.01.98, the RAO UES had 375,862 individual and 1,591 institutional shareholders.

The Central Moscow Depository was the custodian for the RAO UES's stocks. In November 1997, the RAO UES launched the 1st level American Depository Receipts on its common stock.

Shareholders structure in the beginning of 1998 was as follows:

Graph 4.4.1 RAO UES Shareholders Structure



Source: RAO UES (1998).

30% of the state share was transferred to the Regional Administrations proportionally to the regional energy consumption levels.

The RAO UES's board of directors consists of 15 members, including the Chairman, who is elected annually by a general shareholders meeting. At the moment, the Chairman of the Board is Mr Viktor Kudriavy, the first deputy minister for fuel and energy.

Current management board includes: Anatoly Chubais the CEO and Oleg Britvin the 1st deputy, Alexander Kuzmin the 1st deputy, Julia Mozharenko the 1st deputy, Valentin Zavadnikov the 1st deputy, Andrei Rapoport the 1st deputy and Alexandr Remezov the 1st deputy.

Tariff and revenue structure

Despite the specifics of the RAO UES's product (managerial services and operation of the united energy system), the structure of its tariffs and revenues outlines the overall situation in the industry.

Structure of the RAO UES's tariffs in 1997 was as follows:

Table 4.4.2 The RAO UES's service tariff structure

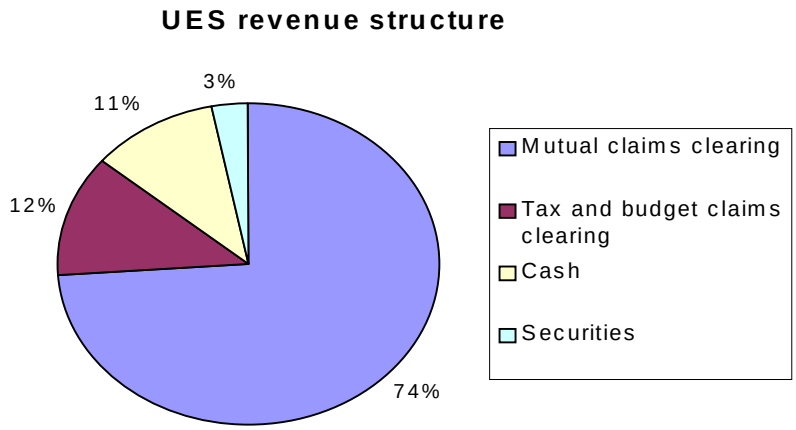
Category	Share in total tariff
Investment component	52.4%
Networks maintenance	8.6%
The CDU, other service and administrative costs	7.8%
Depreciation	8.3%
Research and development	1.5%
Taxes	15.8%
Other expenses	5.6%

Source: RAO UES (1997).

A large share of investment component in tariffs reveals one of the core problems of the industry. Instead of using market-driven investment mechanism, providing fair rate of return on capital and attracting investment funds from the financial market, the RAO UES incorporates investment programmes into its tariff structure.

Another problem of the industry is revealed in the revenue structure by payment category:

Graph 4.4.2 RAO UES Revenue Structure



Source: RAO UES (1998).

As shown above, cash settlements make a minor share in the RAO UES's revenues, which is typical of the energy sector as whole. A low cash share is accompanied with large arrears and mutual debts, making the energy sector an industry with relatively poor finances. This certainly poses limitations on the choice of supplies, as payments for equipment purchases and renovation are possible mostly in the barter form.

As estimated by the RAO UES, the structure of an average electric energy tariff in 1997 (in comparison to 1996) was as follows:

Table 4.4.3 An average electricity tariff structure

Category	Share in 1997	Share in 1996
Profit	12.0%	12.6%
Fuel	31.9%	32.5%
Depreciation	7.3%	8.4%
Wages	7.0%	6.9%
Other expenses	41.8%	39.6%

Source: RAO UES (1998).

It can be clearly seen, that no substantial change has occurred in years 1996-1997. This is an indicator of the low pace of industry restructuring. As competitive market will be introduced and tariff regulation will put fair return on capital as a primary pricing factor, the tariff structure is expected to change significantly.

The Independent energos not controlled by the RAO UES

The RAO UES does not have blocking majority shares in three regional energy utilities, the Irkutskenergo, the Bashkirenergo and the Tatenergo. The first two are described in more detail below, as both of them are major players in the Russian electricity market.

The Irkutskenergo

Located in a well developed Irkutsk region, the Irkutskenergo is a monopoly electricity provider in the region. It is also Russia's largest utility in terms of the installed capacity. The installed capacity of the Irkutskenergo accounts for 12,900 MWe. The Irkutskenergo owns 13 thermal power plants and 3 large hydropower plants, namely the power plants in Bratsk, Ust-Ilymsk and Irkutsk. The hydroelectric power produced by these plants makes 70% of the total Irkutskenergo's output. Hydro-based energy generation is cheap, which makes the Irkutskenergo a power provider with one of the lowest tariffs in the industry.

The company exports part of its surplus electricity to Mongolia and plans to participate in a construction of a transmission line to Mongolia and China.

Major shareholders of the Irkutskenergo include:

The Property Committee of the Irkutsk region	39.9%
The Bank of Bermuda (Cayman) Ltd	12.6%
The Crawford Holdings Ltd	9.0%

The Irkutskenergo itself owns shares in another companies, the most substantial of which are:

The BratskGESstroy Bank	30.0%
The Russian Petroleum	12.7%
The East-Siberian Group	12.7%

The Russian Petroleum is a strategic partner of the Irkutskenergo. It is planned to start conversion of thermal capacity to natural gas using the Russian Petroleum's natural gas extraction operations near Irkutsk to supply fuel for the Irkutskenergo's thermal power stations.

The Bashkirenergo

Located in Bashkortostan, an oil-extracting centre of Russia, Baskirenergo enjoys monopoly position in the regional electricity market. In production volume, the Bashkirenergo is Russia's second largest electricity generator in terms of production volume, with 60% of its output being consumed by petrochemical companies.

The Baskirenergo owns the largest thermal power plant in the region, the Karmanovskaya plant. The Baskirenergo is a surplus electricity producer, selling surplus on the wholesale market.

The Baskirenergo has an installed capacity of 5088 MW and is the 7th largest electricity producer in Russia.

The RAO UES owns less than a blocking share of the Bashkirenergo's equity, with major shareholders being:

The Property Fund of the Republic of Bashkortostan	32.1%
Institutional investors	30.0%
The RAO UES	20.5%
The employees	8.8%

The Bashkirenergo itself owns equity shares in the following companies:

The Bashenergobank	27.3%
The Stroma	17.0%
The Energy-LUKoil	8.0%

Corporate results in 1997

The following table summarises the 1997 results in the major regional energos. Profits, sales and growth rates vary significantly in the different energos, due to the aforementioned high dependence of the energy utilities on operational and financial stability of their major consumers.

Nevertheless, many top 15 companies showed solid growth in sales in 1997, substantially outperforming the inflation rate. The majority of the top selling energos were profitable.

Table 4.4.4 Regional Energos' Corporate Results[1]

Company	97 Sales, RUR million	Growth to 96, %	Profit after tax, RUR million	Assets, RUR million
Mosenergo	21847.1	33.5	2725.8	58252.0
Tiumenenergo	13281.3	N/A	1100.2	42585.5
Sverdlovenergo	9239.7	18.7	1094.5	18647.6
Tatenergo	7260.1	N/A	-94.4	17360.8
Bashkirenergo	7104.5	-0.7	461.6	19216.4
Cheliabenergo	6167.8	7.5	601.7	15172.7
Samaraenergo	6163.5	18.8	591.8	10178.0
Lenenergo	6044.6	8.7	290.4	15548.1
Permenergo	5899.8	4.3	481.6	13649.1
Kuzbassenergo	5892.9	3.8	418.2	14545.5
Krasnoyarskenergo	5304.7	28.2	539.4	19375.0
Irkutskenergo	4893.1	6.3	493.1	21874.6
Khabarovskenergo	4223.9	15.8	751.0	14883.9
Nizhnovenergo	4078.7	7.9	-11.7	7499.9
Dalenergo	3727.3	37.4	385.7	9091.2

[1] As of 01.01.98 official Central Bank USD exchange rate was 5.9600 RUR. The average USD exchange rate in 1997 was 5.76 RUR.

Source: Expert (1998).

Stock market for energy companies

Before the crisis of late 1998, energy stocks were very liquid assets in the Russian market. During 1997, the RAO UES's shares alone made 30% of turnover in the Russian Trading System (RTS), an electronic trading floor.

At the moment, as a consequence of the market meltdown, the liquidity is extremely low. As of 6.12.1998. the following energy stocks were listed in the RTS:

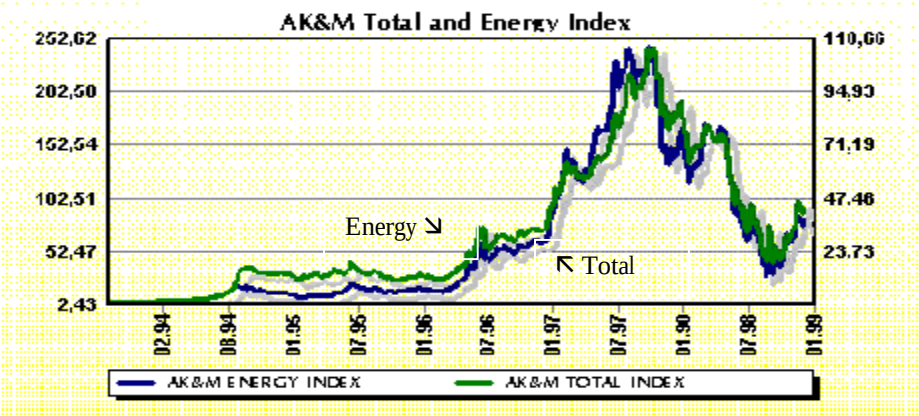
Table 4.4.5 The Energy Stocks Listed in the RTS

Company, shares	Ticker	Category
BASHKIRENRGO ordinary, preferred	BEGY, BEGYP	A
CHELYABENERGO ordinary, preferred	CHNG, CHNGP	A
RAO UES ordinary, preferred	EESR, EESRP	A
IRKUTSKENERGO ordinary	IRGZ	A
KOLENERGO ordinary, preferred	KOLE, KOLEP	A
KRASNOYARSKENERGO ordinary, preferred	KRNG, KRNGP	A
KRASNOYARSKAYA Hydropower Plant, ordinary	KRSG	A
KUBANENERGO ordinary	KUBE	A
KUZBASENERGO ordinary	KZBE	A
LENENERGO ordinary, preferred	LSNG, LSNGP	A
MOSENERGO ordinary	MSNG	A
NOVOSIBIRSKENERGO ordinary, preferred	NVNG, NVNGP	A
PERMENERGO ordinary, preferred	PMNG, PMNGP	A
ROSTOVENERGO ordinary, preferred	RTSE, RTSEP	A
SAMARENERGO ordinary, preferred	SAGO, SAGOP	A
SARATOVENERGO ordinary, preferred	SARE, SAREP	A
SVERDLOVENERGO ordinary, preferred	SVER, SVERP	A

Source: Russian Trading System (1998).

Another 27 companies have their stocks listed in a less liquid "B" category in the Russian Trading System.

Graph 4.4.3 Russian Total and Energy Stock Market Indexes



Source: AK&M (1998).

The energy stocks, as well as the Russian stock market as a whole, experienced rapid growth in 1997, which was ended by the Asian crisis of September 97. Since then, the energy stocks have followed the market's decline. Recent months, however, have showed a slight increase in the prices.

The market for energy stocks is characterised by the AK&M energy index, which is calculated over the leading energy companies[3].

It can be seen, that the energy index dynamics closely follows the index of the total market. This illustrates, that the energy sector is closely correlated with the overall economic performance. As it was mentioned before, the energy sector is a highly regulated industry, with main regulative emphasis being on tariffs, shareholdings and profit sharing. Therefore, long-term investors buying energy stocks were anticipating structural and regulation changes in the sector, which would have allowed them to participate in the energy sector profits. However, with political and economic unrest in Russia, such changes are unlikely to happen in nearest future. This, along with overall stock market collapse, has pushed prices down. The RAO UES stocks, once as high as USD 0.45, have now plunged to a modest USD 0.03 (as of 15.12.98).

Market capitalisation

As the stock market has now little liquidity even in former blue-chips, prices in the Russian Trading System bear less information. Daily turnover in the system has decreased sharply no only due to the market fall, but also due to higher trading risks. With settlement and supply taking over a week in the system, trading risk forces many traders to decrease their activities in the RTS.

Therefore, our survey of market capitalisation is based on the data from the AK&M list, the Russian stock information bulletin board.

As of 11.12.98, market capitalisation of the leading energy stocks was as follows[4]:

Table 4.4.6 Market capitalisation of the energy companies

Company	MCAP, million RUR	MCAP, million USD
The RAO UES	25610.054	1296.055
MOSENERGO	9907.200	501.377
IRKUTSKENERGO	4242.459	214.699
LENENERGO	2542.470	128.668
The Sayano-Shushenskaya Hydropower Plant	2080.485	105.288
KHABAROVSKENERGO	980.591	49.625
PERMENERGO	884.887	44.782
SAMARAENERGO	874.711	44.267
BASHKIRENERGO	647.680	32.777
KOLENERGO	412.445	20.873
The Votkinsk Hydropower Plant	393.401	19.909
ROSTOVENERGO	367.630	18.605
NOVOSIBIRSKENERGO	286.126	14.480
ULIANOVSKENERGO	280.207	14.181
AMURENERGO	264.559	13.389

[3] AK&M index is calculated over a set of companies, based on their MCAP change. Set for energy index and set for total index include leading companies with publicly quoted stocks

[4] MCAP calculated using USD=19.76 RUR (The Moscow interbank rate). MCAP is based on common stock quotes.

VORONEZHENERGO	177.550	8.985

Source: AK&M (1998).

5 CONCLUSIONS

Energy is a factor of production and as such is embedded in the economic structure of a society. The demand for energy is derived from social, economic and industrial activities of the society. The way it interacts with these activities is determined largely by a stock of the inherited capital. At the moment, Russia is undergoing a tremendous structural change that, in the end, will significantly alter its economic, social and institutional structures. The level, at which those structures will stabilise, will finally determine the amount of the inherited capital to be passed on to the new generations and, thus, to serve as a basis for the country's energy future. The outcome is still unclear and can not be reliably quantified. It may be stated only, that the inherited capital will represent only a fraction the one in the last years of the Soviet period, i.e. compared to the output figures of 1988-1990.

Primary energy output will recover only in the long term perspective. Due to the elasticity of energy demand with respect to economic output decline, primary energy consumption will not reach the level of 1990 before the year 2010. The use of fuels in Russia will be driven by the attractive economics of its gas reserves in favour of gas over coal and oil.

Russia is likely to maintain its oil export capacity, assuming that the local producers will manage to implement substantial cost cutting programmes and increase the productivity. This will require large amounts of investment and international participation. A recently debated production sharing law, once adopted, will certainly ease the tension but the global oil market price trends, that are expected to be low for a long period of time, will mainly determine the eagerness of international companies to invest in Russia. However, without urgent measures on the governmental level, foreign investments in the Russian oil sector will not be sufficient to cover its investment needs.

In the final energy demand, not only will electricity take a greater share, but distributed heat will also become more important as a source of energy. In primary energy, gas is expected to grow considerably, especially in the power generation market.

It is still an open and widely debated issue, whether the achieved level will in the long term be sustainable for the Russian economy, taking into consideration its growth perspectives. There is a number of uncertainty factors, that must be taken into account in this respect. They are energy efficiency and productivity increase gains, that may be achieved through a wise investment and public policy.

The energy intensity of an economy at a given time reflects the interaction of technology, social structures and relative prices. Not only are energy efficiency strategies usually inherently friendly to the environment and safe. These strategies also offer a potential to substantially slow down the energy demand growth in a way, that allows society to gain considerable flexibility in choosing how to cope with challenges, imposed by the environment and decrease of the production output. Theoretically, the potential for cost-effective energy savings is very large, as the present study has shown. But in practice, it has proved difficult to capture the full potential, owing to a wide range of well-known institutional obstacles.

Higher energy prices are often seen as a primary energy saving driving force. Unfortunately, there is no proof found in Russia, that increased energy prices will lead to a corresponding energy saving. On the contrary, increasing prices were reflected mostly in the increase of accounts receivable in energy utilities balance sheets and in the corresponding increases in proportion of energy payments settled by barter transactions.

It is important to mention, that the installed equipment in the Russian industry is already worn out and out-dated. The energy intensity, on the other hand, is influenced by the level and quality of the capital equipment in use. Thus, as the industry in order to compete in the open market will invest in new modern technologies, energy intensity gains will result. This is inevitable in Russia for the survival of the industry. Those who will not invest and develop, will be sooner or later driven out of the market and the energy intensity will still improve. Though obvious, the impact of the mentioned factors is very hard to calculate.

There are undoubtedly major advances to be made in productivity. These advances will occur through technological, managerial and communication changes, as well as through changes in the market structures.

New educational programmes for academic institutions in Russia already include basics of the market economy and modern management techniques, that will undoubtedly reflect in the results of the Russian companies as soon as the change of generations in management will gain the full speed. This change is already underway in many oil companies. The CEO of the Unified Energy Systems, Mr.Tchubais has set a goal to build-up a team of highly professional, well-educated young subordinates that will certainly add positive momentum to the development and restructuring of the company.

New organisational structures for gas and electricity utilities are to be developed. The distribution of gas and electricity must undoubtedly be separated from the production, generation and trading. The competitive wholesale markets must be established. Certain advances have already happened, but the major changes still wait to be made. There is a wide discussion going on in relation to these issues. It is not clear yet, what pattern of development will be chosen.

It is clear, however, that delays in decision making will influence long term competitiveness of the Gasprom and the Unified Energy Systems. The gas sector is the least decentralised: the Gasprom is the largest energy producer in the world and has a virtual monopoly over the Russian gas market. In the electric energy sector, the Unified Energy Systems of Russia remains by far the largest electricity producer and, being a transmission monopoly, does not allow the real competitiveness in the wholesale market. The oil sector, on the contrary, is the most decentralised and privatised: Russian oil companies develop rapidly to act like oil companies everywhere.

Possible technological advances in the future can also play an important role, especially in the final shaping of the fuel mix structure in Russia. It is clear, that advances in facilitating international investment and participation in the energy sector will make available the most advanced western technologies and, as a consequence, will allow to benefit from them in the longer term.

There is uncertainty as to the final shape of the fuel mix, where the impact of the new technologies and concerns about the environment will be decisive in the long term. The potential for the development of new technologies based on different fuels is extensive. The rate of development of the technologies will be influenced substantially by the investment ability of Russian government, major producers and consumers.

Due to increasing openness of Russia towards the world market, it is reasonable to assume, that in the medium term a sound part of existing and new construction will use western technological solutions and equipment as an alternative to the local products. On the other hand, lower costs of the local manufacturing will still allow Russian equipment to dominate the market in the short term. The products of joint ventures with the western companies will play a greater role in the Russian market as well.

Two fuel-based power-generation technologies, that stand out as important in achieving simultaneously local and global environmental benefits at competitive costs, are gas turbines and clean coal burning systems. They are top priority development issues for Russia nowadays. The Russian government via state budget funding will facilitate the development of the new local equipment and technologies, that will substitute some of the out-dated equipment. Notwithstanding these policy decisions, it is still assumed, that due to severe budget constraints, the decision making and funding initiative will gradually taken by regional governments and utilities.

The size of a new power generation plant can be, however expected to decrease as a result of advances in production techniques. This will enable plants to be constructed rapidly and hence only in responce to a demand. This, together with the urbanisation and environmental aspects, will decentralise electric power production. However, the need to ensure back-up supplies through a strong network will be of major importance.

The choices ultimately made will be a product of a complex working out of often conflicting and unmonitored forces. The energy/economy structures that will be passed on to the next generations will reflect the policies that are now devised to achieve the goals the Russian public policy makers are seeking. Unfortunately, slow introduction of the new energy sector legislation and regulation framework, lack of consensus in the society concerning many important energy future issues (nuclear energy development, various coal burning power generation alternatives etc.) will also be reflected in the shape of the energy sector in Russia.

It is clear, that stabilisation of the energy sector will be closely connected with the overall economic and political stabilisation. Energy sector will contribute to and be influenced by the macro-economic, industrial and political choices. The energy elements that will determine this influence are a sound resource base, energy export potential, continuing improvements in productivity and energy efficiency as well as a sufficient potential for further technological innovation.

A key conclusion of this analysis is, that a national energy policy is necessary to ensure that the energy investments and choices made today remain coherent and rational in the future. The growing recognition of the environmental impacts of energy use will add a new dimension to the energy policy, a dimension which is unfolding and has substantial importance to the way, in which the energy sector will develop.

The most important public policy challenge remains the facilitation of investments in rehabilitation and modernisation of the installed equipment, new construction and equipment manufacturing, development of the new technologies. The following financing patterns can be identified at the moment:

- financing of the investment costs by directly charging the consumers (investment part of the electric energy tariffs),
- equity financing through the stock market,

- strategic investor participation.

In the recent ten years, investments in the rehabilitation, equipment purchases and new construction were financed from the cash revenues of the energy companies. In the electric energy sector, this practice led to a substantial increase in the corporate tariffs and was immediately adjusted by the consumers in the form of late payments and barter trade that in fact represented hidden discounts. The outcome of this policy was a constant lack of cash resources and purchase of usually over-priced and not the best possible equipment and service. It is of vital importance for the energy companies to change this practice the soonest. Nevertheless, a start must be given by changes in the legislation allowing the full transparency of operation and equal treatment of the customers. Regional disagreements on these demands will lead to a great differentiation of the quality of energy services between the regions.

Equity financing through the stock market has gained some positive results before the financial market crisis of August 1998. Many energy companies have launched their successful ADRs and found out, that transparency of operation may reveal additional investment resources. One can only hope for the wise attitude of Russian government in treating the stock market and foreign investors, as in the longer term this source of financing remains the most viable and realistic for the most of the energy sector companies in Russia.

The continuing privatisation in the energy sector has shown a stable interest by strategic investors towards the Russian energy sector companies. Hopefully, privatisation decisions by the Russian government will favour long term strategic investors instead of the fast cash for the all-ready cash stripped Russian companies. Given the vast natural resource potential of Russia, this policy can give a good long term future for many energy companies.

It can be seen, that Russia is undergoing a process of transformation, the essence of which is through creative destruction of inappropriate structures to end up with an open competitive economy and energy sector. The success of this transformation is determined by many factors, some of which has been described in this paper. The progress is a gradual process and, although there are many drawbacks, we hope, that proper policy decisions will allow Russia to succeed as an important world-wide energy supplier.

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APPENDIXES

APPENDIX 1. List of Laws and regulating acts of electricity sector in Russia

Management of energy sector. Creation of RAO UES.

1. Presidential decree 922 (14.08.92) "Transformation of state owned enterprises of energy and fuel complex into public companies".
2. Presidential decree 923 (15.08.92) "Organisation of energy complex management during privatisation".
3. Presidential decree 1334 (5.11.92) "Implementation of presidential decree 922 in electric energy industry".
4. Presidential decree 222 (3.03.98) "Additional measures for management in electric energy complex in Russia".
5. Government statement 439 (22.04.97) "On measures to provide the management of the state share in RAO UES of Russia".
6. Government statement 6 (6.01.98) "Representatives of State in RAO UES of Russia".
7. Government statement 419 (6.01.98) "A Chairman of State Representatives in RAO UES of Russia".

Restructuring of electric energy complex.

1. Presidential decree 426 (28.04.97) "Principles of structural reform in natural monopolies".
2. Presidential decree 472 (7.05.95) "Main issues of energy policy and energy complex restructuring".
3. Government statement 987 (7.08.97) "A State Programme of measures on structural change, privatisation and improvement of controls of natural monopolies in Russia".
4. Government statement 700 (6.07.98) "An introduction of separate accountability of costs related to regulated activities in energy sector".

Shareholdings in energy companies.

1. Federal Corporations law.
2. Federal law "On special rules concerning state owned equity stakes in UES and other energy companies in state property".

Consumer relations in energy sector.

Electricity consumers relations.

1. Civil Code of Russian Federation
2. Presidential decree 1129 (1.08.96) "Additional measures for ensuring heat and energy supply to institutional and private customers in 1996-1997".

Energy supplies and services payments.

1. Government statement 5 (5.01.98) "On energy supply to budget financed institutions".
2. Government statement 295 (14.04.98) "On institutions budget arrears restructuring".

Energy cut-offs.

1. Administrative trespasses code
2. Government statement 74 (28.01.97) "On list of institutions of strategic significance not eligible to energy cut-offs".
3. Government statement 1 (5.01.98) "On cut-off policy in case of non-payment" (with amendments).
4. Federal law 77 (27.05.98) "On amendments to Criminal Code".

Tariffs regulation.

1. Federal law "On state regulation of tariffs for heat and electric power"
2. Presidential decree 889 (25.07.98) "Measures to enable electricity tariffs decrease"

Federal Wholesale Market of Electric Power regulation.

1. Government statement 793 (12.07.96) "On Federal wholesale electric power market".
2. Government statement 121 (4.02.97) "Principles of pricing and tariff regulation policy for electricity and heat".

Energy Saving.

1. Federal law on Energy saving
2. Government statement 1087 (2.11.95) "On urgent measures of energy savings".

Natural monopolies regulation.

1. Federal Natural Monopolies law.

Hydropower Plant Safety

1. Federal Law “On safety of Hydrotechnical Constructions”.

APPENDIX 2. RAO UES 1997 Financial Statements

BALANCE SHEET (RUR millions)	01.01.98
ASSETS	**98495**
Intangible assets	24
Fixed assets and construction in progress	43754
Long-tern financial investments	41354
Inventory	359
VAT paid	83
Accounts receivable	12237
Short-term financial investments	42
Cash	242
Advance profit use	400
LIABILITIES	**98495**
Charter capital	21558
Additional capital	56804
Reserve capital	39
Savings funds	610
Social funds	320
Purpose financing	5668
Purpose investment financing	1762
Retained earnings	4264
Long-term debt	-
Short-term debt	856
Accounts payable	6591
Future periods income	1
Consumption funds	5
Future expenses reserves	17

Source: RAO UES.

As of 01.01.1998 Official Central Bank USD exchange rate was 5.96 RUR.

Income statement (RUR millions)	1997
Net sales	**12099**
Costs of goods sold	5455
Sales profit	6644
Interest receivable	2
Interest payable	5
Shareholdings income	33
Other operating income	529
Other operating costs	773
Operating profit	**6430**
Other income	43
Other costs	47
Profit before tax	**6426**
Income tax	695
Deductions	153
Investment fund deductions	1762
Retained earnings	**3816**

Previous periods retained earnings	448
Total retained earnings	4264
Including profit unpaid in receivables	3275
Profit to distribution	989
Including used in advance for saving and consumption in 1997	400

Source: RAO UES.