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ENERGY^3: RAW MATERIALS, PRODUCTION, TECHNOLOGY

Competitive Analysis of Northwest Russian Energy Cluster

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ABSTRACT: Energy industries in Russia and in Northwest Russia in particular are of the utmost importance and occupy the largest shares in the total industrial production and exports. Northwest Russia is developing into the major export hub for the Russian energy exports. It means that the appropriate infrastructure and potential to establish processing facilities are created in this area. Energy industries play also an important role as essential suppliers for many local producers. As many Northwest Russian manufacturing industries are still very energy consuming, energy efficiency and energy cost will have a strong effect on their profitability. The so-called energy complex created in the Soviet period in Russia and in Northwest Russia was based on the command economy, not market principles. Therefore, the transition to the market economy led to profound changes in the industry structure and allocation. These changes need to be assessed in order to adjust the business and industrial policy-making to changing circumstances. Analysis of the Northwest Russian energy cluster consisting of oil, gas, coal and peat production and processing, power generation and power engineering industries as well as supporting industries and associated services (prospecting, maintenance and transport, etc.) was aimed to serve this purpose. The analysis was carried out basing on trade and industrial statistics, company data and interviews. As a result the growth prospects and competitive advantages and disadvantages of the energy cluster are identified and described.

KEY WORDS: Northwest Russia, energy, industrial complex, cluster, regional agglomerations, growth, competitive advantage, industrial policy.

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TIIVISTELMÄ: Energiaraaka-aineiden ja energian tuotanto ovat Venäjälle ja erityisesti Luoteis-Venäjälle erittäin tärkeitä. Tuotannon määrässä ja viennissä mitattuna energiaklusteri on tärkein teollinen klusteri. Luoteis-Venäjästä on muodostumassa Venäjän energiaviennin keskus. Tälle alueelle rakennetaan tarvittava kuljetusinfrastruktuuri ja mahdollisesti myös jalostuskapasiteettia. Energia on tärkeä tuotantopanos myös monille Luoteis-Venäjän energiaintensiivisille teollisuudenaloille, ja vaikuttaa oleellisesti niiden kannattavuuteen. Neuvostoliiton aikana Luoteis-Venäjälle luotiin ns. energiakompleksi, joka perustui suunnitelmatalouden periaatteisiin. Siirtyminen markkinatalouteen on johtanut ja johtaa perustavanlaatuisiin muutoksiin energiateollisuuden rakenteissa ja sijoittumisessakin. Näitä muutoksia on huolellisesti arvioitava ja mukautettava liiketoiminta ja elinkeinopolitiikka uusiin olosuhteisiin sopivaksi. Luoteis-Venäjän energiaklusteri koostuu öljyn, kaasun, hiilen ja turpeen tuotannosta, sähkön ja lämmön tuotannosta sekä energiateknisestä teollisuudesta ja niitä tukevista toiminnosta (öljyn ja kaasun etsintä, kunnossapitopalvelut ja kuljetukset). Näiden aloja ja niiden muodostaman klusterin kilpailukykytekijöiden analyysi ja tulevaisuuden kasvunäkymien ennakointi on tutkimuksen keskeistä sisältöä. Analyysi perustuu tilastolliseen tarkasteluun, yritysten antamaan aineiston sekä haastatteluihin.

AVAINSANAT: Luoteis-Venäjä, energia, teollinen kompleksi, klusteri, alueellinen agglomeraatio, kasvu, kilpailuetu, elinkeinopolitiikka.

Preface

Europe needs energy. Russia, on the other hand, lives on exports of energy and energy raw materials. Russia's unexploited reserves will generate huge business opportunities also in the future. The features of business activity in the energy sector are, however, more diverse than this. Europeans have learnt to conserve energy and use it efficiently. Energy is increasingly being produced from biofuel or generated by wind power. Technologies are highly advanced – Finland is a good example of this. With the help of our energy technologies, Russia could profit much more using a smaller amount of raw materials.

On the other hand, Russia has its own expertise in the field of energy, concentrated on the other side of the Finnish border in St. Petersburg. Lenin defined socialism as the electrification of the whole country. Therefore, huge amounts of money were devoted to power production and technological development, and the most important decisions were made in the Central Committee of the Communist Party. Universities and research centers, however, were where the knowledge was created and the technology developed.

One of the biggest questions involving Russia's energy sector is whether its R&D and production of technology will survive in conditions of market economy. Foreign companies could be of great help in this respect, and incentives to do so abound. These companies would get an opportunity to utilize the country's research institutes, the production capacity of Russian manufacturers and their customer relations with energy producers in Russia and developing countries.

The role of Northwest Russia in the world's energy business is growing. Russian shipments of crude oil and oil products via the Baltic Sea are increasing manifold. The prospect of building a gas pipeline under the Baltic Sea to Europe appears to be growing. Indeed, greater shipment activity of energy products poses a risk to the environment. It is high time to start developing common ground rules and environment-friendly technologies together with Russia.

This book deals with the Northwest Russian energy cluster. We hope that the fresh approach of our Russian researchers and the substantial data material will offer new ideas to decision-makers in Russia and in Western countries.

Helsinki, February 2003

Pentti Vartia

Authors' Preface

This study is done in the framework of larger research project devoted to the analysis of current and prospective competitiveness of industries of Northwest Russia. This project aims to assess important issues and development trends for the newly emerged clusters of economic activities in this region. The project implies the separate analysis of the five industries most important to the economy of this region: forest, energy, metallurgy and metalworking, ICT and food, and preparation of a concluding study devoted to laws of development and future prospects of the Northwest Russian economy. The research was carried out by a consortium of participants, including: *The Center for Strategic Research* (www.csr.ru), a leading Russian think tank that prepared a current action plan and strategy for the Russian Government; *ETLA* (www.etla.fi) – the Research Institute for the Finnish Economy, a leading Finnish economic research institute; and *Solid Invest* (www.solidinvest.com), a St. Petersburg research-based consulting company. We are happy to express our appreciation of valuable help, understanding and support provided by these organizations in our research.

The informational and analytical base collected in the course of the research could be very important for the decision-makers at different corporate and governmental levels both in Russia and the neighbouring areas, and Finland primarily.

The methods and analysis approaches, used in this study, are quite new to Russia and worth to be used wider in the framework of governmental industrial policy and corporate strategies development.

This particular publication deals with the largest and most successful cluster of the Northwest Russian economy – the energy cluster. It is important to follow the tendencies of its development because this cluster for many reasons is able to become one of the effective vehicles for economic growth in the region. Development of new oil and gas fields, expansion of export infrastructure and increasing demand for power engineering products and related knowledge generate a plenty of opportunities for Russian and foreign investors to capitalize on it as deeper market reforms are implemented.

We would like herewith to express our gratitude to the pool of Finnish companies and institutions ABB Oyj, Fortum Oyj, Finergy, Gasum Oy, Kvaerner Pulping, National Emergency Supply Agency, Vantaan Energia, Wärtsilä Oyj that ordered and supported this study and the Steering Group members *Mr Kari Salminen* (Gasum Oy), *Mr Pertti Petänen*, *Mr Kari*

Kuukkanen and *Mr Jari Ekholm (*Kvaerner Pulping), *Mr Markku Rekola* († 12.12.2002) and *Mr Mika Purhonen* and (National Emergency Supply Agency), *Mr Jouko Helenius* (Vantaan Energia), *Mr Harry Lindroos* (Wärtsilä Oyj), *Mr Antero Hietaluoma* (ABB Oyj) and *Mr Jaakko Tusa* (Fortum Oyj). We would also like to thank other experts involved in the project *Mr Harry Viheriävaara* and *Anna-Maria Lyytinen (*Finergy). Many thanks also to Russian companies that provided their valuable input and took part in discussions, interviews and case studies in the project.

The authors are very thankful to the industry experts, who provided their valuable inputs in all the stages and parts of the research: *Mr Hannu Hernesniemi*, *Mr Sergey Boltramovich* and *Mr Anton Savchenko*. We would like to thank also *Mr Andrey Averin* and *Mr Vasily Murashov* (for support in data mining and processing), *Ms Anna Ignatieva* and *Ms Melina Laakso* (for assistance in seminar arrangement, which took place in the framework of research process), *Ms Veronika Voinovian* (for general assistance), *Ms Mary Catherine Gannon*, *Mr Astamur Panov* and *Ms Daria Kozeichuk* (for text translation and language proof reading).

We hope that the results of our research will be interested to the wide range of readers and will be of high value for the purpose of facilitating the further growth of the cluster.

Helsinki, November, 2002

Pavel Filippov, Grigory Dudarev and Alexey Osipov

Note: We ask the reader to note that in almost all figures a comma is used to denote a decimal, in accordance with Russian practices.

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Summary

The present paper is devoted to the analysis of the Northwest Russian energy industries in the new conditions of the transition to the market economy. Northwest Russia is one of the seven federal regions of Russia. It borders with Baltic States, Finland and Norway. Nearly 15 million inhabitants live in this area. Administrative center of this federal region is the City of St. Petersburg. Northwest Russia is rich in oil, gas and coal. A very substantial part of the current production is exported. Electric power and heat are produced at the large and concentrated carbon fuelled power plants. In addition to this, hydro- and nuclear power are of great importance as sources of electric energy. Part of the electric power is exported to Finland and to the Northern European electricity market. The City of St. Petersburg is undoubtedly the center of the Russian energy technology manufacturing.

The energy cluster plays a leading role in the economy of Northwest Russia, equal to that of metallurgy and metalworking. In the period of transition the energy companies developed into the major source of budget revenues for federal and regional governments in Russia (about 40% of the total). The energy industries (oil and gas) performed substantially better than many others in the period of sharp decline in domestic demand during the initial phase of transition. This was a result of their ability to shift relatively easily to exports, as their products were competitive on the world market. Today more than 50% of the total exports in Russia are represented by the energy. Today these are the most export-oriented industries in Russia. There are also energy industries in Northwest Russia that were not successful in the period of transition. These are the coal, peat and shale oil production.

The period of transition brought also other changes that have a profound effect on the future of the energy industries and an overall economic development in the country. The pricing principles have changed from centralized and set by state bodies to the ones based on true costs of companies. Changes in the tariff policy, mergers and acquisitions, the restructuring of natural monopolies, the creation of market for maintenance and services, and other processes that are now underway will significantly influence the energy industries in the future. The energy industries in Russia are still preserving many remains of the Soviet system. They are largely state controlled, monopolized and regulated. All this has an adverse effect on the overall economics and competitiveness of the

Russian economy. The urgent necessity for changes is well understood on the highest levels of decision-making in Russia. To reform energy industries and make them internationally competitive is among the major challenges that the Russian Government is facing today. The ideas related to reforming the energy industries to the new conditions, to opening the markets for competition are among the most widely discussed matters at present. There is no consensus reached on these matters so far. There are many who support market reforms and many who oppose. The outcome of these debates is difficult to forecast.

The described changes will not only be associated with forthcoming reforms, - the directions and dynamics of development of the cluster are being determined by fundamental factors and conditions that are already in place today. Such factors that underlie economic growth could be assessed using M. Porter "diamond" model of the national competitiveness in a systematic way. These model is targeted to study 1) competition, industry structure and business strategies, 2) demand characteristics such as market size, growth and how demanding in terms of specific product characteristics the customers are as well as other demand related matters and condition of the user-producer relations, 3) extent of the cluster company networks, state of development of different areas of activity and dynamics of networking, and also 4) inherited assets such as raw material resources, locations, industrial assets and created factors, importance of which is growing today, i.e. availability of educated workforce, R&D, financing and transport and information and communication infrastructure. Government decisions or their absence could be also observed through the prism of the above factors. These factors and conditions will determine both the current competitive positions and the future potential of the companies. This model was used to assess the competitiveness and development prospects of the regional energy cluster of Northwest Russia. This framework was adjusted and fine-tuned basing on the recent developments in the strategic management, regional planning and new economic geography theories to fit into the analysis of the regional cluster.

We believe that the cluster approach is, owing to the two main reasons, a good tool to assess industrial change in the Russia and its regions: 1) The planning, allocation and investments in the Russian industries were made on basis of the regional scientific-industrial complex thinking. It incorporated many ideas similar to the ones included in the proposed cluster approach such as importance of proximity and agglomeration effects as well as education and R&D were an essential part of the complexes, its knowledge basis. 2) Although the model is not especially targeted or equipped to assess the transition economy, it still allows to gen-

erate a vision of the possible development outcomes, i.e. it demonstrates how the future competitive cluster shall look like and represents an extensive list of determinants that could influence its competitiveness. This method allows evaluating the possible development of the cluster in a systematic and broad way. In other words, not only the primary industries, in case of the energy cluster, oil and gas production and processing, electric energy and coal, etc. are assessed but also their interdependence as well as the influence of the related and supporting industries, associated services and government actions on the competitiveness are analyzed.

At present, the energy industries are among the most important sectors of the regional economy. Moreover, the importance of the cluster and its regional differentiation are expected to increase in the future, due to the exploration of new oil and gas deposits, the growth of the volume of production of power engineering, the possible creation of new oil refineries and increase in the transit flows aiming at exports through the newly created infrastructure in Northwest Russia (ports on the Baltics in Primorsk, Vysotsk, Ust-Luga, etc and on the Barents Sea in Varandei Bay, etc.. There is a good basis for such development as the energy industries in Northwest Russia traditionally played a very important role in Russia. In the early Soviet period the GOELRO plan of the electrification started in Northwest Russia and was the first economic development program that a new Soviet state committed to develop after the revolution.

As we see the energy cluster of Russia has had a long evolution. Its development started from transition to steam-driven engines and use of electricity as well as from extraction of oil from the oil fields near Baku. The most significant oil and gas fields, power plants as well as other facilities and infrastructure were created during the Soviet period. The cluster developed in this period as an isolated, domestic market oriented system within the command economy. Its international connections and integration into the global trading and manufacturing networks were practically non-existent. Energy has had an important mission in the Soviet system. The enormous natural treasures of the country made it possible to develop the industry, they were used to provide nearly free electricity and heat for the population.

After the Second World War development of the energy companies and technologies was among the most important national priorities. Northwest Russia was chosen as the location for the equipment manufacturing and R&D for the energy sector in that period. As a result, the energy technology oriented regional scientific-industrial complex was created here in the late Soviet period.

Today, most of the products in the cluster are exported, and this trend will clearly persist in the future. The oil companies are already the most advanced in Russia. These companies are run as the similar companies in the developed world. The degree of integration of the cluster into the global network will grow, and so will its dependence on processes unfolding on a global level. It is anticipated that the structure of the foreign trade will change. There will be more processed energy exported in future. There are also the first signs of internationalization by the oil companies that are looking at investments abroad. We believe that this trend will substantially develop in the near future.

Russia has a substantial positive trade balance with OECD countries in terms of energy products. In particular, oil, oil products, and gas form the basis of Russian exports and are the country's primary source of hard currency (Chapter 4). These goods – in Northwest Russia, primarily oil and oil products, as reserves of gas in deposits under exploitation in the region are relatively small – are in high demand on the world market, which serves as the most important prerequisite for the potential successful development of the cluster in the future. The export of electric energy is still small, but it also has potential for significant growth. At the same time, Russian imports of energy products are insignificant.

Another important feature of the energy cluster in Northwest Russia is its regional concentration that determines the further development of the certain activities in already developed locations. The authors of the study have singled out four large agglomerations of the cluster (Chapter 5): Pechora (oil, gas); Vorkuta (coal), St. Petersburg (electric energy, oil processing, power engineering), and Kola (electric energy). The Timano-Pechora (oil and gas) and the St. Petersburg (power engineering) agglomerations, which carry the greatest weight on the domestic and foreign markets, will largely determine the further development of the cluster.

Today, the primary sectors of the energy cluster of Northwest Russia include oil extracting, oil refining, gas, coal, and shale industries, electric energy. These sectors are undergoing restructuring and adaptation to new economic conditions. The degree of restructuring of various sectors of the cluster differs, however, and there are sharp discrepancies in their competitive potential.

Research has shown (Chapter 6) that the single obvious competitive advantage of the energy cluster in Northwest Russia now is its wealth of raw materials, in particular, oil and gas deposits that were already explored during the Soviet period. In the last ten years, however, investment in the development of raw material resources, as well as in other

factors of production (manufacturing facilities, infrastructures, human capital), has been insufficient. This has undermined much of the former potential in these areas. Oil production and oil refining, the most successful branches of the cluster, were exceptions to this pattern.

During the crisis in the Russian economy, which resulted in a sharp reduction in domestic demand, foreign markets played a vital role in sustaining the energy cluster. In recent years, starting from the 1998 when the domestic currency sharply devaluated, the domestic market has grown steadily. It has a long way to go, however, before it recovers the volumes it achieved during the Soviet period. Changes in the structure of demand have given rise to differentiation within the cluster. Industries with high export potential (the oil and gas sector) are distinguished by relatively high prosperity, whereas the oil and shale industries, and power engineering, to a certain degree, are today experiencing serious difficulties.

On the corporate level, the major problem in the cluster remains the low level of competition. The markets of the basic industries of the cluster are monopolistic or oligopolistic. The prices remain regulates by the state on the costs plus amortization basis (except oil). Anticipated liberation of prices for such energy sources as gas and electric energy will be a major catalyst for further changes in the industry structure and will change its structure. Increase of the domestic prices to the levels of export prices will motivate energy saving and increasing of the efficiency. Also the energy producers will concentrate on more efficient solutions that will be seen in improving the profitability on the contrary to the current situation. As a result in the medium to long term there could be development of the dispersed energy production (for example combined power and heat production in smaller settlements), increase in usage of biofuels (first of all wood and wood waste based).

The most important part of the Northwest Russian energy cluster is the energy technology production and related education and R&D. These activities are concentrated in St. Petersburg where the turbines, generators, electric engines, gas pipeline compressor units are designed and manufactured. All types of the power plants are also designed in this city. During the ten years investment break these activities have suffered much more than the energy production itself. For example, hiring of the new personnel, i.e. training of the future professionals, ceased nearly completely during this period. Problems of the power engineering will make also upgrading of the energy production activities more difficult. This is an area where focused industrial policy could achieve a lot in closing the gap between the current utilization of the potential and actual anticipated demand. For example liberalization of the electricity markets

will result in substantial increase of investment. There is a sharp deficit of entrepreneurs and entrepreneurship in some areas of activity. There also completely new markets such as a potentially very large market for industrial services and financial services taking shape at the moment. The monopoly companies of the socialist period carried out these activities themselves and financing was obtained always from the state purse.

Involvement of the Russian federal and regional governments in development of the energy industries is urgently needed in new, indirect way. Excessive government regulation of the cluster has hindered the pace of its reforms, in contrast to other branches of industry. Industrial policy is still inconsistent and devoid of clearly formulated goals. The direct, short term measures are most often preferred instead of more sustainable indirect influence through building the infrastructure, improving education and research as well as creating a favorable investment and business climate. Among other significant problems are the low level of transparency of business, the significant burden of social welfare (as an example the obligations to employ local personnel in great numbers and maintain the local social welfare facilities), and very high levels of environmental pollution.

Each of the major industries of the cluster possesses both positive features, capable of stimulating its development in the future, and bottlenecks (Chapter 7). It is demonstrated that the existing factor conditions, i.e. inherited assets and infrastructure, human capital, R&D and educational system create a good background for the further development. Nevertheless achieving growth will require substantial investments and changes in the production allocation for many areas of activity. Improving competitiveness of the Northwest Russian oil and gas industries will require to reduce by the order of magnitude the costs of the pipeline transportation. It is envisaged that new, breakthrough solutions and approaches will be needed. As an example introduction of the ice-breaking supertankers to deliver oil and liquefied gas from the Barents Sea directly could be one of such innovative answers to this challenge.

In order to ensure its successful development, the cluster must grapple with a series of problems directly related to improving the investment climate. Among the key problems are the excessive regulation, the slow transition to the new international standards, bureaucracy, complicated and often contradictory legislation and slow restructuring. There is also an urgent need for the more consistent policy and clear commitment to market reforms. A great interest in the development of the energy industries expressed by the governments on the federal and regional levels leaves a hope that the underlined changed will follow soon.

We believe that the greatest prospects for the development of the cluster are connected with the growth of the domestic market, the growth of competition as a result of reforms, and the increasing importance of Northwest Russia in both exporting and processing of energy raw materials. Growing importance belongs also to the growing exports of the raw and processed energy. The importance of Northwest Russia in European and global energy supplies will increase. As a consequence the investments in oil and gas prospecting and involving of the new fields in the industrial use and development of the related infrastructure will grow as well.

Yhteenveto

Tutkimuksessa analysoidaan Luoteis-Venäjän energiasektoria kehittyvän markkinatalouden uusissa olosuhteissa. Luoteis-Venäjä on yksi Venäjän seitsemästä suurpiiristä. Se rajoittuu Baltian maihin, Suomeen ja Norjaan. Alueella asuu 15 miljoonaa ihmistä ja sen hallinnollinen pääkaupunki on Pietari. Luoteis-Venäjällä on rikkaat öljy, kaasu ja hiilivarat, ja merkittävä osa sen tuotannosta suuntautuu vientiin. Sähköä ja lämpöä tuotetaan isoissa keskitetyissä voimalaitoksissa. Lisäksi vesi- ja ydinvoimalla on tärkeä rooli. Osa sähköntuotannosta viedään Suomeen ja sitä kautta pohjoismaisille sähkömarkkinoille. Venäjän energiateknisen teollisuuden ehdoton keskus on Pietari.

Energiaklusteri on Luoteis-Venäjän johtava klusteri yhdessä metalliklusterin kanssa. Siitä on kehittynyt tärkeä myös valtiontalouden kannalta. Venäjän valtio ja eri alueet saavat energiasektorilta suurimmat tulonsa – keskimäärin arviolta noin 40 prosenttia kokonaisbudjetista. Öljyn- ja kaasuntuotanto selvisivät olennaisesti paremmin kuin muut sektorit Neuvostoliiton luhistumista seuranneena siirtymäkautena, jolloin kotimainen kysyntä romahti. Kotimaan markkinat voitiin helposti korvata viennillä. Nykyään yli 50 prosenttia Venäjän vientituloista tulee energiaraaka-aineiden ja energian viennistä. Energiantuotanto onkin Venäjän vientiin suuntautunein teollisuudenala. Energiantuotannon sisällä on kuitenkin myös huonosti menestyneitä aloja kuten esimerkiksi hiilen, turpeen ja öljyliuskeen tuotanto.

Siirtymäkausi – muuntuminen sosialistisesta yhteiskunnasta markkinataloudeksi – toi tulleessaan muutoksia, joilla on perustavanlaatuinen vaikutus energiasektoriin ja talouden kehitykseen yleensäkin. Hinnoittelu on muuttunut ylhäältä määrätyistä hinnoista kustannusperusteiseksi sääntelyksi. On tapahtunut yhtiöiden sulautumisia ja yritysostoja. Monopoliasemassa olevien energiayhtiöiden rakennetta on muokattu uuteen uskoon. Käyttö- ja kunnossapitopalveluille on syntynyt markkinat. Muutokset jatkuvat ja vaikuttavat pitkälle tulevaisuuteen. Muutoksista huolimatta Venäjän energiasektorissa on vielä melkoisesti Neuvostoajalta periytyneitä piirteitä kuten laaja valtion kontrolli ja sääntelyjärjestelmä sekä monopolit. Näillä on kielteinen vaikutus Venäjän taloudelliseen kehitykseen ja yritysten kilpailukykyyn. Venäjän korkein valtiojohto on ymmärtänyt, että nopeat muutokset ovat välttämättömiä. Energiasektorin uudistaminen ja saattaminen kansainvälisesti kilpailukykyiseksi on Venäjän hallituksen yksi tärkeimmistä haasteista. Parhaillaan käydään vilkasta keskus-

telua, kuinka energiasektori muutettaisiin vastaamaan uusia olosuhteita. Tärkeimpinä kysymyksinä ovat markkinoiden avaaminen uusille yrityksille ja kilpailun lisääminen. Toistaiseksi uudistusten sisällöstä ei ole päästy yhteisymmärrykseen. Kaavailuilla muutoksilla on myös vastustajansa. On vaikea ennustaa mikä on uudistuksista käytävän keskustelun lopputulos.

Energiasektorin muutos ei tietystikään ole kokonaan riippuvainen tulevista uudistuksista, vaikkakin niillä on erittäin tärkeä merkitys. Kehitykseen vaikuttavia tekijöitä voidaan systemaattisesti tarkastella M. Porterin klustereiden tarkasteluun kehittämällä kilpailukyvyn timanttimallilla. Mallissa tutkitaan 1) kilpailuolosuhteita, toimialojen rakennetta ja yrityksen strategioita, 2) kysyntäolosuhteita kuten kysynnän suuruutta, kasvua, asiakkaiden vaativuutta ja muita kysynnän piirteitä sekä tuottajien ja asiakkaiden suhteiden laatua, 3) klusterin yritysverkostojen kattavuutta, eri toimialojen kehittyneisyyttä ja yritysten välisten suhteiden dynamiikkaa sekä 4) perittyjä tuotannontekijöitä kuten raaka-aineita, sijaintia teollista tuotantokoneistoa ja yhä tärkeämmäksi nousevia itse luotuja tuotannontekijöitä kuten koulutettua työvoimaa, tutkimusta, pääoman saantia ja tietoliikenteen ja kuljetusten infrastruktuuria. Näiden kautta myös valtion toimet ja niiden puute vaikuttavat. Nämä tekijät määräävät nykyisen kilpailukyvyn ja ennakoivat sen tulevaa kehitystä. Käytimme tätä mallia arvioidessamme Luoteis-Venäjän alueellisen energiaklusterin kilpailukykyä ja sen tulevaa kehitystä. Lisäksi otimme huomioon yrityksen strategian, alueellisen suunnittelun ja talousmaantieteen uusia tutkimustuloksia ja sovelsimme niitä alueellisen klusterin tutkimukseen.

Arviomme on, että klusterilähestymistapa on kahdesta syystä hyvä työkalu kun tutkitaan Venäjän ja sen eri alueiden teollisuuden kehitystä. Ensinnäkin, Venäjän teollisuuden suunnittelu, sijaintipäätökset ja investoinnit tehtiin käyttäen alueellisen tieteellis-teollisen kompleksin käsitettä. Siinä oli monia samanlaisia piirteitä kuin klusteriajattelussa, esimeriksi toimintojen läheisyyttä ja agglomeraatioetuja korostettiin ja koulutus, tutkimus ja tuotekehitys olivat oleellinen osa kompleksia, sen tieteellinen puoli. Toiseksi, vaikka mallia ei ole tarkoitettu siirtymäkauden yhteiskunnan prosessien analysoimiseen, se antaa kuitenkin vision kehityksen lopputuloksesta eli siitä, millainen kilpailukyisen klusterin tulisi olla. Lisäksi se antaa kattavan kehikon klusterin kilpailukykyyn mahdollisesti vaikuttavista tekijöitä. Tämän metodin avulla on näin mahdollista systemaattisesti ja laajasti arvioida energiaklusterin kehitystä. Ei siis tutkita pelkästään öljyn, kaasun ja hiilen tuotantoa tai sähkön ja lämmön tuotantoa tai energiateknistä teollisuutta vaan myös niiden keskinäistä vuorovaikutusta ja lisäksi teollisten lähi- ja tukialojen ja erilaisten palvelujen vaikutusta ja julkisen vallan panosta.

Nykyisin energiaklusterin toimialat ovat Luoteis-Venäjän teollisuuden tärkeimpiä toimialoja – alueen talouden selkäranka. Niiden merkityksen odotetaan tulevaisuudessa vielä kasvavan, kun uusia öljy- ja kaasuesiintymiä aletaan hyödyntää, energiatekninen teollisuus elpyy, mahdollisesti rakennetaan uusia öljynjalostamoita ja energiaraaka-aineiden kauttakulkuvienti lisääntyy. Vientimahdollisuuksia lisää oleellisesti uusien satamien valmistuminen Itämerelle ja Barentsin merelle. Itämerellä laajennetaan Primorskin eli Koiviston satamaa ja Vysotskin eli Uuraan sataman yhteyteen rakennetaan öljysatama, Batareynajan lahdelle öljytuotteiden satama ja Ust-Lugaan bulkkirahtisatama. Barentsin merelle on tulossa satama Varandein lahdelle. Luoteis-Venäjä on ollut edelläkävijä Venäjällä. Neuvostoaikana maan suunnaton sähköistyssuunnitelma, GOELRO esimerkiksi toteutettiin ensimmäisenä Luoteis-Venäjällä. Nyt Luoteis-Venäjästä näyttää kehittyvän yksi maailman energiahuollon, -kuljetusten, -jalostuksen ja -kaupankäynnin keskuksista.

Venäjän energiaklusteri on pitkän evoluution tulos. Sen kehitys alkoi höyryn ja sähkön käyttöönotosta ja Bakun öljykentiltä. Merkittävimmät öljy- ja kaasukentät avattiin, voimalaitokset rakennettiin sekä siirto- ja jakeluverkot vedettiin Neuvostoliiton aikana. Tuolloin klusterin kehitys oli kuitenkin eristäytynyttä, suuntautui kotimarkkinoihin ja oli tiukasti osa komentotaloutta. Sen kansainväliset yhteydet ja integroituminen globaaleihin markkinoihin olivat olemattomat. Energialla oli järjestelmässä tärkeä tehtävä. Maan uumenien rikkauksilla mahdollistettiin teollisuuden kasvu, rahoitettiin sosialistisen yhteiskunnan kuluttajille lähes ilmainen sähkö ja lämpö. Vientituloilla pönkitettiin valtion kassaa.

Toisen maailmansodan jälkeen energiayhtiöt ja energiateknisen teollisuuden kehittäminen oli Neuvostoliiton kehittämisen prioriteettialoja. Luoteis-Venäjä valittiin energiateknologian valmistuksen ja T&K:n keskukseksi. Seurauksena oli, että Luoteis-Venäjälle kehittyi alueellinen voimakas tieteellis-teollinen energiateknologiaan erikoistunut kompleksi?

Nykyisin suuri osa energiaklusterin tuotannosta viedään, ja tämä on myös tulevaisuuden suuntaus. Venäläiset öljy-yhtiöt ovat maan yhtiöistä edistyneimpiä. Niitä johdetaan kuin kehittyneitä länsimaisia yhtiöitä. Klusterin integroituminen globaaleihin yritysverkkoihin kasvaa ja samoin kuin sen riippuvuus kansainvälisistä yrityksistä. Arvioimme myös, että viennin rakenne muuttuu. Tulevaisuudessa viedään energiaraaka-aineista pidemmälle jalostettuja tuotteita. Tässä prosessissa tarvitaan myös ulkomaisia suoria sijoituksia Venäjälle. Ensimmäiset merkit venäläisten öljyyhtiöiden kansainvälistymisestä ovat myös nähtävissä. Tämä kehityskulku vahvistuu tulevaisuudessa.

Venäjällä on merkittävä kauppataseylijäämä energiaklusterin tuotteissa. Tutkimuksessa tarkasteltiin Venäjän ulkomaankauppaa OECD-maiden kanssa. Öljy, öljytuotteet ja kaasu muodostavat Venäjän viennin kivijalan. Niistä saatavat tulot ovat myös Venäjän valuuttatulojen pääasiallinen lähde. Luoteis-Venäjä saa tulonsa öljy- ja öljytuotteiden viennistä. Parhaillaan hyödynnettävät kaasuesiintymät ovat suhteellisen pienet, mikä rajoittaa kaasun vientiä. Sen sijaan Venäjän merkittävimmät vielä hyödyntämättömät kaasuvarannot ovat Luoteis-Venäjällä. Öljyllä, öljytuotteilla ja kaasulla on voimakas kansainvälinen kysyntä, joka on yksi klusterin kehityksen perusta myös tulevaisuudessa. Sähkön vienti on vielä suhteellisen vähäistä, mutta sen kasvupotentiaali on suuri. Venäjän energian tuonti, ymmärrettävistä syistä, on lähes olematonta.

Tärkeä energiaklusterin piirre Luoteis-Venäjällä on sen alueellinen keskittyneisyys. Kirjan luvussa 5 on määritelty neljä alueellista keskittymää – agglomeraatiota. Timan-Pechorassa on öljyä ja kaasua, Vorkutassa tuotetaan hiiltä ja Kuolassa sähköä. Pietari on energiateknologian keskus ja ympäristöineen vahva myös sähköntuotannossa ja öljynjalostuksessa. Timan-Petchoran öljyn ja kaasun tuotanto ja Pietarin energiateknologia ovat näistä keskittymistä tärkeimmät niin viennissä kuin toimituksissa kotimaahan. Ne vaikuttavat eniten klusterin kehitykseen myös tulevaisuudessa.

Luoteis-Venäjän energiaklusterin päätoimialat ovat öljyn tuotanto ja jalostus, kaasun tuotanto, hiilen ja öljyliuskeen kaivu ja sähkön tuotanto. Nämä toimialat ovat uudelleen strukturoinnin alaisina vastatakseen paremmin kehittyvän markkinatalouden tarpeita. Kilpailukyvyn kannalta ne eroavat toisistaan voimakkaasti.

Tutkimus osoitti, että Luoteis-Venäjän energiaklusterin selvin yksittäinen kilpailuetu on rikkaat raaka-ainevarat, erityisesti kaasu- ja öljyvarat, joiden voimakas hyödyntäminen aloitettiin Neuvostoliiton aikana. Viimeisen kymmenen vuoden aikana investoinnit uusien lähteiden kehittämiseen ja tuotantovälineisiin sekä henkilöstön osaamisen ovat olleet riittämättömät. Tämä on huomattavasti rajoittanut tulevia kehitysmahdollisuuksia. Öljyn tuotannossa ja jalostuksessa, jotka ovat myös kannattavimmat energiaklusterin toimialat, tilanne on huomattavasti parempi kuin muilla toimialoilla.

Venäjän talouskriisin aikana kotimainen energian kysyntä laski jyrkästi. Vientimarkkinoilla oli tuolloin ratkaiseva merkitys tuotannolle. Viime vuosina, vuoden 1998 devalvaatiosta lähtien, kotimainen kysyntä on kasvanut tasaisesti. Kysynnän rakenteen muutos on aiheuttanut isoja eroja kannattavuuteen. Vientiin suuntautuneet toimialat, öljyn ja kaasun tuotanto, ovat kannattaneet hyvin. Sen sijaan öljyliuskeen ja hiilen, joita käy-

tetään pääasiassa kotimarkkinoilla, tuotanto on ollut huonosti kannattavaa tai peräti kannattamatonta. Energiatekniikan valmistajat ja suunnittelutoimistot ovat olleet suurissa vaikeuksissa, koska investoinnit kotimaassa ovat olleet jäissä.

Yritystasolla pääasiallinen ongelma on ollut kilpailun puute. Tärkeimpien toimialojen markkinat ovat monopolien ja muutamien toimijoiden, oligopolien käsissä. Valtio säännöstelee yhä energian myyntihintoja lukuun ottamatta öljyn hintoja. Sallitut vähittäismyyntihinnat kattavat kulut ja arvioidun pääomakannan kulumisen. Odotettu kaasun ja sähkön hintojen vapauttaminen antaisi merkittävän kehityssysäyksen teollisuudelle ja muuttaisi sen rakennetta. Hintojen nousu lähemmäksi vientihintoja toisi tullessaan energiansäästön ja tehokkaamman käytön. Vastaavasti energiantuottajat pyrkisivät kustannustehokkaampiin ratkaisuihin, kun tehokkuus näkyisi myös kannattavuuden parantumisena toisin kuin nyt. Seurauksena voisivat keskipitkällä ja pitkällä tähtäimellä olla myös hajautetun energiantuotannon lisääntyminen (esimerkiksi yhdistetyn sähkön ja lämmön tuotanto pienimmissä asutuskeskuksissa) ja energiantuotanto biopolttoaineista eli lähinnä puusta sekä jätteistä.

Luoteis-Venäjän energiaklusterin merkittävä osa on energiateknologian valmistus ja siihen liittyvä koulutus, tutkimus ja tuotekehitys. Nämä ovat keskittyneet Pietariin, jossa tuotetaan esimerkiksi, turbiineja, generaattoreita, sähkömoottoreita, kaasuputkilinjojen kompressoriasemia ja kaapeleita sekä suunnitellaan kaikkia voimalaitostyyppejä. Kymmenen vuoden lähes totaalisen investointitauon aikana nämä alat ovat kärsineet huomattavasti enemmän kuin energiantuotanto konsanaan. Esimerkiksi työhönotto – tulevien osaajien rekrytointi – lakkasi kymmeneksi vuodeksi lähes kokonaan. Energiateknisen teollisuuden ongelmat vaikeuttavat energiantuotannon uudistamista, kun se väistämättä tulee ajankohtaiseksi. Energiateknisen teollisuuden ja sen T&K:n edistämisessä fokusoidulla teollisuus- ja energiapolitiikalla voitaisiin saada aikaiseksi merkittäviä tuloksia. Esimerkiksi sähköverkon vapauttaminen kaikille avoimeksi markkinapaikaksi ja hinnoittelun vapauttaminen lisäisivät investointeja merkittävästi. Eräillä toimialoilla on selvä puute yrittäjistä ja aloitteellisuudesta. Erilaisille palveluille – kuten esimerkiksi voimaloiden ja energiaverkkojen käyttö- ja kunnossapidolle ja rahoituspalveluille – ovat syntyneet kokonaan uudet markkinat. Sosialismin aikaan monopoliyritykset hoitivat nämä toiminnot itse ja rahat investointeihin tulivat valtion kassasta.

Venäjän valtion ja alueiden johdon sitoutumista energiaklusterin kehittämiseen tarvitaan nyt kipeästi. Toimenpiteiden pitää olla kuitenkin epäsuoria, kohdistua kilpailun lisäämiseen ja toimintaedellytysten kehittämiseen. Valtion liiallinen sääntely on johtanut uudistusten hitauteen verrattuna teollisuuden muihin toimialoihin. Tällä hetkellä energiasektoriin

kohdistuva elinkeinopolitiikka on epäjohdonmukaista eikä sillä ole selkeitä tavoitteita. Valtio puuttuu suoraan energiahuoltoon ja ohjaa sen toimintaa. Usein turvaudutaan lyhytvaikutteisiin kriisitoimenpiteisiin, joilla korjataan seurauksia eikä ongelmien syitä. Suositeltavampia olisivat epäsuorat toimenpiteet kuten infrastruktuuri-investoinnit, energiamarkkinoiden pelisääntöjen kehittäminen, koulutuksen ja tutkimuksen edistäminen ja toimenpiteet investointiedellytysten parantamiseksi. Myös liiketoiminnan läpinäkyvyyttä pitäisi parantaa, yritysten yhteiskunnallisia velvoitteita (esimerkiksi työllistämisvelvoite ja erilaisten kunnallisten palvelujen järjestämisvelvoitteet) pitäisi vähentää ja saastuttaminen olisi saatava kuriin.

Energiaklusterin jokaisella tärkeällä toimialalla on sekä positiivisia tekijöitä, jotka voivat stimuloida tulevaa kehitystä, että kehityksen pullonkauloja (luku 7). Osoitamme, että tuotannontekijäolot eli peritty yritysvarallisuus ja infrastruktuuri sekä inhimillinen pääoma, T&K ja koulutusjärjestelmä luovat hyvän perusta tulevalle kehitykselle. Kuitenkin kasvun saaminen aikaiseksi edellyttää olennaisia investointeja ja muutoksia tuotannossa ja sen sijoittumisessa monilla aloilla. Esimerkiksi Luoteis-Venäjän öljy- ja kaasuteollisuuden pitää pienentää putkikuljetusten kustannuksia oleellisesti. On ennustettavissa, että perusteellisesti uusia ratkaisuja – läpimurtoja – ja lähestymistapoja syntyy. Esimerkki tällaisesta läpimurtoratkaisusta olisivat uudet, jäätä särkevät supertankkilaivat, jotka kuljettaisivat öljyä ja nesteytettyä kaasua suoraan Barentsinmereltä asiakkaille.

Energiaklusterin menestyksellinen kehitys voidaan turvata ratkaisemalla sarja vakavia ongelmia, jotka nyt huonontavat investointien edellytyksiä. Tärkeimpiä ongelmia ovat liiallinen sääntely, uusien kansainvälisten standardien hidas käyttöönotto, byrokraattisuus, monimutkainen ja useissa tapauksissa ristiriitainen lainsäädäntö ja energiasektorin hidas uudelleenorganisointi. Tarvitaan myös johdonmukaista, yhtenäistä elinkeino- ja energiapolitiikkaa sekä vahvaa sitoutumista energiamarkkinoiden uudistamiseen. Venäjän valtion ja alueiden johdon osoittama suuri kiinnostus energiaklusterin kehittämiseen antaa toiveita siitä, että tässä korostetut muutokset ja uudistukset toteutuvat.

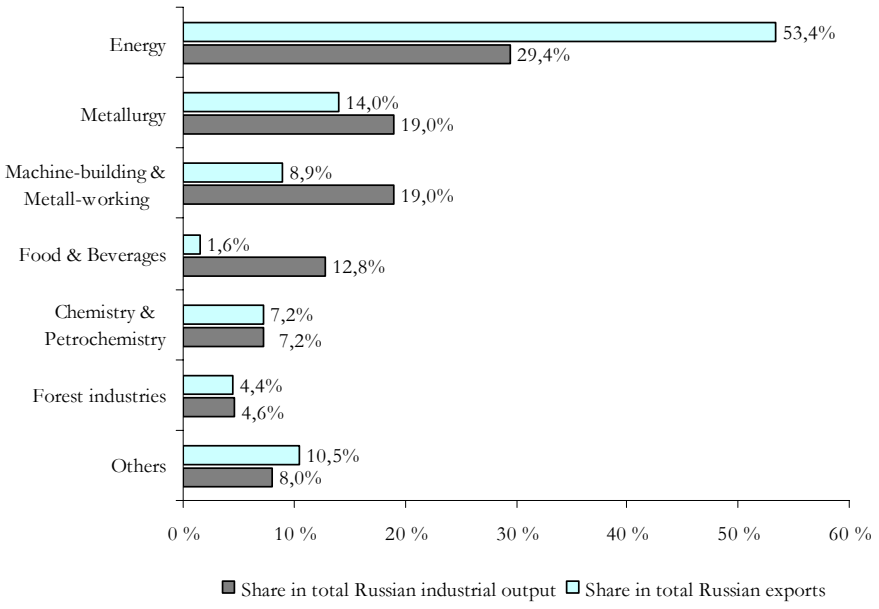
Arviomme mukaan Luoteis-Venäjän energiaklusterin lupaavimmat tulevaisuudennäkymät ovat kotimaisen kysynnän kasvussa ja energiasektorin uudistuksen lisäämässä kilpailussa. Ne lisäävät energiatuotannon ja energiateknologian kilpailukykyä. Kasvava merkitys on myös energiaraaka-aineiden ja jatkojalosteiden viennillä. Luoteis-Venäjän asema Euroopan ja maailmankin raaka-ainehuollossa kasvaa. Samalla investoinnit öljyn ja kaasun etsintään ja esiintymien ottamiseen teolliseen käyttöön kasvavat, kuten myös investoinnit kuljetusten vaatimaan infrastruktuuriin.

1 Introduction

The energy cluster occupies an exceptionally important position in the Russian economy, and in the economy of Northwest Russia, in particular. Hard currency revenues from exports of the energy cluster form today the largest share of Russian foreign trade. The federal budget in Russia is highly dependent on revenues from the companies of the energy cluster. Energy companies account for about one third of the total production output, and 40% of the budget revenues.

An important premise for this study is our conviction that analyzing the energy cluster will provide insights into the development of many other industries. All branches of the economy depend on the products of the energy sector (fuel, electric and heat power). The greater the dependency, the greater the influence of the energy cluster on the development of the respective sectors. Under prevailing conditions in Russia, price formation of the products of the cluster is among of the most important factors determining the competitiveness of leading sectors of the econ-

Figure 1.1 The Energy Cluster Compared to Other Russian Industries in 2000



Source: Goskomstat (State Committee for Statistics)

omy. The harsh climatic conditions in most of the territory of Russia, and in particular in the Northwest, further increase the significance of the energy cluster.

A large industrial base was created during the Soviet period to satisfy the demand of the energy sector for equipment and technologies and to provide technological independence from Western suppliers. The energy sector is not only an important supplier for many Russian companies, but is also their largest customer. Energy companies consume 30% of the aggregated production output of these other industries. Companies of these industries enjoy both the advantage of having a secured market, and the disadvantage of being highly integrated in energy cluster technologies and processes, making them highly vulnerable. Understanding these interconnections is another important aim of this study.

Box 1.1 Definition of Terms

Throughout this study we use such terms as *energy cluster, energy sector* and *energy industries*, which appear to be synonyms, but in fact differ significantly.

The term *energy sector* refers only to industries producing primary or secondary energy resources: oil, gas, coal, shale oil and peat, oil products, and electric power.

The term *energy industries* includes both producers of energy and manufacturers of power equipment.

The term *energy cluster* describes the complex of energy producing industries and producers of related technologies, servicing companies, R&D and educational institutions, and other companies and institutions, including large consumers, which interact one with another in all aspects of the energy business (see Theoretical Framework for more details).

Until recently, the Russian energy cluster was analyzed on the basis of tonnage of prospected deposits, kilometers of mains and power supply lines, and quantity of wells, mines and collieries. At the same time, the corporate component, which is one of the key competitive factors for this cluster, was completely neglected. It is obvious that energy companies should be studied not only as a combination of basic natural and technical factors, but also as entrepreneurial entities having their own goals, strategies, creative and managerial abilities, all of which will determine the efficiency of their production practices and market transactions in the long run.

During the Soviet period, the so-called industrial complex approach was used to make important investment and development decisions. This approach implied a territorial organization of manufacturing that was based on maximum use of local resources, and provided for the specific manufacture of products by specialized local industries, which in turn satisfied the demands of consumers throughout the Soviet Union. This approach obviously took into account the positive effects of interconnections between companies. On the other hand, it had a damaging impact, due to the neglect of transportation costs and competition. As a result, the relative costs of the development of new products, which were always very high, were ignored in a drive to maintain complete self-sufficiency and arrive at unified solutions based on government decisions.

Meanwhile achieving scale economies by concentrating production at single facilities with a full production cycle inevitably led to the loss of flexibility and high (and growing) costs of supplies due to lack of opportunity to outsource some parts of their production in an open market with more efficient suppliers.

At present, the energy cluster is undergoing important structural changes that have fundamentally affected the market environment. Formerly, most of the products of the cluster were marketed domestically, the largest consumers being the army and the defense industry. In the 1990s, due to a sharp decrease in Russian military expenditures and the overall crisis in industry and agriculture, domestic consumption of products of the cluster decreased significantly. Opening of the domestic market and liberalization of prices for most of the goods incur increasing costs of energy companies and decreasing demand for their products. This led to a reduction in volumes of production and forced the companies of the oil and gas sector to increase exports. Today, exports guarantee the relative prosperity of the oil and gas sector of the energy cluster. In contrast, other sectors (the power engineering, electric energy industry, and coal industry), with their significantly lower export potential, are experiencing grave difficulties under the new economic conditions.

The corporate sector was also subject to profound changes. Up until now, the reforms have not affected the energy cluster to the degree that they have affected other industries. Thus far, only the oil and oil refining industries, and the power engineering, have been privatized. The reforms in the electric power industry have just begun, and it is still too early to predict what the results of these efforts will be. Reform of the gas sector is anticipated in the future. Further restructuring will undoubtedly have a great impact on both the development of the energy cluster, and on all industries of the Russian economy that depend on its products.

During the past decade, the energy cluster has changed radically. These changes have affected both its individual components and the relations between them. This requires a new understanding of the situation, and an analysis of current trends in order to anticipate possible lines of development of the cluster.

There are virtually no Russian publications that examine the issues of the present study. The research that has been done either analyzes the development, the cooperation, and integration of the companies of the energy industry and related sectors superficially, or it analyzes the subject from the perspective of the vertical integration of the companies, thus failing to examine thoroughly enough the ongoing processes in the corporate sector.

Considering the problems outlined above, this paper aims at achieving the following aims:

- To assess development potential and trends for the Northwest Russian Energy cluster based on the modern industry structure analysis, e.g. cluster analysis, competitive advantages model etc.
- To identify the factors and determinants underlying current growth and advantages, which could serve as a base for possible creation of the competitive cluster, as well as obstacles for the further cluster development
- To create information base and possible ideas for the Russian and regional industrial policy in this sector based on the analysis of its competitiveness and growth potential
- To work out a range of possible of actions to improve investment climate in the sector
- To create ideas and comprehension for focusing corporate business strategy along the most promising lines of the cluster development.

The implementation of the study implied comprehensive analysis of the available industry statistics as well as case studies and analysis of the companies from the different sub industries of the cluster.

The study includes a critical analysis of statistical material (The Organization for Economic Cooperation and Development, Goskomstat of Russia - the State Committee of Statistics), data from Russian and international industrial associations, and analytical material obtained from official and other open sources. The remaining gaps were filled by our own estimates, based on our industry expertise.

We arranged also a series of structured interviews with top management of the leading companies in order to find out most up-to-day insights and views on the main advantages of the cluster, typical obstacles and possible ways for further development. In the framework of the company's research we carried out totally 12 case studies. The sample of companies was drawn from the list of leading regional companies in the sector by sales and form a representative selection of the total population owing to the fact that companies selected were the largest by far in the respective industries.

Below in the text we present our vision on the cluster structure, competitive advantages, and outline the various facets of opportunities, bottlenecks and obstacles to achieving sustainable growth and competitiveness of the Energy cluster in Northwest Russia. We present also possible lines of development and feasible actions for industrial policy, which could lead to sustainable cluster growth and creation of the long-term competitive advantages.

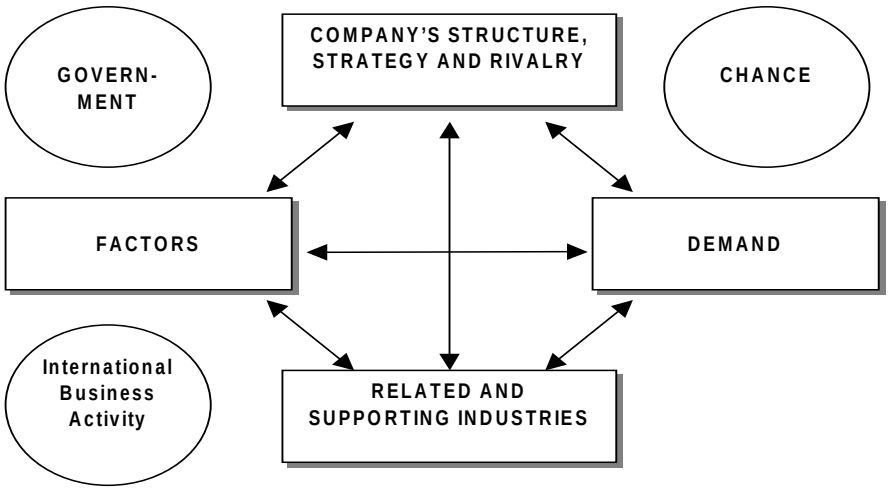
It is worth mentioning, that the study is one of the first attempts to imply to the Russian energy industries modern research practises and present accumulated statistics and analysis. We see the main role of our research in initiation of the further discussions in the concerned parties and probably in creation of the starting point for the next studies as despite the large number of questions, raised and analysed in the study, there is still place for more focused, in-depth and comprehensive analysis.

2 Theoretical Framework

2.1 Introduction

The present study is inspired by the influential book *The Competitive Advantage of Nations*, published in 1990 by Michael Porter, a professor of Harvard University, and by later research on matters related to regional development and competitive advantages (see box below). In the approach presented in his book, Michael Porter describes how companies find sources of competitive advantages in the specific combinations of skills and networks created in their industries and around it in specific countries and regions. He also studied the competitiveness of nations and regions in terms of their ability to offer companies an environment that provides unique advantages embedded in the networks and industrial structure of those particular regions. The study was grounded in detailed case studies of regions that are known for their persistent ability to provide the world with companies that are able to outperform others, such as Silicon Valley, Detroit, northwest and central Italy, etc.

Figure 2.1 "Diamond" Model



As a main tool in the analysis presented in M.Porter Study the "Diamond" model of national competitiveness was introduced (presented below in Figure 2.1). In this study this model is also used, although

slightly adjusted (for more information see box below), as a key tool for assessing and analyzing the competitiveness of Northwest Russia. Although, initially, Michael Porter used this model for studying national competitiveness, it was later tested to fit the studies of regions that are positioned within boundaries of certain countries, or even to regions that comprise neighboring areas of different countries.

The "Diamond" model distinguishes four main sources of competitive advantage. These are

- *Factors.* This category includes production factors such as natural resources and geographical location, as well as created factors inherited from preceding stages. The first group can include natural resources, demographic conditions, geographical location, etc. The second group usually includes production facilities, and positions on various markets, infrastructure, human capital and R&D potential.
- *Demand.* The presence of a sufficient demand for the primary goods is the necessary condition of development and a source of competitive advantage. Here it is important that existing demand allows achieving economies of scale in local production. This demand is formed by local and export constituents. The local demand is a necessary starting source for creating competitive advantages for firms that will cluster in the region, thus reinforcing local advantages. Such specific characteristics of domestic demand as high quality and diversification requirements of consumers, or user-producer cooperation and consequent demand for specific solutions and product/service combinations, which for certain reasons were not possible in the other regions, substantially enforce the sustainability of competitive advantages of domestic producers. In certain industries, the strong and rapidly growing export market and demanding foreign customers played an essential role in formation of competitive domestic producers as well. In this case access to the foreign markets played a key role in formation of the competitive advantage.
- *Related and Supporting Industries.* The existence of developed related and supporting industries could be a source of competitive advantage for regional companies due to the possibility of obtaining advantages from the early access to high quality and reliable supplies of essential and unique or rare components and materials, from the cost advantages gained from the competitive local supplies. This also allows for an increase of production efficiency as a result of specialization. An available developed system of subcontractors and suppliers in a given region makes it possible to offer more complex products and after-sale service systems. It creates a unique local system of industrial co-

operation that exceeds and surpasses similar competitors' systems by their possibilities and degree of development.

- *Company's Structure, Strategy and Rivalry.* The industry structure is an important determinant of the possibility to gaining competitive advantage if the industries are competitive and the competition motivates leading companies to invest in the product and market offering, management and marketing as well as process development. In this case the larger markets for essential supplies and components are created, infrastructure could be better targeted to meet specific requirements of the particular industries, the competitive pressures also motivate higher organizational efficiency and training as well as spin-offs.

Porter offers for consideration two additional areas from which companies are able to draw sources of competitive advantage in his model:

- *Chance.* The role of chance or "luck" reflects rapid changes on world financial markets; changes in currency quotations, an unexpected growth in local/international demand and the event of war. All these sudden and unexpected events create situations on the market when unforeseen opportunities are created. In some cases these opportunities could become a source of competitive advantage.
- *Government.* The influence of government, through its current policy (liberal, deterrent, etc.), is only considered as an attribute in analysis. However, this policy determines the performance of all actors in the regional and/or national economy. A rational governmental policy provides for the growth of potential investor confidence and attracts capital, experience and technology to the economy.

As a result of studies of globalization, another potential source of competitive advantage was later added to Porter's "Diamond" model of national competitiveness: this is international business activity.

International business activity became a source of competitive advantage for companies from particular regions as a result of their internationalization, i.e. their ability to locate production facilities in regions that could offer the best advantages for the particular activity, and thus gain from access to several "diamonds" of the national advantage simultaneously.

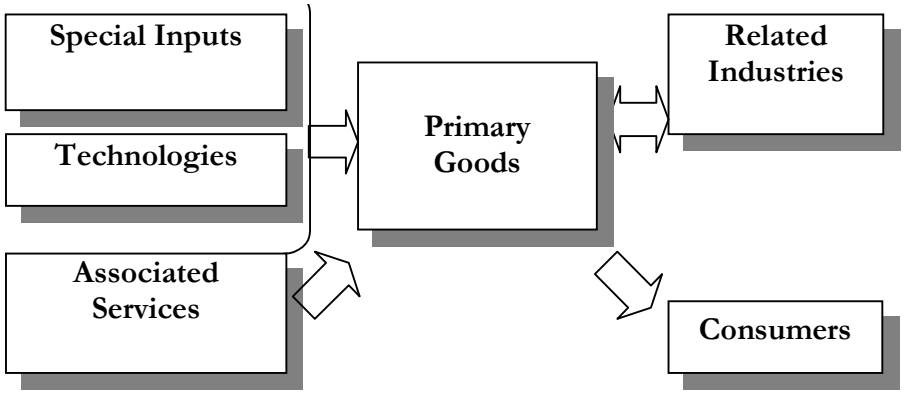
2.2 Concept of the Cluster

As we discussed in earlier in this Chapter the regional competitiveness is based on the ability of the particular location to offer the firms opportunities to gain competitive advantage owing to the specific factor and demand

conditions, high demand and quality conscious consumers, and developed networks of competitive companies in related and supporting industries located in this region.

Cluster analysis presumes that no specific industry can be viewed separately from others, but should be analyzed systematically within a cluster of vertically and horizontally linked sectors. It is obvious that the development of a key industry would give a push to the development of supplying and consuming industries, as well as service segments associated with the cluster.

Figure 2.2 Cluster Structure



A cluster structure can be illustrated as a set of separate, but closely interrelating sectors of the regional/national economy, as well as special inputs inherent for the region. There are the following elements in a cluster:

- *Primary goods* – a list of goods or groups of goods, which are competitive on the world market and companies manufacturing these products form the core of the cluster.
- *Specialty inputs* – the main factors of production inherent for the country (region) are the raw materials, transport, infrastructure, labor force, educational system, R&D etc.
- *Technologies* –a description of key technologies, machines and equipment consumed by the core sector of the cluster and its producers, located in the same region.
- *Related and supporting industries* – the different sectors of the economy and particular companies, whose products are directly or indirectly consumed or may be consumed by the core sector.
- *Consumers* – the main consumers of primary goods manufactured by the companies of the cluster.

An analysis and understanding of the cluster and its structure can help companies to create focused development strategies, and authorities to identify the sources of competitiveness in their particular regions, and to create on the basis of this an efficient and active system of general development, of infrastructure and operational environment improvements, including relevant regulatory acts, actions and decrees of the legislative power.

Although there is an extensive body of theory and research behind the matters presented in this chapter we do not dare to bother readers with further explanations and would like to proceed to the analysis presented in the following text. Those who are interested to learn more we ask to refer to the forthcoming book "Advantage Northwest" by Grigory Dudarev and Hannu Hernesniemi where these issues will be addressed in more detail. A short summary of theoretical routes used as knowledge basis for the study is presented below in Box. 1.

Box 2.1 Theoretical Routes

It was long time a widely accepted fact that national and regional location is central to growth, increased welfare and well-being. Already in the end of the 19th century Alfred Marshall introduced "industrial districts", later Joseph Schumpeter – "innovation clusters", Eric Dahmen – "development blocks", François Perroux – "development and growth poles", economic geographers – industrial and "high-technology" agglomerations. These concepts assessed the geographic concentration of economic activities and innovation from different perspectives. Going here deeper into the intellectual history underlying these approaches and the difficulties of making the above concepts analytically operational is beyond the scope of the present review. Nevertheless we will touch upon their implications that were integrated into the approach used in our study. The reason why these concepts were not successful was not because policy makers did not consider them important: the source of growth and the origins of disparities have remained central to the preoccupations of policy makers and analysts. The unresolved issues that underlie the wide use of the "cluster" concept are related to the following questions: Why do activities cluster? Why is clustering important? How can the clustering process be managed? Is that possible? What are the possible tools and factors that could influence clustering in certain regions? Can, and should, one do something about it?

Michael Porter in his book "The Competitive Advantage of Nations" presented some answers and explanations for many of the above questions. He incorporated implicitly many previous developments, mentioned above in the knowledge base (Rouvinen and Ylä-Anttila, 1999). Although, according to these authors, the framework presented by Porter is rewrap of old ideas, they agree that the "diamond" model is internally consistent and in the line with the mainstream competitiveness literature. The ambiguities surrounding the cluster concept (and other related concepts such as industrial districts), proper

definitions, and their relationships to regional economic performance are the subject of extensive literature (Asheim and Isaksen, 1997; Feser, 1998a, 1998b; Harrison, 1992; Heinenreich, 1996; Isaksen, 1997; Jacobs and de Man, 1996; Kaufman et al., 1994; Park and Markusen, 1995; Steiner, 1998).

Notwithstanding the fact that this model is obviously a good and comprehensive tool to assess competitiveness and clusters, i.e. represents a certain advance in this area, it has some drawbacks. As Penttinen demonstrated in 1994 they are the following: competitiveness can also be found outside clusters; the diamond model does not properly account for foreign direct investment and multinational enterprise; the model may not be suited to small open economies (as it was suggested by Rouvinen and Ylä-Anttila, 1999 we also used broader cluster definitions); the model may not be applicable to resource-based industries (Rouvinen and Ylä-Anttila, 1999 applied the model to resource-based industries successfully); the role of macroeconomic variables in the Porter's model is unclear; it is unclear whether model is dynamic or static; the studies may not be conducted with sufficient rigour (the loosely defined theory offers possibilities for misuse).

One of the main advantages of the Porter model was that it remarkably departed from traditional analysis and integrated the new, more up-to-date developments in theory such as cluster-based approach. The main differences between traditional and cluster-based approach are that by specifying strict boundaries for industries or sectors (mostly based on statistical data accounting procedures), the traditional sectoral approach fails to take into account the importance of interconnections and knowledge flows within a network of production (Rouvinen and Ylä-Anttila, 1999).

The cluster-based approach also has substantial importance as a tool to study regional development issues. Empirical studies today are far more frequently conducted on the sub-national level (Nelson, 1993, Ohmae, 1995) and often patterned after Porters' model of competitive advantage. There is also a substantial contemporary research in regional development (Russo, Storper and Scott, von Hippel) and sources of competitive advantages (Barney, 1992 a, 1992 b, Asanuma, 1989, Dyer) that complements Porter's model in a major way adding more understanding and insight into the localization of process of the knowledge creation and diffusion, learning, etc.

In conventional macroeconomics the markets are characterized by anonymous relationships between suppliers and users. Anonymity according to Gibbons and Weijers complicates product innovation because new product development requires effective transfer of specific cost and performance needs knowledge from the potential user to the would-be producer. The challenges of the product innovation process are well captured by Lundvall who stated that reciprocal information flows between producers and users are essential to successful innovation. Rothwell who introduced the notion there are two main interfaces in user-producer interactions extended this view. These are the interface between the supplier and the producer and the producer and the customer. The above arguments stress importance of geographical proximity, personal knowledge and trust in the development of new products through user-producer cooperation.

John Holmes studying the Californian agglomeration went along theoretical lines of transaction cost theory. He rooted flexibility in the division of labour in production and linked that to agglomeration via analysis of the transaction costs associated with the interfirm linkages, i.e. traded exchange. This analysis is parallel to a major trend in business economics, i.e. that of network forms of production. The transaction cost theory is about the allocation through cost-minimization owing to its concentration on the traded input-output relationships. The evolutionary theory and knowledge based view in the strategic management open the way to understanding "untraded" interdependencies, which does not appear in recorded input-output transactions (Storper, 1997, Storper and Salais, 1992).

Another significant challenge and difficulty in the present study was to assess the transition to the market economy and its impact on clusters and competitiveness. In this respect one shall mention the territorial-industrial complexes by Kolosovsky (1969) approach that included creation of both production facilities and a network of specialized higher educational establishments and R&D organizations in the certain region that was a central national and regional industrial policy and planning tool in the Soviet period. Implementation of this approach resulted in the major distortions in the production allocation decisions and, as a result of the on-going changes, the regional industrial landscape is bound to change substantially in Russia. We believe that material presented in our study could shed some light on the processes of re-allocation in the Russian economy. We used also Porter diamond model to assess the regional competitiveness in the Northwest Russia. Brown and Brown (1998) examined empirically the structure-conduct-performance paradigm in Russia and found supporting evidence. Therefore we believe that there is at least some evidence that one of the corner stones of the Porter approach, i.e. industrial organization approach is suitable to assess the period of transition.

3 Identification of the Energy Cluster of Northwest Russia

3.1 Structure of the Cluster

The energy cluster of Northwest Russia is represented by a variety of industries related to energy production, including oil production and oil-refining, gas production and gas-processing, coal production, shale oil production, power generation and distribution, power engineering as well as many other industrial, servicing, R&D, educational and infrastructure entities.

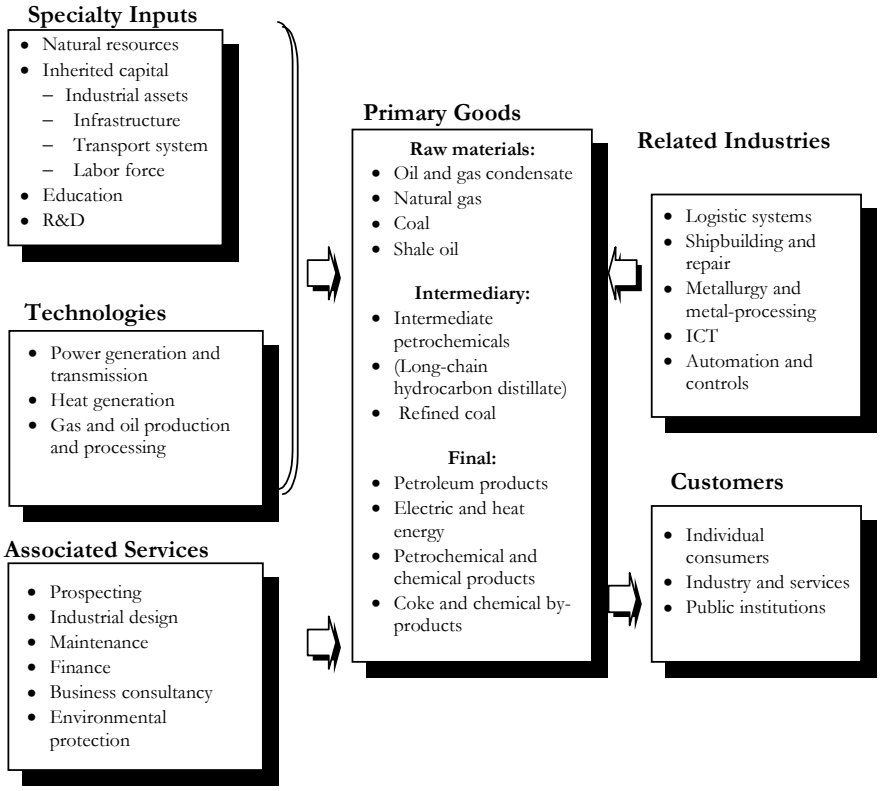
The structure of the energy cluster of Northwest Russia is taking shape at the present time. The expected restructuring of gas and electric power monopolies, the development of new oil and gas fields, new investment projects, emerging industrial services and other factors could substantially alter the structure of the energy industry.

Northwest Russia has a rather small number of large energy firms that work throughout Russia and abroad and are represented in the region by a wide network of subsidiaries and affiliated companies. Unlike many other industries, in which markets were introduced already at the beginning of the 90s, in the electric power and gas sectors the monopoly positions of the companies established in the Soviet period have been preserved, and prices have remained regulated by the federal government and regional authorities on the basis of actual cost and investment.

Basic prerequisites for competition exist in oil, coal and equipment production, but even in these industries there are many limitations and distortions. Such industries as gas and electric power production are monopolized.

The cluster structure is shown in the figure below. The cluster is based on available natural resources (oil, gas, coal, shale oil, hydropower, etc.) and substantial inherited industrial and human capital. In the Northwest region there is a well-developed educational and R&D system and several leading power technology and equipment manufacturers that make the region, and especially St. Petersburg, the largest Russian center of power engineering.

Figure 3.1 The Energy Cluster Chart



Products with low added value, first of all crude oil, dominate among the primary goods with obvious competitive position on the world market. Petrochemicals and oil products are competitive mainly on the domestic market due to comparatively low quality. The situation, however, is changing, and in the future these products could contribute substantially in the regional export. Electric power production is also a very promising industry in terms of export potential due to existence of excess capacities and cost-competitiveness.

The most significant specialty inputs of Northwest Russia are existing energy resources (oil, gas, coal, water resources, etc.) and production facilities inherited from the Soviet period.

Within the region there is a concentration of large-scale power engineering companies that manufacture equipment and develop technologies for power generation, and gas and oil transporting. The share of the Northwest in the manufacture of steam and hydraulic turbines is 60% of the total general production in Russia, and the manufacture of gas turbines has been developing steadily. Due to dramatic reduction of

the domestic market of new equipment in the 90's, power engineering have long been specialized mainly on servicing after-sale and replacement markets. Besides this, there are many smaller companies producing equipment for oil and gas production, coal mining and other activities within the energy cluster.

The development of the energy cluster in Northwest Russia is also stimulated by transit trade and the processing of raw materials supplied from other regions. Already today, St. Petersburg and the Leningrad region function as hubs through which natural gas, oil, petrochemicals, coal, electric power and other commodities are exported to Western markets. The growth of traffic of energy products creates opportunities for establishing new industrial facilities (oil refineries, power plants, etc.) in the region.

Personnel training for the energy companies of Northwest Russia is carried out by a large number of specialized educational institutions that have close connection with the companies. In addition, large R&D organizations operate in the region, many of which are the largest in Russia in their segment. The major educational and R&D centers for the energy cluster in Northwest Russia are: St. Petersburg, Ukhta, Arkhangelsk, and Murmansk.

Among the most important associated services of the cluster prospecting, industrial services for extracting and processing companies, information and communication services, fund raising should be mentioned. During recent years many energy companies have started to sell off non-core assets and outsource maintenance and repair services. However the effective and competitive service market practically does not exist at the moment due to a number of infrastructure and structural problems.

At the present time, the key energy companies (first of all oil, gas and electric power producers) are the most prosperous and well capitalized in Russia. Due to large scale of domestic operations, access to foreign markets, and improved management, energy companies generate substantial cash flow that helps them, on the one hand, act as largest investors, and, on the other hand, pay out 80% of the total dividends in Russia today. The current financial performance and long-term competitiveness of coal and shale-oil companies is rather weak. Producers of energy equipment gain profit last years but their sales have decreased dramatically since the beginning of the 90s and they need huge investment in modernization and up-grading of their equipment and technologies to retain their traditional markets.

The development of the cluster is largely influenced by the state, but the industrial policy lacks coordination and focus. The permanent di-

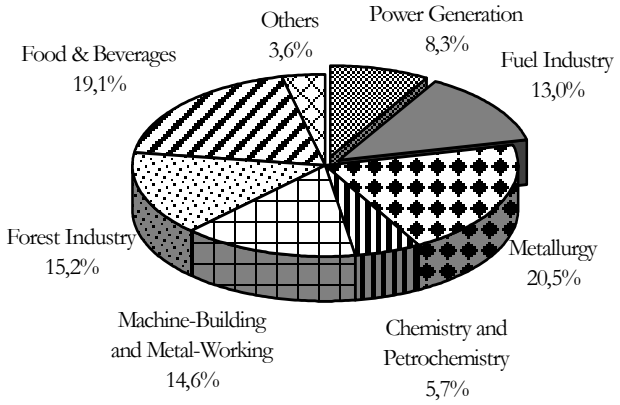
lemma of balancing needs of energy companies and the rest of the economy till recent time was traditionally resolved by the government in favor of the rest of economy.

3.2 The Role of the Energy Cluster in the Economy of Northwest Russia

The energy cluster occupies one of the key positions in the economy of Northwest Russia. The share of energy producing companies in the structure of industrial output in Northwest Russia was 21.3% in 2000. Fuel products account for the largest share (13%), due mainly to the oil production and processing industries. If to take into account also power engineering, petrochemistry and other companies related to the energy cluster its share accounts for more than 30% of the total industrial production.

The industrial output of the electric power sector is to a great extent determined by the level of prices for electric power, which is set by the government (Regional Energy Commissions) and price trends on the global oil market. It may be supposed that the policy of liberalization of the power industry market that is being carried out in Russia will inevitably lead to an increase in energy prices within a period of several years[1],

Figure 3.2 Share of the Energy Industry in the Industrial Production Structure of Northwest Russia in 2000



Source: Goskomstat (2001)

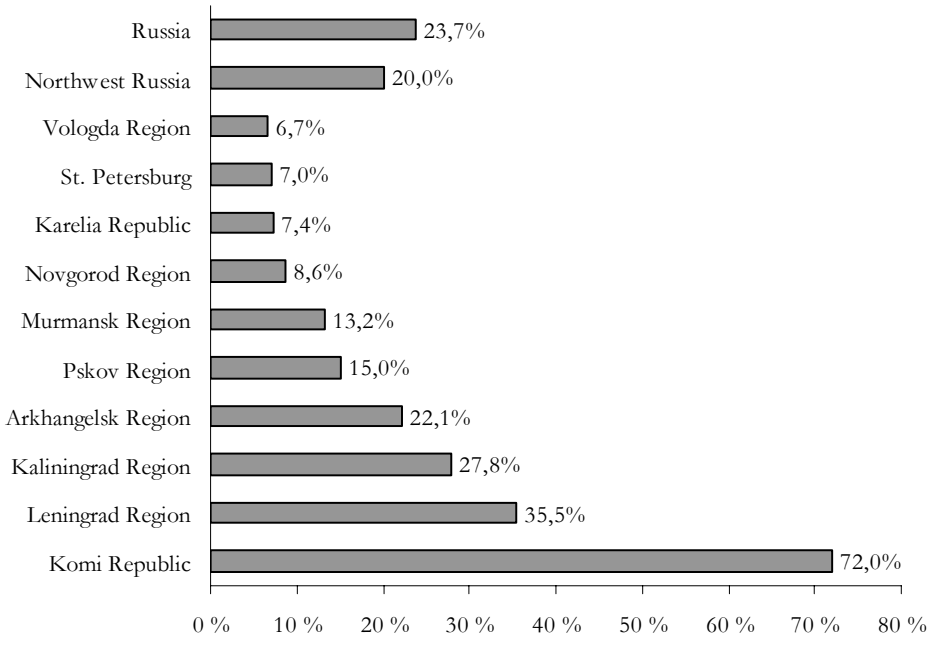
1 Active implementation of RAO UES of Russia restructuring program is scheduled for the period after 2004 - the year of the presidential election.

and as a consequence to an increase in the share of the electric power sector in the total industrial output. The growth of the power industry as a result of tariffs could substantially outpace overall industrial growth in Northwest Russia.

The energy sector plays a significant role in the economy of most of the regions in Northwest Russia. The basis of energy production in the Republic of Komi is formed by oil producing companies. In the Murmansk, Arkhangelsk, Kaliningrad and Pskov regions – the energy sector is primarily represented by electric power producers. The largest oil processing plant in Northwest Russia (KINEF) and the largest electric power supplier (Leningrad Nuclear Power Plant) are located in the Leningrad region.

The energy companies of Northwest Russia produce 10.6% of electric power, 4% of oil, about 15% of oil products, 8% of coal (including 18% of coking coal), and 100% of shale oil in the total industrial output of Russia. The production volume of energy products, excluding natural gas, exceeds domestic consumption in the region. About 99% of the

Figure 3.3 Share of the Energy Industry in the Industrial Production Structure of Northwest Russia in 1999



Source: Goskomstat (2000)

Table 3.1 The Significance of the Energy Sector in Russia and Northwest Russia (2000)

Indicator	Russia	Northwest Russia	Share of Northwest Russia, %
Production of fuel and energy products, million rubles, including:	1,210,125	137,642	11.4
- Power Generation	375,088	30,757	8.2
- Fuel industry	987,253	106,884	12.8
The number of employees, thousand people*	1,629	140.1	8.6
Energy resources:			
- Oil, million metric tons	15.3	1.3	8.6
- Gas, trillion. m^3	49.6	3.3	6.6
- Coal, billion metric tons	272	8.3	3.1
- Including coking coal, billion metric tons.	60	3.5	5.8
- Shale oil, billion metric tons	4.6	1.2	25.2
Installed power capacity, GW	212	30.8	14.5
Installed oil primary processing capacity, million metric tons per year	290.4	22.3	7.7
Oil production, million metric tons	348	14.5	4.2
Gas production, billion m^3	581	3.9	0.7
Production of oil products million tons, including:			
- Gasoline	32.8	2.1	6.4
- Diesel oil	49.2	4.4	8.9
- Fuel oil	48.2	10.2	21.2
Power generation, TWh	877.8	90.4	10.6
Coal production, million metric tons, including.	258	18.8	7.3
- Coking coal, million metric tons	72.0	11.0	15.3
Shale oil production, million metric tons	2.0	2.0	100

Note: * The data of employees is from 1999
Source: Goskomstat (2001), company data (2002)

electric power generated in the region, about 100% of power-generating coal, 80% of coking coal and 40% of oil products are produced and consumed in Northwest Russia.

Table 3.2 Fuel and Electric Power Consumption and Their Share in Industrial Output of the Northwest

Product	*1995*	*1996*	*1997*	*1998*	*1999*	*Consumption in the Northwest Compared to Production, % (1999)*
Electric energy, GWh	n/a	n/a	81,276	81,562	82,589	99.4
Coal, thousand metric tons	16,687	15,808	15,170	14,522	14,776	77.0
Gas, million m^3	25,058	26,862	27,642	28,115	29,494	7.6 times
Gasoline, thousand metric tons	1,277	12,514	1,116	1,048	1,116	48.5
Diesel oil, thousand metric tons	2,970	2,699	2,482	2,275	2,292	55.9
Fuel oil, thousand metric tons	8,369	7,719	7,212	7,263	6,432	63.4

Source: Goskomstat (2000), Company data (2000)

The energy companies in Northwest Russia demonstrate labor productivity that exceeds the average level in Russia. The high productivity of the regional companies is promoted by such factors as a high level of utilization of production capacity, relatively new oil production[2] and oil processing companies[3], as well as a high level of mechanization of coal production companies[4].

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2 Timano-Pechorskaya oil and gas field is a relatively new territory for oil production. The northern part of the field has begun to be exploited intensively only recently. Additionally, a large number of joint ventures with the participation of such companies as CONOCO (USA), Fortum (Finland) and others were established in Northwest Russia in the early 90s. The high concentration of foreign investments in the region promoted the introduction of new modern technologies for oil production.

3 The KINEF oil processing plant (Leningrad region) is the last of the recently built plants in Russia, and is one of the most modern domestic enterprises. KINEF has the most stable and the highest level of capacity utilization among Russian oil processing companies. Today the company follows an active investment policy aimed at the modernization of production.

4 The coal companies in the Republic of Komi are among the most mechanized companies in Russia. One of the major strategic goals of the companies is productivity growth, which today is realized primarily through layoffs and equipment replacement.

3.3 Brief History of the Cluster

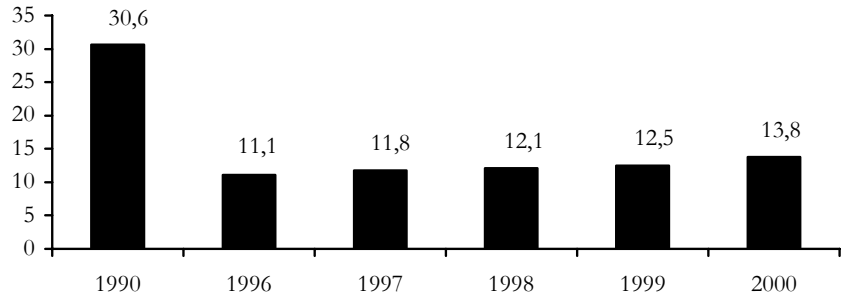
Oil-production and oil-refining. Oil production in the Republic of Komi began in the 18th century in the Ukhta region. However, production volumes were rather small until the 1930s. In 1929, prospecting was launched there, and a number of large industrial deposits were explored. In 1934, an oil-refining plant was built in Ukhta. By the mid 40s, more than 170 thousand metric tons of oil were produced in the Republic of Komi.

In the 60s and 70s, the development of the oil industry in the Republic of Komi was boosted by the discovery of a new large oil-and-gas province located in the northern regions. This province also includes the territory of the Nenetsk autonomous district and the sea shelf. Presently, it is the major source of raw materials for the oil and gas industries in Northwest Russia. Its development began in 1967 in the Usa region, and since then it has been gradually expanding and moving to the north. The oil-trunk pipeline Usa-Ukhta-Yaroslavl (more than 15,000 km in length) was built in the 70s in order to transport extracted oil to the central regions of the country.

Despite the expansion of the Ukhta oil-refining plant, already by the mid 60s its capacities were not sufficient to meet the demand of Northwest Russia for petroleum products. In 1966, the Kirishi oil-refining plant (in the Leningrad region) was opened. Initially it was oriented towards supplying fuel for the Navy. Later, it concentrated on the production of fuel for power generation and other petrochemical products.

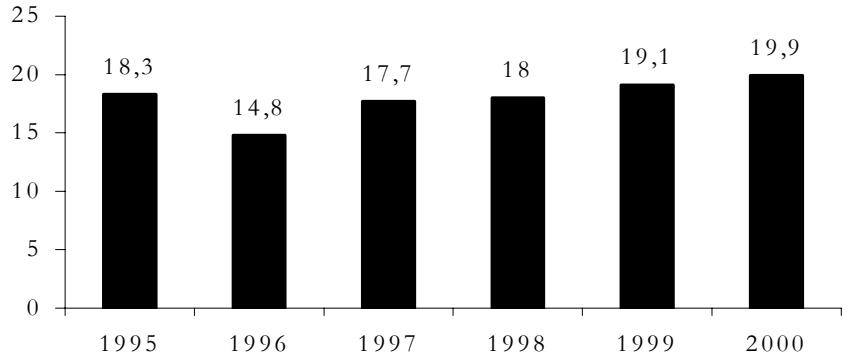
In the early 90s, oil production volumes in Northwest Russia dropped by almost three times, due to the overall industrial crisis. Since 1996 the production volumes have begun to grow slowly.

Figure 3.4 Oil Production in Northwest Russia, million metric tons



Source: Goskomstat (2000), Komistat (2001), Minenergo (2001), LUKOIL (2001)

Figure 3.5 Primary Oil Refining in Northwest Russia, million metric tons



Source: Surgutneftegaz (2001), LUKOIL (2001), Goskomstat (1999)

The oil-refining industry was one of the most successful industrial sectors in the 90s. Not less than 85% of the Kirishi plant's capacities were utilized (the plant provides more than 80% of oil refining in Northwest Russia).

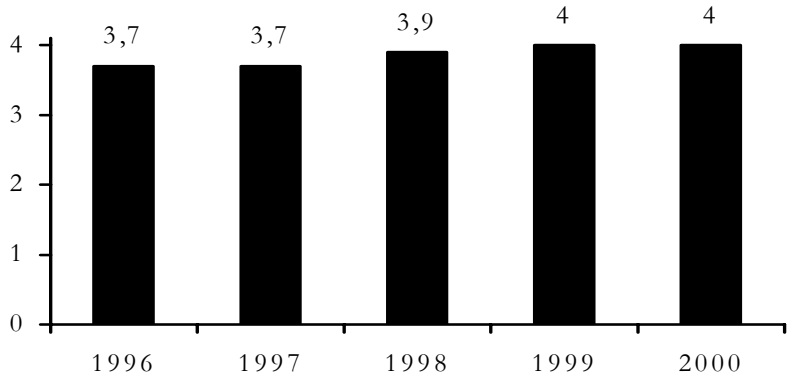
The gas industry. The production of gas in the Republic of Komi began in 1935. The gas-processing plant, which was built in Sosnogorsk a few years later, is still the only gas-processing plant in Northwest Russia.

In order to provide Northwest Russia with gas, the Lentransgaz enterprise was established in 1948. Initially it supplied shale gas from Estonia to Leningrad, and later switched to using main gas pipelines for the transporting of natural gas from other regions. The development of gas pipelines for exporting gas to Western Europe began in the 70s. These pipelines are exploited by Lentransgaz, as well.

In the 60s, the exploitation of new gas deposits began in the Republic of Komi. The Vuktyl-Ukhta-Torzhok main gas pipeline was built from Vuktyla (one of the largest of these deposits) to the southeast. In 1976, this gas pipeline was connected with another gas pipeline from Tyumen region, which helped significantly to increase gas transportation. In 1986, the Severgazprom enterprise was established. Today it controls virtually all gas production in Northwest Russia and carries out most transportation.

During recent years, gas production in Northwest Russia has been rather stable. Possibilities for growth of production at the deposits currently under exploitation have been all but exhausted.

Figure 3.6 Gas Production in Northwest Russia, billion m^3



Source: Goskomstat (2001)

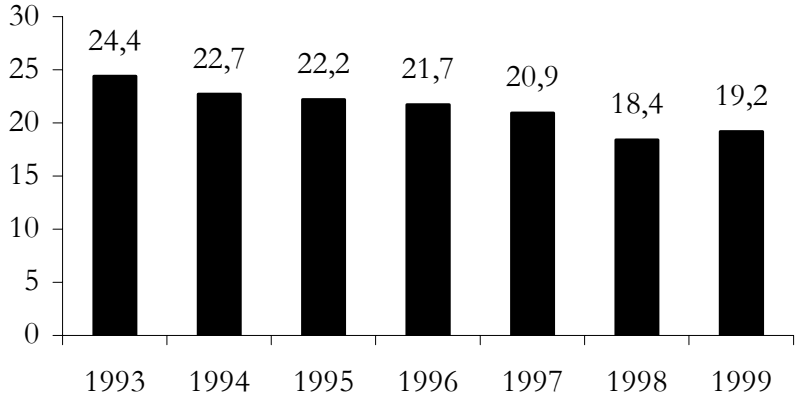
The coal industry. Coal production in the Pechora coal field also began in the 30s. In 1941, the Severo-Pechorskaya railroad was built in order to provide for transporting coal. In the 40s, the coal industry in the Republic of Komi grew rapidly. Twelve new coalmines were opened, and the production volume in the Vorkuta region was 2.2 million metric tons. Since 1955, after the construction of Severstal, Pechora coal was used in the coke industry.

Coal production in the region gradually grew: from 16.4 million metric tons in 1962 to 31.5 million metric tons in 1988. Along with the Vorkuta region, coal production was also developing in the Inta region. High-capacity coalmines were built. One of the largest mines in Europe – the Vorgashorskaya mine, with a capacity of 4.5 million tons of coal per year – was opened in 1975.

In the 90s, the Russian coal sector went through a deep crisis. Many mines were closed down, the number of workers in the coal industry was halved. Coal production in Northwest Russia also declined significantly, and presently continues to fall despite the government support of the sector.

Power generation. The power industry in Northwest Russia began in the 17th century when sawmills started using water-power. In the 19th century, the first steam engines were introduced at St. Petersburg plants. The initiation of production of steam engines gave rise to Russian power engineering. The first power plants were also built in St. Petersburg. In the beginning of the 20th century, power plants also appeared in Novgorod, Pskov, and Arkhangelsk.

Figure 3.7 Coal production in Northwest Russia, million metric tons



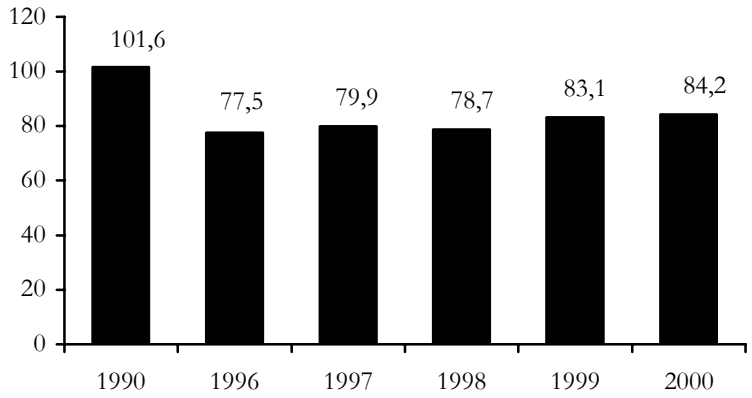
Source: Rosinformugol (2001)

In the 20s and 30s, the construction of large power plants and power-transmission systems began in Northwest Russia in accordance with the state plan for the development of the power industry. In 1927, the first unified energy system was created in Northwest Russia – in Leningrad – which also included power plants in Karelia, and the Murmansk, Pskov, Novgorod and Vologda regions, and had a total capacity of 156 MW. In the 30s, a number of new hydropower plants of medium power capacity were built on the rivers of Karelia and the Murmansk region.

During the 50s and 60s, the power industry intensively developed in the Republic of Komi. In Vorkuta and Ukhta thermal power plants, working on coal and fuel oil, were built. However, energy capacities in Northwest Russia were not sufficient to meet the demand, and in large industrial centers (Leningrad and the Kola Peninsula) the construction of nuclear power stations began. They were put into operation in the 70s, and in the early 80s, both of them reached their planned capacity. The development of the gas industry at the same time stimulated the switch from coal, peat and fuel oil to cheaper and less polluting natural gas in most thermal power plants of Northwest Russia[5].

[5] It is expected that prices for natural gas will grow significantly in the future, making coal, peat and fuel oil reasonable sources of energy and adding value to biofuels.

Figure 3.8 Electric Power Generated in Northwest Russia, TWh



Source: Goskomstat (2001)

During the 90s, under the conditions of overall industrial slowdown, power consumption in Northwest Russia fell by one third. As a result, there was a slump in power production volumes. In 1999, the gradual growth of production began, stimulated by an increase in the demand for energy.

4 International Trade and the Position on the World Market

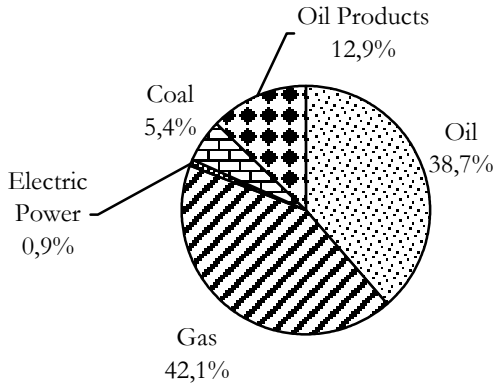
4.1 Russian Energy Export

At present, the export of energy resources forms the foundation for the country's exports, accounting for over 50% of the total.[6] The revenues from the export of energy resources constitute the backbone of the federal budget, and are the basis of all the investment activity of the oil and gas industry.

During the past decade, the export of energy resources decreased from 706 million tons of coal equivalent in 1990 to 554 million tons of coal equivalent in 2000. This decrease was caused by a rapid fall in the volume of exports in the electric power industry (by 65%) and in the oil industry (by 34%).

The reduction in supplying of energy resources by more than three times to the former republics of the Soviet Union had the most noticeable impact on the fall in exports. At the same time, beginning in 1993, exports to other countries showed, on the contrary, a tendency toward

Figure 4.1 Russian Energy Export Structure, 2000



Source: Minenergo (2001)

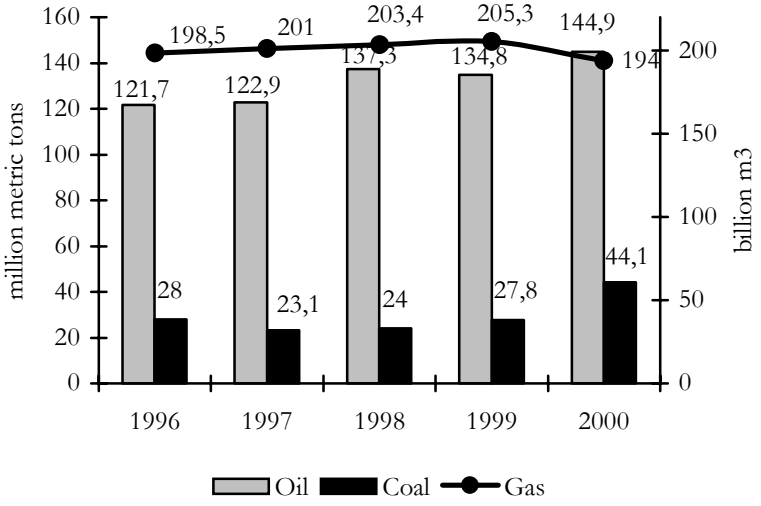
[6] This portion of energy resources in the total volume of exports in Russia indicates an extremely unfavorable situation in most other industrial sectors of the economy.

steady growth. In 1993 – 1999, the total export of energy resources abroad (to countries other than the former republics of the Soviet Union) grew by more than 50%.

As has always been the case, primary energy resources account for most of the energy exports, occupying a volume of more than 86%. The drop in the volume of export of oil and oil products and electric power, against the background of the increase of the volume of export of natural gas, however, brought about changes in the breakdown of exports of energy resources.

In all, in 2000 approximately 145 million metric tons of oil were exported (107.5% of the level of 1999), of which 88% was exported to countries abroad, and 12% to the CIS countries. According to Goskomstat data, in 2000 the exports of natural gas amounted to 194 billion m^3,[7] including 60 billion m^3 to the CIS countries.

Figure 4.2 The Export of Primary Energy Resources in Russia



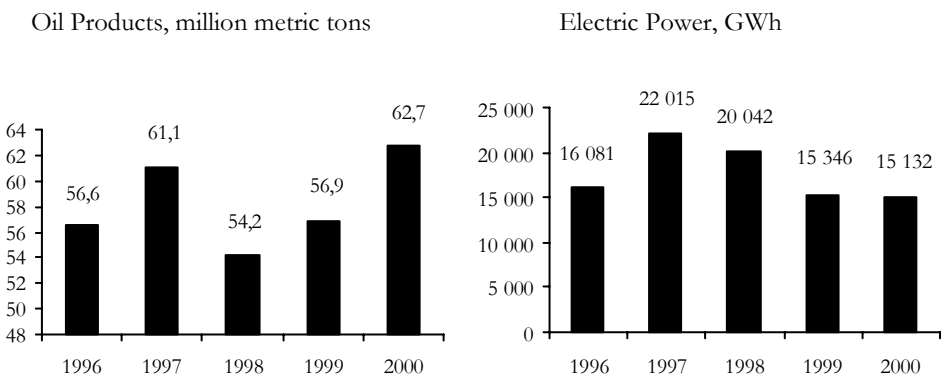
Source: Goskomstat (2000, 2001)

[7] The estimation of export volumes found in official statistical analyses often differs from estimations by exporting companies themselves, the government of the Russian Federation, and institutes for independent analysis. This primarily concerns exports of natural monopolies - Gazprom and RAO UES of Russia. For example, the export of gas in 2000 amounted to:

- 194 billion m^3 according to Goskomstat estimates;
- 217.2 billion m^3 according to estimates of the Ministry of Energy of the Russian Federation;
- 217.9 billion m^3 according to estimates of Gazprom and the Itera Group;
- and 168 billion m^3 according to British Petroleum estimates.

The exports of products of the processing sector and the electric power industry, at present, do not play a determining role in the total volume of exports of the energy cluster. In 2000, the processing industries accounted for only 13.8% of the total volume of exports. The situation has shown a tendency toward improvement in recent years, however. The exports of oil products grew to 62.7 million metric tons in 2000; however this is due to fuels with a low octane number (about 50% of which is diesel fuel, and 40% furnace fuel oil). Theses oil products are exported primarily to the European market. The export of electric power, almost half of which goes to Finland, amounted to more than 15 GWh in 2000.

Figure 4.3 Exports of Oil Products and Electric Power

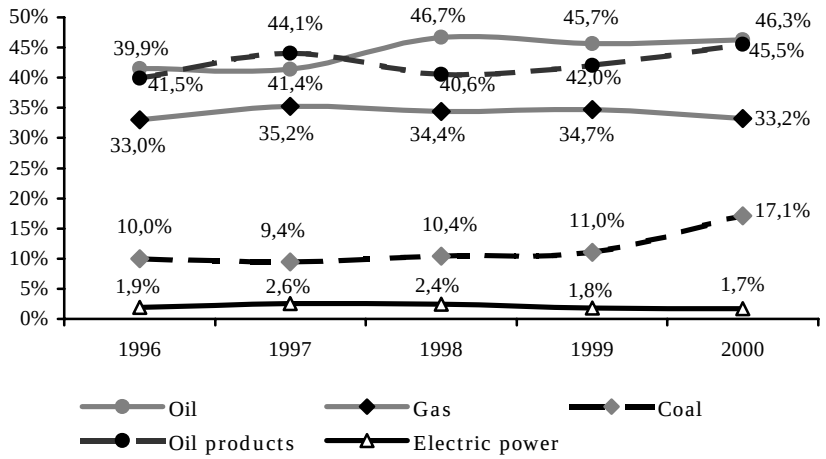


Source: Goskomstat (2000, 2001)

In the 1990s, the role of exports for companies grew significantly. This has primarily been the case in the oil and gas industry, the exports of which exceed 30% of the total production volume. At present, no more than 2% of the electric power being produced is exported. At the same time, the electric power industry has significant exporting potential, and as energy systems are synchronized and the export network infrastructure develops, the export of electric power may grow.

The exports of the products of the power-plant industry (which is an essential part of the energy cluster of Russia) today are insignificant, and are directed primarily to developing countries, with which Russia has traditionally had economic and political ties: India, China, Iran, and others. These products are generally not offered on the highly competitive markets in Europe and North America.

Figure 4.4 The Volume of Exports in the Total Output of the Russian Energy Sector, %



Source: Goskomstat (2000, 2001)

In 2000, the export revenue of energy resources of Russia grew by 74% in comparison with 1999, and amounted to $54.2 billion. It should be noted, however, that this growth is primarily due to the favorable state of the market of energy resources.

Table 4.1 Exports of the Products of the Fuel and Energy Complex (F&EC)

	1997	*1998*	*1999*	*2000*
Total export revenue, billion US dollars	89	74.9	75.7	105.5
Export revenue of the F&EC, billion US dollars	40.3	29.5	31.2	54.2
Portion of the F&EC in the total export revenues, %	45.3%	39.4%	41.2%	51.4%

Source: Goskomstat (2001)

Therefore, exports of energy resources form the foundation for Russian exports. They account for 51.4% of the revenues from the total exports of Russian products and services. At the same time, the breakdown of exports suggests that the potential of the energy industry of Russia is currently not being optimally utilized, even considering the objective difficulties of the transition period.

4.2 Russian Energy Products on OECD Markets

The statistics of Russia's international trade with countries belonging to the Organization of Economic Cooperation and Development are used in order to analyze the position of the cluster on the international market. On the one hand, there are some drawbacks involved in this approach, since it represents not the entire world market, but only a part of it. On the other hand, it is characterized by significant advantages for the analysis, because the statistics available for the OECD countries are quite reliable, and the OECD market is highly competitive, which facilitates a more objective analysis of the competitiveness of goods and industries and the application of the results to the world market.

The International Trade by Commodities Statistics (ITCS) are used for the analysis; commodity groups are classified according to the HS - Harmonized System.

Box 4.1 Methodology for the Foreign Trade Analysis

For analysis of the clusters' positions on the foreign markets we use statistics of international trade of the countries, belonging to the Organization for Economic Cooperation and Development (OECD), with Russia. This approach is characterized by a number of advantages. First, OECD includes the most developed countries of the world, and thus its statistics allows analyzing positions of the Russian products on the most competitive and large segment of the global market. Moreover, detailed data of the ITCS (International Trade by Commodities Statistics) is available for the OECD countries, including more than 6 000 product groups (classified by HS – Harmonized System), which make possible detailed and comprehensive trade analysis.

We divide the analysis of the Russian foreign trade into two main parts:

- Study of competitive positions of the Russian products on the OECD markets (Russian exports analysis)
- Assessment of the import-substituting potential in Russia (Russian imports analysis)

1. Competitive positions of the Russian products

To assess the competitive edge of the Russian commodities on the OECD markets we estimate average share of the Russian exports in total OECD imports. It is considered that Russia has got competitive edge in those products where its exports share in OECD imports is over the Russian average share and trade balance is positive (separated by cut-off dotted lines in the tables below).

The analysis starts from the brief look on the shares of the Russian products on OECD markets by the most aggregated two digit groups. Here the main sectors where Russia got competitive edge are outlined.

№ HS	*Product Group*	*Russia's share in OECD imports*
Russian average		1,09%
05	Pr. Group 1	3,14%
84	Pr. Group 2	2,10%
34	Pr. Group 3	0,60%
67	Pr. Group 4	0,51%

On the next step we go deeper into classification of the product groups, sketching out competitive positions on the four-digit level.

№ HS	*Product Group*	*Russia's share in OECD imports*
Russian average		1,09%
0504	Pr. Group 1	5,56%
8416	Pr. Group 2	4,78%
5710	Pr. Group 3	1,56%
1905	Pr. Group 4	0,78%

On this level of classification we look also on the largest OECD markets and share of Russian products on them. This is aimed on assessing not only relative indicators of competitiveness, but also absolute figures of Russian exports.

№ HS	*Product Group*	*OECD market, million USD*	*Russia's share in OECD imports*
5603	Pr. Group 1	20 000	0,06%
1209	Pr. Group 2	15 000	0,15%
0504	Pr. Group 3	4 000	0,56%
3402	Pr. Group 4	2 500	0,43%

Finally the most detailed (six-digit) product groups, possessing larger than Russian average share on the OECD markets, are revealed. Analysis on this stage makes it possible to bring study on the level of certain products and corresponding companies, and thus to sketch not only competitive commodities, but also outline competitive manufacturers.

№ HS	*Product Group*	*Russia's share in OECD imports*
Russian average		1,09%
841610	Pr. Group 1	9,86%
500420	Pr. Group 2	5,13%
341790	Pr. Group 3	2,84%
232178	Pr. Group 4	0,89%

2. Import-substituting potential

The analysis of import-substituting potential starts from sketching out commodity groups with highest share of Russian imports in OECD exports. Those products, which have more than Russian average share, are considered as possessing relative import-substituting potential (separated by cut-off dotted lines in the table below).

№ HS	*Product Group*	*Russia's share in OECD exports*
Russian average		0,83%
45	Pr. Group 1	2,45%
08	Pr. Group 2	1,07%
24	Pr. Group 3	0,59%
1208	Pr. Group 1	6,87%
4503	Pr. Group 2	2,45%
0813	Pr. Group 3	0,26%

On the next step we focus on the volumes of Russian imports. The statistical cluster analysis is used for singling out commodity groups with import-substituting potential. All the 6-digit commodity groups are divided into three clusters by volume of imports into Russia. The first cluster is interpreted as product groups possessing substantial possibilities for creating import-substituting production in Russia. The second cluster includes product groups with a good potential for import substitution. The third cluster is interpreted as product groups with very small possibilities for creating import-substitution production in Russia.

Product groups	*Average Russian imports, million USD*	*Average share in OECD exports*	*Domestic production potential*
4419, 5902 2413	524	3,34%	Substantial
3414, 4218 2911, 4811	256	2,57%	Good
Other	45	0,32%	Insignificant

Product groups with substantial and good potential for creation of import-substituting manufacturing are of interest for the further analysis.

№ HS	*Product Group*	*Russian imports, million USD*	*Russia's share in OECD exports*
Russian average			
4419	Pr. Group 1	712	2,20%
5902	Pr. Group 2	456	2,56%
2413	Pr. Group 3	404	5,50%
3414	Pr. Group 1	305	3,56%
4218	Pr. Group 2	287	2,45%
2911	Pr. Group 3	224	1,05%
4811	Pr. Group 4	208	3,22%

Finally, similar statistical cluster analysis is applied to the most detailed six-digit product groups. This, as in competitive edge study, helps to bring analysis on the level of certain products.

№ HS	*Product Group*	*Russian imports, million USD*	*Russia's share in OECD exports*
Russian average			
441912	Pr. Group 1	457	5,67%
590201	Pr. Group 2	325	4,07%
421835	Pr. Group 1	156	3,56%
341404	Pr. Group 2	123	2,45%
481102	Pr. Group 3	98	3,22%

Russia has a positive trade balance with the OECD countries in the articles "Mineral fuels, oil & products of its distillation, etc,." with a substantial export volume and a significant share of the OECD market.

Table 4.2 Indexes of Foreign Trade of Russia with the OECD Countries by Energy Sector Products

Index	*1999*	*1998*
Total exports, million USD	19,461	15,039
Share in total imports of OECD countries	6.3%	3.46%
Total imports, million USD	190	1,508
Share in total exports of OECD countries	0.13%	0.45%
Trade balance, million USD	19,271	13,531

Source: OECD statistics (1999)

The share of all Russian exports in the total imports of the OECD countries is 1.09%, and the share of fuel and energy imports is 6.3%, which proves the relative competitiveness of this product group on international markets.

For a deeper analysis it is useful to examine the statistics of international trade by different commodity groups, taking into account market volume.

Table 4.3 The Competitiveness of Russian Energy-Related Products on OECD market, 1999

S #	*Article*	*Share in OECD imports*	*OECD imports, million USD*	*Exports from Russia, million USD*	*Trade balance, million USD*
7	Mineral fuels, oils and product of their distillation, etc.	6.29%	309, 272	19, 467	19, 271
711	Petroleum gases and other gaseous hydrocarbons	7.54%	42,575	3,212	3,211
710	Petroleum oils & oils obtained from bituminous minerals other than crude, etc.	6.59%	61,943	4,085	3,966
709	Petroleum oils and oils obtained from bituminous minerals, crude	6.42%	176,855	11,361	11,361
701	Coal; briquettes, ovoids & similar solid fuel manufactured from coal	4.10%	14,874	610	608
704	Coke & semi-coke of coal, lignite/peat, whether or not agglomerated; retort carbon	3.94%	1,355	53	51
702	Lignite, whether or not agglomerated, excluding jet	2.89%	116	3	3
716	Electrical energy	2.15%	5,275	113	113
703	Peat (including peat litter), whether or not agglomerated	1.22%	539	7	7

Source: OECD statistics

As the above tables show, Russia is relatively competitive in the markets of many energy products. The bulk of Russian exports is, however, represented by raw materials. The tendency of improving the situation can be noticed, but its pace is quite modest.

It is interesting to examine the Russian export shares using a detailed, 6-digit classification. Table 5 presents commodity groups with a significant market in the OECD countries (more than $1 billion), where Russian export share is above average (1.09%).

Table 4.4 The Competitiveness of Russian Energy-Related Products, HS, 6-digit level, 1999

S #	*Article*	*Share in OECD imports*	*OECD imports, thousand USD*	*Exports from Russia, thousand USD*	*Trade balance, thousand USD*
271121	Natural gas in gaseous state	15.63%	19,757,588	3, 088 370	3, 088, 370
271000	Petroleum oils & oils obtained from bituminous minerals, o/than crude, etc.	6.59%	61,942,888	4,084 615	3,966,049
270900	Petroleum oils and oils obtained from bituminous minerals, crude	6.42%	176,854,690	11,360 545	11,360,545
270112	Bituminous coal, whether or not pulverised but not agglomerated	4.04%	13,012,332	525,847	525,601
270400	Coke & semi-coke of coal, lignite/peat, whether or not agglomerated; retort carbon	3.94%	1,354,896	53,372	50,914
270119	Coal nes, whether or not pulverised but not agglomerated	2.78%	1,167,816	32,419	32,408
271600	Electrical energy	2.15%	5,275,013	113,379	113,293
271112	Propane, liquefied	1.47%	5,759,602	84,745	84,722
271113	Butanes, liquefied	1.15%	2,430,228	27,927	27,652

Source: OECD statistics

A detailed analysis of competitive Russian product groups also shows the clear orientation of exports towards raw materials in the Russian energy sector.

4.3 The Role of Northwest Russia in Exports of the Russian Energy Sector

Northwest Russia occupies one of the strategic positions in Russian exports. Due to the favorable geographical position in relation to foreign markets, and to significant investments in the development of the trans-

port and harbor infrastructure, the role of the Northwest region as a large gateway to international markets has been growing in recent years. Today, the major products exported from Northwest Russia are oil, oil products and electric power, most of which go to European countries. The share of Northwest Russia in the Russian export substantially exceeds its share in production, that indicates the export orientation of the region.

The table below contains data on energy products exported from Northwest Russia.

Table 4.5 Energy Sector Exports in Northwest Russia

	Oil, including gas condensate, million metric tons	*Oil products, million metric tons*	*Coal, million metric tons*	*Electric energy, TWh*
Total Russian exports	134.8	56.9	27.8	17.9
Total exports from Northwest Russia	7.7	11.3	0.3*	8.5
Export share in total production in Northwest Russia, %	61.6	65.7	1.5	10
The share of Northwest Russia in total Russian exports, %	5.7	19.9	1.1	47.5

Note: According to estimations of experts, the export of energy coal amounts to 800 thousand metric tons per year
Source: Goskomstat (2000, 2001), Lenenergo (2001), Lukoil (2001), Surgutneftegaz (2001)

Oil products represent the largest share in the total export volume of energy products in Northwest Russia. Oil refining companies of Northwest Russia export more than 11 million metric tons of oil products. KINEF is responsible for 99% of the exports of oil products. The current export orientation of the company is explained by its favorable geographic location and the limited domestic market. Presently, KINEF exports more than 65% of its products. It is expected, that export oriented oil-refining will develop in the region.

The share of Northwest Russia in oil exports accounts for 7% and is expected to grow in the future as a result of the intensive development of the Timano-Pechora oil and gas province. Oil is exported mostly from the southern and central deposits of the field, located in the Republic of Komi (66% of the total oil exports).

The total amount of electric power exports from the Northwest region is over 8.5 TWh. It comprises 47.5% of the total electric power exports from Russia. The main exporter is RAO UES of Russia (90%), which owns intersystem power grids[8].

The potential of electric power exports in Northwest Russia will be determined by the development of the transport infrastructure, investments into modernization of old and construction of new generating facilities (the construction of the second generating unit at the Northwest Power Plant, and the construction of Power Plant #2 in the Kaliningrad region).

Development of new gas deposits in the region and, first of all Shtokmanovskoe field, will result in increase of gas export. As expected most part of extracted gas will be exported.

In addition to fuel and energy, there is also a potential to increase exports of power engineering products. Although the competitiveness of Russian manufacturers of power equipment is much lower than that of Western companies, the prospects for growth in this sector do exist. The major factors favorable to the development of power engineering are related to growth of domestic market and changes in the investment climate.

Thus, further development of energy sector will be oriented to exploit existing export potential of Northwest Russia.

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[8] RAO UES of Russia exports the major portion of power to Finland (about 6.7 TWh). Electric power is delivered through the substation (1,100 MW in capacity) located in the area of Vyborg. Electric power in the Northwest region is also exported by Lenenergo (from the Svetogorskaya hydroelectric power plant), Kolenergo, which sells electric power to Norway and Finland, and Pskovenergo, supplying consumers in Lithuania and Belarus with electric power.

5 Elements of the Energy Cluster of Northwest Russia

5.1 Industries and Their Agglomerations

There are six industries that manufacture primary products in the energy cluster of Northwest Russia:

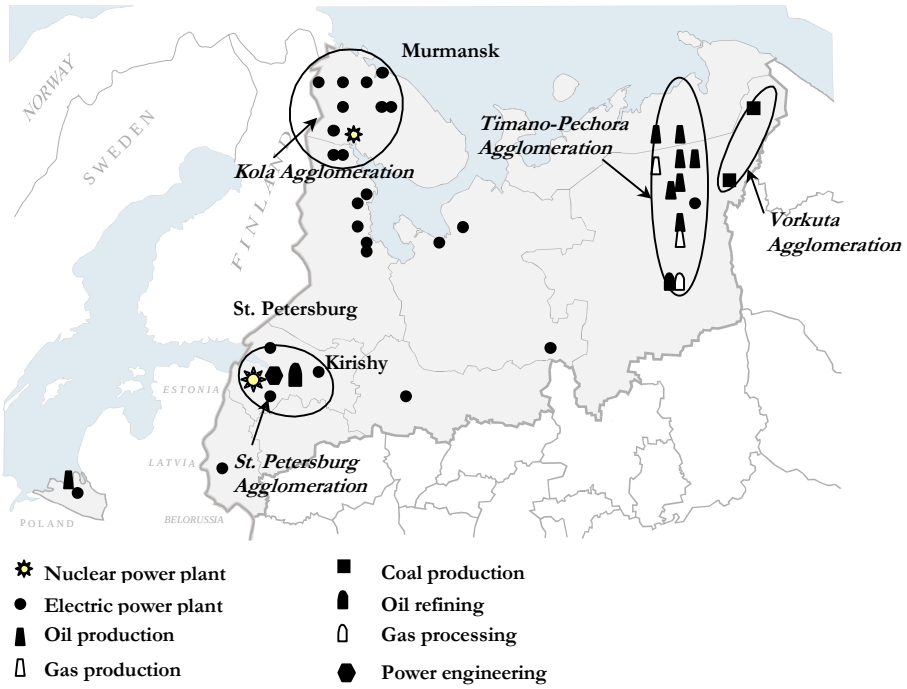
- The oil production industry, including oil production and transportation;
- The oil refining industry;
- The gas industry, including gas production, transportation and processing;
- The power industry, including power generation and transmission of electric and thermal energy;
- The coal and shale industry, including coal and shale extraction and enrichment;
- The power engineering industry, including manufacturing of equipment for energy production and transportation

Four regional agglomerations of the energy cluster can be distinguished in Northwest Russia. They are the Kola, St. Petersburg, Timano-Pechora and Vorkuta agglomerations. They differ from one another.

Today, the Timano-Pechora and Vorkuta agglomerations specialize primarily in the extraction of raw materials and are based around oil, gas and coal deposits. The extraction of raw materials there dominates over processing of them and electric power production. At the same time, there is significant potential for the development of the power industry in the region, based on large available reserves of raw materials and hydro resources, and the geographical proximity to large consumers located in the Urals and Central Russia.

The Kola agglomeration is characterized by considerable energy production, which includes nuclear, thermal and hydropower plants. The region possesses the highest potential for the development of hydropower in Northwest Russia, due to favorable relief conditions and the energy of high tides.

Figure 5.1 The Largest Agglomerations of the Energy Sector in Northwest Russia



St. Petersburg agglomeration includes the largest power plant in the region (the Leningrad nuclear power plant), a number of thermal and hydropower plants, KINEF oil refining plant (one of the largest in Russia), and the power engineering complex of St. Petersburg. Here, the energy cluster produces products with higher added value, and there is a significant potential for future development.

The St. Petersburg agglomeration is the most important one in Northwest Russia. The main companies that provide scientific and technical engineering support for other agglomerations, as well as educating most of qualified personnel in Northwest Russia are located here. In addition, St. Petersburg and the surrounding areas of the Leningrad region are a gateway in trade, scientific and innovation networks.

Besides this agglomeration there is an extensive network of relatively small thermal and hydropower plants in Northwest Russia that supplies local consumers with power. The concentration nodes of this network are the regional energy companies (subdivisions of RAO UES of Russia), which are based in the administrative centers of the regions.

5.2 The Oil Production Industry

The Northwest is one of the largest oil regions in Russia. In terms of volume of oil production, it occupies the third place after Western Siberia and the Volga region. One of the largest oil and gas provinces in Russia – Timano-Pechora – is located here.

Figure 5.2 The Structure of the Oil Sector in Northwest Russia

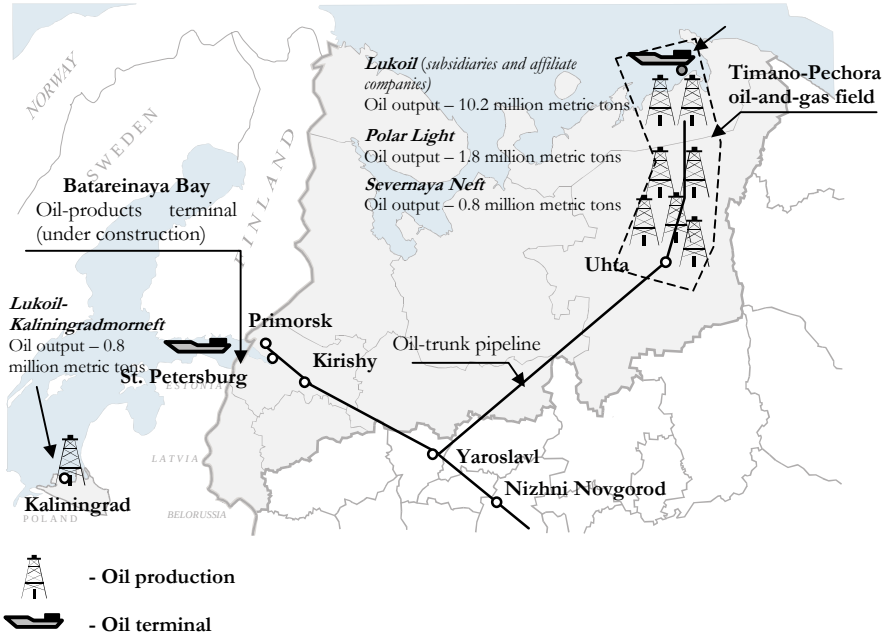


Table 5.1 Oil Reserves in Northwest Russia

	Reserves, million metric tons
Total in Russia	15,300
Total in Northwest Russia	1,395.6
Including:	
The Republic of Komi	506.6
The Nenetsk autonomous district	865
The Kaliningrad region	24

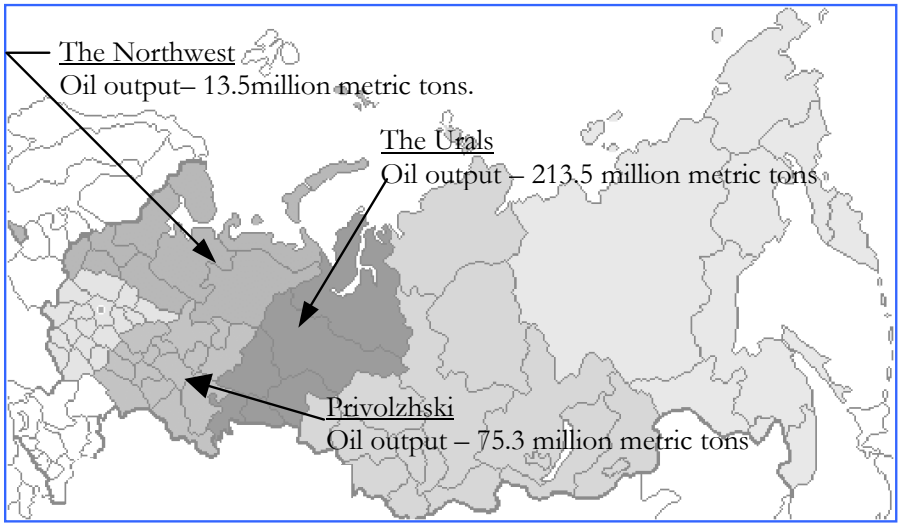
Source: Minenergo (2000), LUKOIL (2001), The Center for Strategic Research (2001)

Oil is extracted in three regions of Northwest Russia: the Republic of Komi, the Nenetsk autonomous district (geographically part of the Ark-

hangelsk region), and the Kaliningrad region. These regions possess oil resources that amount to 1,395.6 million metric tons of explored reserves. Especially significant are the deposits of the Timano-Pechora oil and gas province, geographically located in the Republic of Komi and the Nenetsk autonomous district. The province is under active development and already by 2010 the abovementioned regions are expected to provide more than 10% of the total volume of oil produced in Russia. The importance of this region can be explained by three major factors:

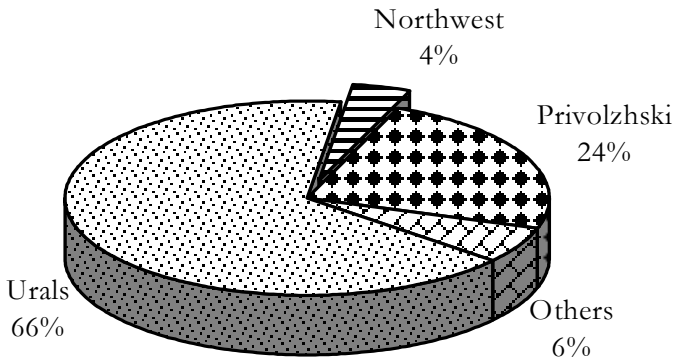
- The geographical proximity of the Northwest region to Western markets allows it to export oil and oil products at transportation costs that are lower than those for transporting oil from other oil regions of Russia.
- Oil production in old Russian oil regions, such as the Northern Caucasus, the Southern Urals, and the Volga region is declining as a result of depletion of resources. Thus, the development of new deposits in the relatively new Timano-Pechora oil and gas fields in the future will help to stabilize the total oil production in Russia. Timano-Pechora is to become the second oil region after Western Siberia in terms of production.
- The region has a strategic importance in providing the northern territories of the Russian Federation (such as the Republic of Komi, the Arkhangelsk and Murmansk regions, and others) with oil products.

Figure 5.3 The Major Oil-Producing Regions (Russian Federal Districts)



Source: Goskomstat (2001)

Figure 5.4 The Share of the Northwest in Russian Oil Production (by Federal Districts)



Source: Goskomstat (2001)

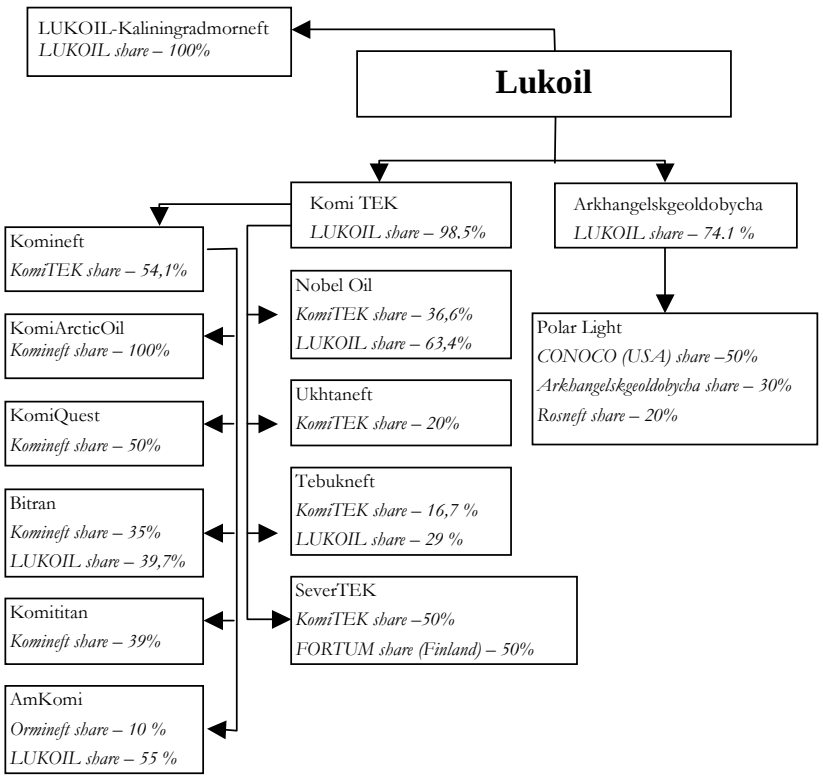
Small oil deposits are located in the Kaliningrad region (18 deposits), and have only regional significance. On average, the reserves of each deposit amount to 1.5 million metric tons. The largest oil deposit in the Kaliningrad region, Kravtsovskoe, is located offshore in the Baltic Sea (the possible reserves are estimated at 8.9 million metric tons). Currently, this deposit is being prepared for development.

More than 40 oil companies operate in the region. They explore the deposits, carry out the development of mining, and produce oil and gas condensate. Lukoil is the largest oil company in Northwest Russia.

Box 5.1 Lukoil

Lukoil actively operates in the region, developing the transport infrastructure, and making the largest investments into the exploration and development of deposits. Today, Lukoil controls virtually all large oil producing companies in Northwest Russia. The company has a sound strategy, which is aimed at the concentration of resources and the creation of entry barriers for other firms. The following instruments for implementing this strategy are used: the acquisition of other companies, and the development of its own transport infrastructure - oil pipelines and sea terminals - in order to provide oil shipping by sea. At the present time Lukoil factually gained a monopolistic position in oil production. The growth rates of oil producing industry in Northwest Russia are presently fully connected with the activities of Lukoil in the region.

Lukoil Subsidiaries and Affiliated Companies in Northwest Russia



An essential part of the oil industry, which promotes its effective development, is the transport infrastructure, and in the first place, oil pipelines and ports. It is actively developing in Northwest Russia. Large investments are attracted into the construction of oil ports and pipelines. Today, two main projects in the area of oil transportation are being carried out in Northwest Russia: the Baltic Pipeline System and the Northern Territories.

The transport capacity of the existing oil pipeline Haryaga-Usinsk today amounts to five million metric tons per year. This is insufficient if we take into consideration the future increase in oil production in the Nenetsk autonomous district. This is why there are plans for construction of an additional Haryaga-Usinsk oil pipeline, with transport capacity of five million metric tons.

Table 5.2 Largest Oil Producing Companies in Northwest Russia

Company	*Oil production, million metric tons per year*	*The share of production in the region, %*	*Turnover, million USD*	*Personnel, people*
LUKOIL[9]	11.35	82.2	-	-
Including its subsidiaries:				
KomiTEK (including Kominift)	3.95	28.6	380.6	4,873
Nobel Oil	1.3	9.4	69.3	273
KomiArcticOil	1.04	7.5	91.9	400
Bitran	0.5	3.6	35.8	175
LUKOIL-Kaliningradmorneft	0.68	4.9	83.7	1,092
Tebukneft	1.46	10.5	72.5	2,600
Severnaya Neft	0.84	6.1	60.9	500
Polyarnoe Siyanie	1.8	13.0	226.5	no data

Source: LUKOIL (2001), The Federal Securities Commission (2001), Goskomstat (2000)

Box 5.2 The Development of the Oil Transport Infrastructure in Northwest Russia

The Baltic Pipeline System

The Baltic Pipeline System (BPS) has been constructed as an alternative to existing transport routes of Russian oil through ports of the Baltic countries, such as Ventspils (Latvia) and Buting (Lithuania). BPS includes:

- The existing Haryaga-Usinsk-Ukhta-Yaroslavl-Kirishi oil-trunk pipeline,
- New oil-trunk pipelines:
  - Haryaga-Usinsk
  - Kirishi-Primorsk

An oil port near Primorsk (the Leningrad region) for the export of oil from deposits of Western Siberia, the Timano-Pechora oil and gas province, the Urals, and the Volga region, as well as from the CIS countries (primarily from Kazakhstan).

[9] Lukoil subsidiaries, in which the company possesses 100% of the stock, produce 7.5 million metric tons of oil in Northwest Russia (54% of the total oil production). According to the annual report of Lukoil, the total production volume in Timano-Pechora equaled 10.7 million metric tons in 2000 (including oil production by joint ventures and affiliated companies, in which Lukoil does not possess the controlling interest).

According to the project, the transmission capacity of the Baltic Pipeline system is going to be 30 million metric tons per year, which breaks down into two stages: 12 million metric tons, and 18 million metric tons, respectively. Presently the construction of the second stage of the system is being carried out.

Northern Territories

Northern Territories is a joint project of the Lukoil and CONOCO Companies, aimed at the development of a group of oil deposits in the North of the Timano-Pechora oil and gas province. According to the project plan, a transport infrastructure will be developed by constructing a local pipeline network and an oil terminal on the shore of the Barents Sea in the area of Varandeya bay. The total transmission capacity of the terminal according to the project will accommodate 7.5 million metric tons of oil per year.

The Murmansk Region

The port of Murmansk may also become a direction of oil export. The Murmansk harborage does not freeze all the year round and allows the loading of tankers of 300,000 metric tons displacement. This project was initiated by the Lukoil company, which possesses 22% of the port's chapter stock. According to estimates of Lukoil managers, the load capacity of the new oil terminal may amount to 30 to 50 million metric tons a year. However, the prospects for this project have not yet been determined, because prior to its implementation it will be necessary to build a pipeline connecting Yaroslavl and Murmansk and to receive substantial investments from the Transneft company.

Today, two major owners of the oil transport systems (oil pipelines, and oil terminals and ports) operate in Northwest Russia. The largest owner is the government, represented by the Transneft company, which is constructing the Baltic Pipeline System (BPS project further on). Besides the trunk-oil pipelines, the government also has the Primorsk seaport, which is now under construction. Thus, the government has assumed all the risks connected with implementing the BPS project. These risks may be rather high, since the installation of the BPS facilities and the increase in the shipping and export of oil through Northwest Russia will lead to stronger competition with the ports in Latvia and Lithuania. The Baltic ports Buting and Ventspils have already attracted large investments (mainly from the USA) for modernization. The sea does not freeze there during the winter period; in addition, the Russian companies Lukoil and Yukos are shareholders in these ports. Thus, in the event of successful development of the BPS in Northwest Russia, price competition for oil shipping is expected to increase in the future.

The second largest owner of transport infrastructure is Lukoil. It owns the pipeline from the Haryaga deposit to a distribution network near the

town of Usa[10,] and also the oil terminal in Varandeya bay on the coast of the Barents[11] Sea in the Nenetsk autonomous district, as well as a related pipeline system (now under construction), which connects the oil deposits in the north of the Timano-Pechora oil and gas field.

Today, the interest of the Russian oil companies in the development of an oil transportation infrastructure is growing. Competition in this sector is intensifying, because oil companies follow the same strategy of growth of oil exports, resulting in the expansion of their global market share.

The increase in the pipeline transportation capacity, as well as the development of Northwest Russia port infrastructure, and consequently the growth of oil transit, reinforce the region's position as the gateway to global markets of energy resources. Furthermore, potentially favorable conditions for the development of the oil-refining sector prevail, in the light of an advantageous geographical position and export opportunities, as well as the infrastructure, which allows access to raw materials.

5.2 The Oil-refining Industry

The oil-refining sector in Northwest Russia is represented by two subsidiaries of the largest Russian oil companies – KINEF (Surgutneftegaz) and LUKOIL-Ukhtaneftepererabotka (LUKOIL). Oil-refining plants in Northwest Russia provide 11.4% of primary refining of oil in the Russian Federation, which amounted to 174.5 million metric tons in 2000. The companies are the main suppliers of oil products in the region. About 35% of KINEF products and 95% of Ukhtaneftepererabotka products are sold in the Northwest.

Oil-refining plants are characterized by low indicators of processing depth: at KINEF this indicator is 53%, and for Lukoil-UNP it is only 45%. In light of the above, one of the primary strategic goals of the companies is their technological modernization with the aim of deeper refining of oil.

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[10] Several court hearings between the LUKOIL and Transneft companies have taken place, which concerned the status of this pipeline (trade route or trunk-line). If declared a trunk-line the pipeline would be subject to antimonopoly law, and consequently, prices for oil transportation would be determined by the government. In 2001, the court declared this pipeline to be a trade route.

[11] The first stage of the terminal has already been installed.

Table 5.3 Oil Refining Companies in Northwest Russia

Index	*Lukoil – Ukhtanefteper-erabotka (or Lukoil –UNP)*	*Kirishinefteorgsintez (or KINEF)*
Location, city/region	Ukhta, Republic of Komi	Kirishi, Leningrad region
Installed primary oil processing capacity, million metric tons	5.0	17.3
Primary processing, million metric tons	3.6	16.3
Turnover, million USD	18.36	570
Personnel, people	1,250	6,098

Source: Surgutneftegaz (2001), LUKOIL (2001)

It is important to note that the oil-refining companies in Northwest Russia, as well as the majority of refineries in Russia, are absolutely dependent on the policy of the parent companies concerning the distribution and investments of oil products. The parent companies distribute oil products through their affiliated companies and cover the expenses of refineries through a transfer pricing system.

Figure 5.5 Oil Refining in Northwest Russia

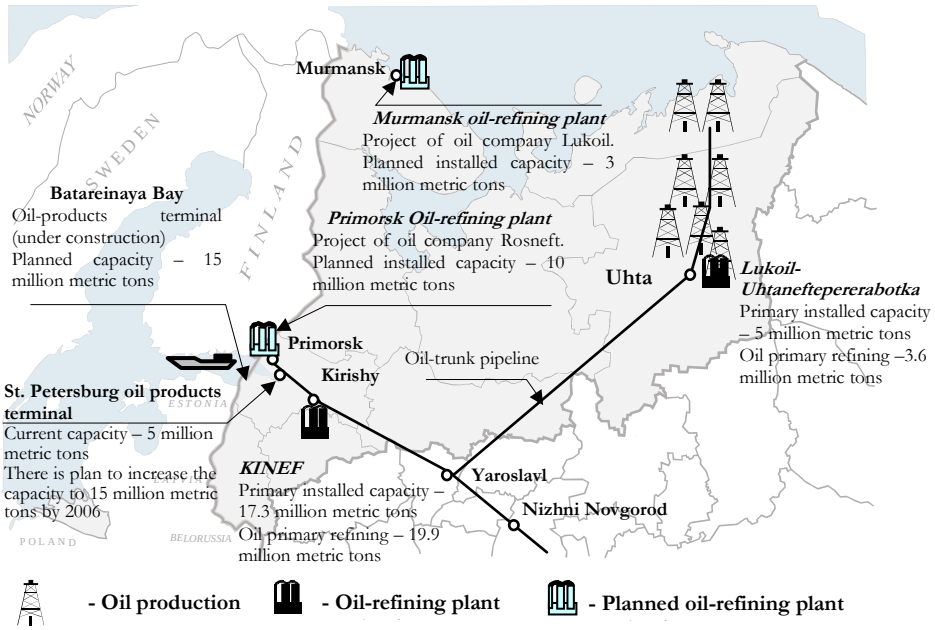
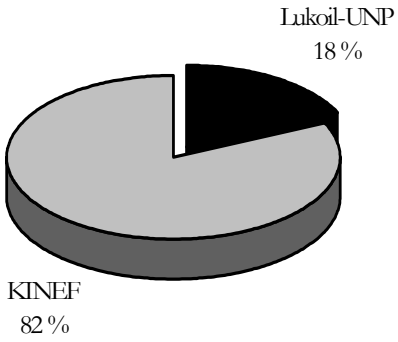


Figure 5.6 Shares of Companies in Primary Oil Processing in Northwest Russia



Source: Surgutneftegaz (2001), LUKOIL (2001)

KINEF is located in the Kirishi area of the Leningrad region. Raw materials are supplied by Surgutneftegaz from deposits in Western Siberia through a trunk-oil pipeline.

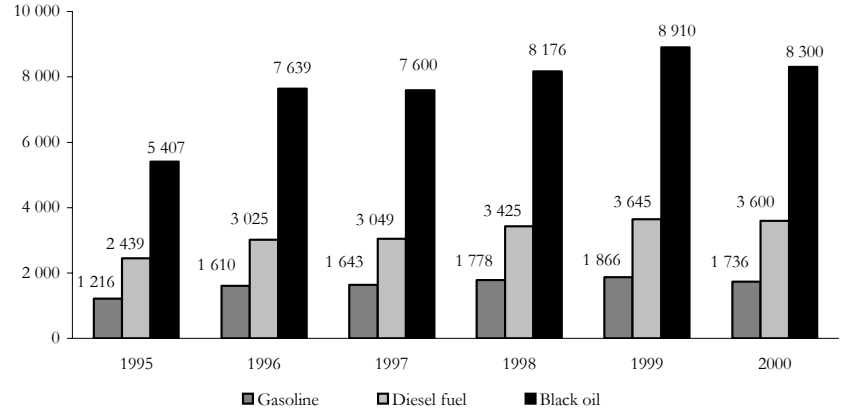
KINEF is one of the largest and most modern oil-processing plants in the Russian Federation. Its installed oil-processing capacity equals 17.3 million metric tons. The depth of oil processing is 53%. The enterprise was initially established mainly for supplying fuel oil to naval bases of Northwest Russia. The primary strategic goal of the company is to increase the depth of oil processing and to produce oil products with high added value. Presently, KINEF is constructing a plant for deep oil processing, which should help it to increase its production volumes of gasoline to 5 million metric tons per year.

The company is actively carrying out a policy of diversification, introducing petrochemical and chemical production. Approximately 30% of the company's commodity output is represented by petrochemical products. Two subdivisions of the company have been established:

- Izofleks plant produces bituminous-polymeric materials for plumbing and flashing. It is the largest Russian plant producing materials of this kind.
- A complex producing linear alkylbenzene, the major component of synthetic detergents. This product is supplied to both Russian and foreign producers of synthetic detergents.

KINEF manufactures a total of 40 kinds of products, the primary ones being: gasoline, diesel fuel, fuel and bunker oil, oil asphalt, liquefied hydrocarbon gases, and petrochemical products (oil aromatizers).

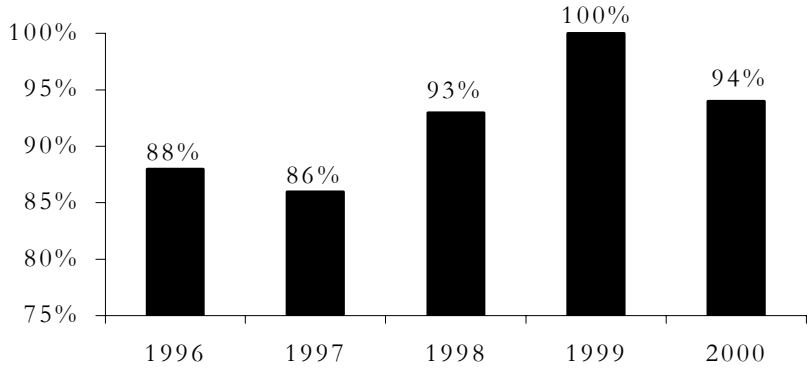
Figure 5.7 Oil Products Manufacturing by KINEF, thousand metric tons



Source: Surgutneftegas (2000)

The share of KINEF in the total volume of primary oil processing in Russia equals about 10%. The plant demonstrates one of the highest levels of utilization of production capacity of all Russian oil-processing plants.

Figure 5.8 Utilization of KINEF capacity



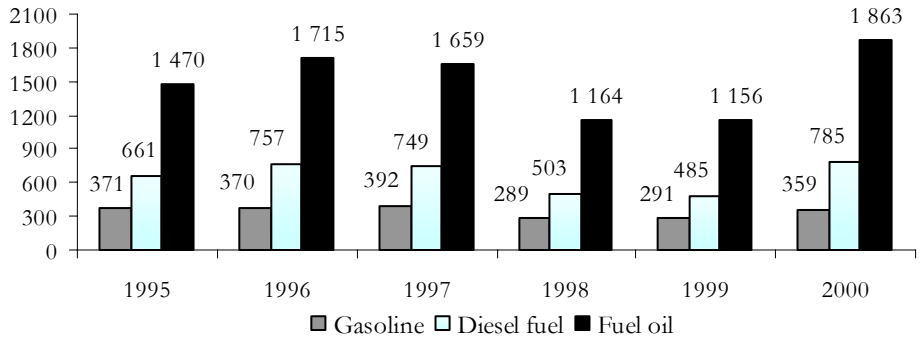
Source: Surgutneftegaz (2000)

KINEF is currently an export-oriented company. Presently, 60-70% of the company's products go for export. The export volume in 1999 was 11.12 million metric tons of oil products and petrochemical products. The primary domestic consumers of the company's products are located in Northwest Russia – The Leningrad, Novgorod, Pskov, Murmansk regions, and the Republic of Karelia.

LUKOIL-UNP is one of the oldest oil-processing plants in the Russian Federation. It is located near the city of Ukhta in the Republic of Komi. The installed capacity for primary oil processing is 5 million metric tons per year. Crude oil is supplied through the oil pipeline from the oil deposits of Timano-Pechora oil and gas field, located in the Republic of Komi.

Until not long ago, the plant occupied the last place in the country in depth of oil processing, not exceeding 42-43%. This factor determined the low share (12%) of light-end products in the total commodity output of the company. In 1999, Ukhta Oil Processing Plant was acquired by Lukoil, the largest Russian oil company, which actively began carrying out the plant's modernization. Reconstruction of the first oil processing machine was completed in 2001, and helped to increase the depth of oil processing to 55%.

Figure 5.9 Oil Products Manufacturing by Lukoil-UNP, thousand metric tons



Source: LUKOIL (2000), Goskomstat (2000)

The volume of primary oil processing carried out by Lukoil-UNP today comes to about 3.6 million metric tons per year. The share of the company in the total volume of Russian primary oil processing is 2.1% (in 2000, oil processing grew by 200%, compared to the level of 1999). After the plant's acquisition by Lukoil, the utilization of production capacity grew significantly, and exceeded 70% in 2000. In 2001, Lukoil-UNP acquired the oil-processing company Bitran-pererabotka, which had used the facilities of Lukoil-UNP and had been a daughter company of Lukoil.

Lukoil-UNP is the only large oil-processing company in North Russia. Oil products by this company are sold primarily in the northern regions

(such as the Republic of Komi, and the Murmansk and Arkhangelsk regions). A total of 95% of its products are sold on the domestic market. Export is not significant in the total volume of sales. Only fuel oil is exported (about 130,000 metric tons per year).

The interests of the two largest players in the Northwest Russian market for oil products, Lukoil and Surgutneftegas, do not intersect either in the delivery of raw materials or in terms of their major consumers. Competition is observed primarily in the retail market for gasoline.

Today, the production facilities in Northwest Russia are being expanded due to the reconstruction of existing refineries. A number of companies have announced plans for establishing new refineries, due to the development of the pipeline system and the growth of oil transit through the region. The most ambitious plans belong to Surgutneftegas and Rosneft, who intend to build a refinery in the area of Primorsk. It is expected that the capacity of this refinery will amount to 7 – 10 million metric tons. The refinery will be completely oriented towards export. Lukoil has also announced its intention to build a new enterprise. It is expected to erect a refinery in the area of Murmansk. Its annual refining capacity may amount to 3 million metric tons. It is important to note that the prospects for implementing these plans are not clear. The companies are on the initial stage of the projects development and it is possible that new alternative projects may appear in the future. In any case, it is evident already today that the competition in the oil-refining business is intensifying in Northwest Russia.

As it is in the oil industry, the transportation infrastructure for the export of oil products is developing in Northwest Russia. Today, Russian companies are attempting to re-direct the flow of export oil products from the ports of Ventspils (Latvia) and Tallinn (Estonia). However, the existing infrastructure hinders the achievement of this goal.

The major operating terminal for oil products is located in St. Petersburg. Five million metric tons of oil products, including 2.9 million metric tons of fuel oil and 2.1 million metric tons of diesel oil, are exported through this terminal. The implementation of a plan to expand the terminal will increase its capacity to 15 million metric tons by 2006. It will require significant investments in the infrastructure, including deepening the maritime canal, the development of highways and railroad systems, etc. Some other projects include:

- Building a terminal with a capacity of 15 million metric tons a year near the Batarejnaya bay in the Leningrad region. Surgutneftegas plans to implement this project.
- Building a terminal with a capacity of 3 million metric tons a year in Vysotsk (the Leningrad region). Lukoil plans to implement this project.

- Building a terminal with a capacity of 5 million metric tons a year in the area of Luzhskaya Guba (the Leningrad region). Transneftеproduct (the subsidiary of Transneft) plans to implement this project.
- Building a terminal with a capacity of 10 million metric tons a year in the area of Primorsk (the Leningrad region). The project belongs to Transnefteproduct.

Thus, at the moment there are many competing projects in the area of transshipment of oil products for export. It is difficult to determine their prospects for implementation. In addition, these projects are oriented towards the same exporters of oil products (the largest exporter being Surgutneftegas, which plans to build its own terminal).

5.3 The Gas Industry

The gas industry of Northwest Russia is represented by the subsidiaries of Gazprom company, which carry out transportation, extracting and sale of natural gas. The largest subdivisions of Gazprom in the region are Severgazprom and Lentransgaz. They provide 100% of the transportation volume and 99.9% of the natural gas production volume in Northwest Russia.

Figure 5.10 The Gas Industry in Northwest Russia

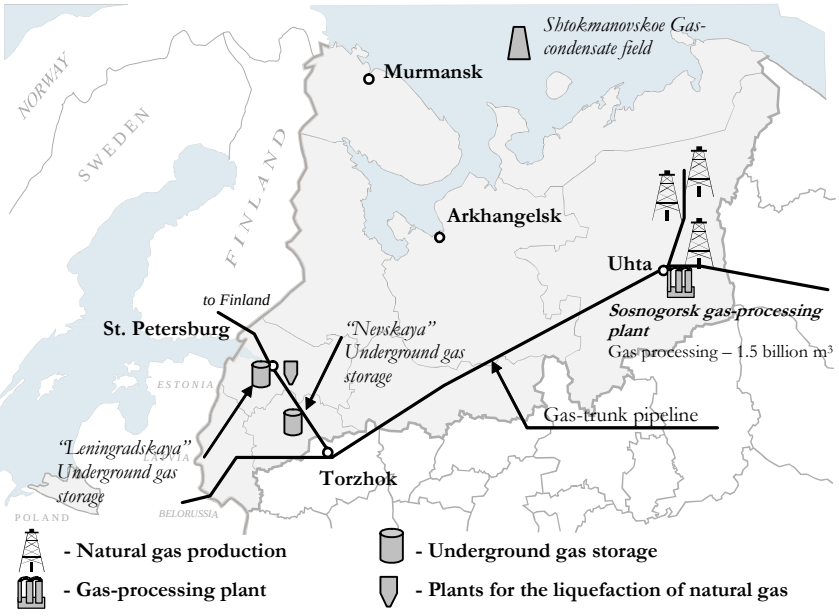


Table 5.4 Production and Transportation Volumes of Gas Companies in Northwest Russia

Company	*Gas transportation volume, billion m³*	*Gas production volume, billion m³*	*Turnover, million USD*	*Personnel, thousand people*
Severgazprom	76.8	3.3	-	2.4
Lentransgaz	70	-	-	3.5

Source: Company data (2001)

Trunk-transportation of gas is carried out by 22 operating departments of the Lentransgaz and Severgazprom companies. These companies make up a unified system of gas transportation, which supplies gas to all the regions of Northwest Russia and for export. Most of the gas (95%) is supplied from the northern areas of the Tyumen region. The total length of the gas transportation systems of both companies is more than 17,000 km, including more than 3,200 km of gas-pipeline branches.

Box 5.3 Gazprom

Gazprom is the largest gas company in Europe. Today, the company controls 29.9 billion cubic meters of natural gas stock (65% of the explored Russian gas reserves). The Gazprom share is 90% of the total extracted gas in Russia (512 billion cubic meters) and 21% of global production.

The largest problem Gazprom faces today is resource depletion. The major fields, where more than 60% of Russian gas is extracted (Medvezhje and Urengojskoye), are largely exhausted and levels of extraction are decreasing. These fields are depleted by 70% on average. For this reason, Gazprom mainly invests in the development of new gas fields in Western Siberia. In 2001, Gazprom began to exploit a new gas field, Zapolarnoye, with reserves amounting to 2 billion cubic meters. This field should become Gazprom's main field in the future, and it is expected to produce 100 billion cubic meters of gas per year.

The primary strategy of the company in Northwest Russia includes the development of gas pipelines for exporting gas to European consumers. The only major project for gas extraction is the development of the Shtockmanovskoye shelf deposit in the Barents Sea. However, due to lack of financial resources, the development of this field is constantly postponed. The planned extraction of gas at the Shtockmanovskoye shelf deposit is scheduled to begin no earlier than 2008.

At present, Gazprom reduces gas supply to the domestic market as a result of the decrease in production and the obligations of exporting gas (according to long-term contracts, Gazprom will have to export 2.3 trillion cubic meters in total). Consequently, the role of oil companies on the domestic gas market is increasing. The major oil companies have already begun to develop gas fields. It is expected that the share of oil companies in the domestic gas market may reach 25% in the next decade.

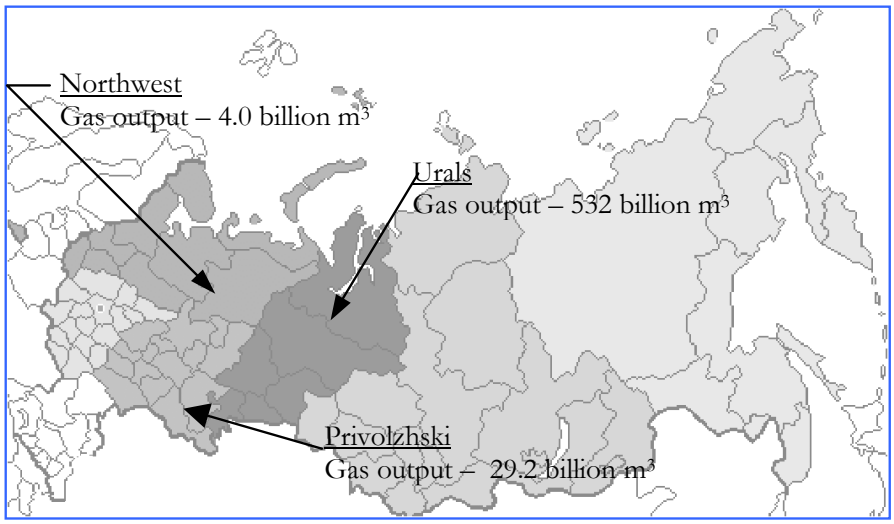
Table 5.5 Gas Reserves in Northwest Russia

	Reserves, trillion m³
Total in Russia	49.2
Total in Northwest Russia	3.3
Including:	
Shtokmanovskoe deposit	2.8

Source: Minenergo (2000), Gazprom (2001)

The main element of the Northwest Russian gas-transport infrastructure is the Severnoe Siyanie main gas pipeline, which is 7,300 km in length. Severnoe Siyanie is operated by Severgazprom, which transports gas through the pipeline to the town of Torzhok (Tver region). The gas then goes to the gas-transport system of Lentransgaz and is distributed to Russian regions and for export. The major gas importers are Finland, Germany, the countries of Eastern Europe, and the Baltic countries.

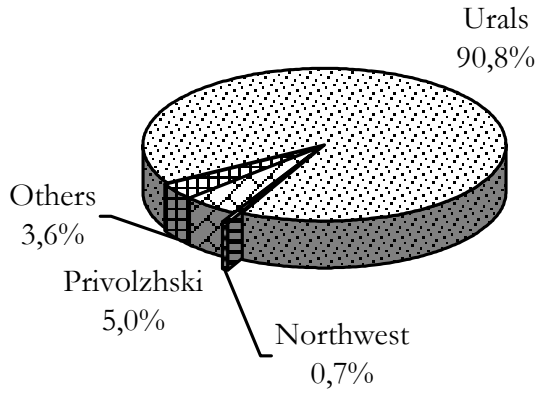
Figure 5.11 The Main Gas Production Regions in Russia (by federal district)



Source: Goskomstat (2001)

Significant growth of gas pumping is expected in the near future. This is connected with the installation of the Yamal-Europe transcontinental gas pipeline, part of which goes through the zone of the Northwest gas companies.

Figure 5.12 Gas Production in Russia (by federal district)



Source: Goskomstat (2001)

The amount of gas produced in the Northwest equals 4 billion m^3 (natural gas and oil gas), which is 0.7% of the total Russian gas production volume. The share of natural gas in the total production volume is 82%. Natural gas is extracted in gas and gas-condensate fields of the Republic of Komi; oil gas – in the oil fields of all three extracting regions of the Northwest.

The depletion of the natural gas reserves (on land) under exploitation of the $A+B+C_1$[12] categories in the Republic of Komi amounts to 69.9%, on average. At the present moment, the explored reserves of gas in Northwest Russia are estimated to be 3.3 trillion m^3. Most of the industrial reserves of gas (74%) are assets of Severgazprom. The assets of Severgazprom include ten oil- and gas-condensate deposits, with current recoverable gas reserves of 332.2 billion m^3, gas condensate reserves of 35.1 million metric tons, and oil reserves of 14.0 million metric tons.

Box 5.4 Future development of gas production in Northwest Russia

The future development of gas production in Northwest Russia is connected with the development of a number of new deposits in the Timano-Pechora oil and gas field and of the Shtokmanskoe gas-condensate deposit on the shelf of the Barents Sea. The gas reserves of the Shtokmanskoe deposit amount to 2.8 trillion m^3, which is comparable to the reserves of the largest deposits in the north of the Tyumen region. Rosshelf, a subsidiary of Gazprom, carries out the development of the shelf of the Northern seas.

[12] According to Russian classification of reserves.

During recent years, more and more experts oppose this project with the following arguments:

- Availability of large undeveloped gas reserves in the Tyumen region, the major gas-producing region in Russia.
- Development of shelf deposits requires considerably more investment than the development of deposits on land.
- Development of the Shtokmanovskoe deposit will require the establishment of a new transport infrastructure and also significant investments into the modernization of shipbuilding companies, in order to allow to construct drilling platforms. As for the Tyumen region, the required infrastructure has already been developed for the most part.

The future of the Shtokmanovskoe deposit and the timeframe for its exploitation have not yet been determined. Its proximity to markets, as well as its interest for European companies, may become crucial factors for the development of this deposit in the medium term.

Gas extraction in the region experiences a series of negative trends. The largest gas-condensate fields, the Vuktylskoye[13] (70% of the gas reserves and 90% of the extraction of the Republic of Komi) and the Zapadno-Soplesskoye, are at a stage of declining production, and their capabilities for increasing extraction are exhausted. The remaining fields in which extraction is taking place will be able to sustain the current level of extraction for only a few years. There are no gas fields ready for extraction in the Republic of Komi. The tested fields are remote from the gas-transport infrastructure, and putting them into operation requires significant investments.

The processing of gas and gas condensate in Northwest Russia takes place in the Sosnogorsky gas-processing plant (the Republic of Komi), founded in 1941. At the moment, the Sosnogorsky plant is a unit of the Severgazprom company. Its annual capacity is 1.5 billion cubic meters of processed gas.

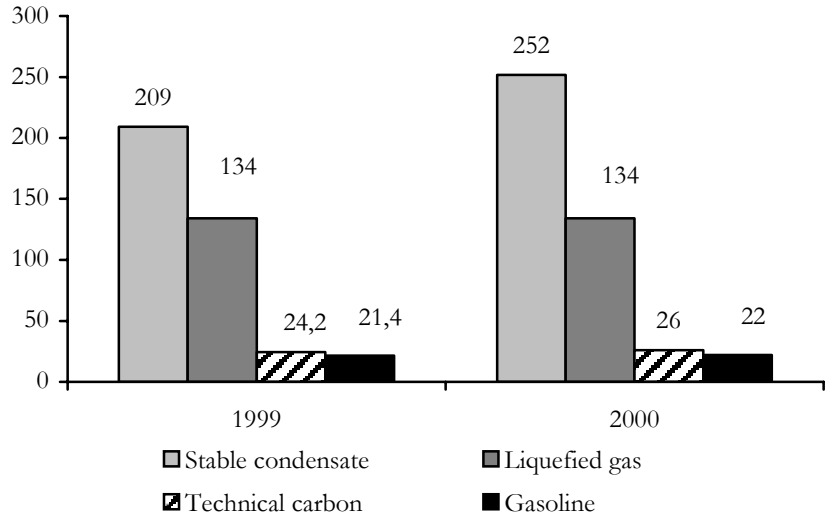
The main products of the Sosnogorsky gas-processing plant are:

- Liquefied gas
- Stable condensate
- Technical carbon
- Gasoline

[13] Today, the Vuktylskoye field is the largest field under exploitation in the Northwest.

At the present time, Severgasprom is implementing the reconstruction of the Sosnogorsky gas-processing plant. The main goal of restructuring is to modernize production, as well as to increase production capacity and the depth of gas processing.

Figure 5.13 Production of Sosnogorsk Gas-processing Plant, thousand metric tons



Source: Severgazprom (2000), Komistat (2000)

In addition to Severgazprom, the Lentransgaz company produces, stores and transports liquefied natural gas. The plant for natural gas liquefaction was established at the company, and at present the annual volume of liquefied gas production of Lentransgaz is 196,000 metric tons. Today, the company is trying to expand the production and distribution of liquefied gas in Northwest Russia.

The sales of gas within the region are supervised by subdivisions of special Gazprom division – Mezhregiongaz.

5.4 The Power Production Industry

The power industry in Northwest Russia is represented by nine regional companies (which are subsidiaries of RAO UES of Russia), three large electric power plants (under the direct control of RAO UES of Russia), two nuclear power plants, as well as a number of small electric power plants and boiler houses, which belong to the municipalities and to in-

dustrial enterprises. The total installed capacity of generating facilities in Northwest Russia equals 30.8 GW, which is 15% of the total installed capacity of the Russian energy sector; 84.2 TWh of electric power was generated in the region (9.5% of the total Russian production volume) in the year 2000.

Box 5.5 RAO UES of Russia

RAO UES of Russia is an industry-wide holding company supplying electric and thermal power to industries, and the public and private sectors, as well as providing centralized control over the Unified Energy System of Russia. The holding company consists of:

- 73 regional energy companies (AO-energos);
- 32 large-scale public power plant corporations (AO - power plants);
- Public Corporation of Central Dispatching of Unified Energy System of Russia;
- Account Center of FOREM;
- 5 power supply management companies;

As of January 1, 2002, the production facilities of RAO UES of Russia consisted of thermal and hydropower plants with a total capacity of about 156 GW (72% of the installed capacity of electric power plants in Russia). The length of transmission lines of 220 KV and higher is 151,000 kilometers. Six united energy systems, including the Northwest, Central, Middle Volga, Urals, Northern Caucasus and Siberia, are operating jointly. The Eastern system functions separately from the UES of Russia.

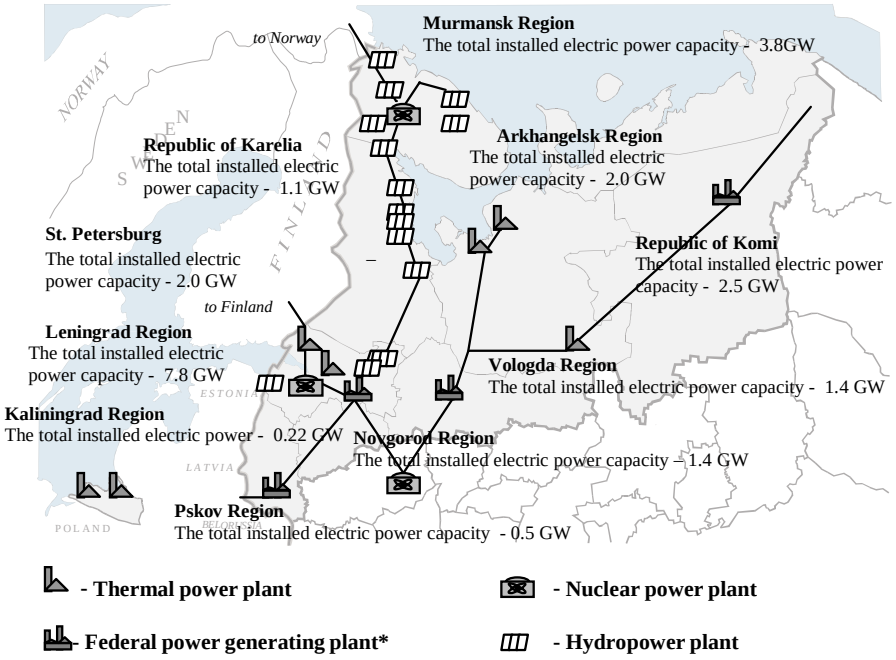
The power plants of the company produced 626.8 TWh of electric energy in 2001. This is 70.6% of the total production volume of Russia. The supply of thermal energy equaled 479.6 million Gcal in 2001.

In 2001, the power systems of Byelorussia, Estonia, Latvia, Lithuania, Georgia, Azerbaijan, Kazakhstan, Ukraine, Moldova, Uzbekistan, Turkmenistan, Tajikistan and Mongolia functioned concurrently with the UES of Russia. The company is constantly increasing the volume of export of electric power. In 2001 it exported 17.9 TWh for an amount of $254 million.

In the last years RAO UES of Russia managed to improve significantly its business performance. The consolidated revenue of RAO UES of Russia amounted to $13.71 billion in 2001, with a net profit of $1,4 billion.

In 2001, the restructuring of RAO UES of Russia started. The main goals of the restructuring process include creating a competitive electric power market, as well as attracting strategic investments to the industry. The results of the reform will largely determine the dynamics and the directions of energy sector development in Northwest Russia. The issue of power industry reform in Russia and in Northwest Russia is specified in the Appendix "Energy Networks as a Marketplace."

Figure 5.14 Power Sector of Northwest Russia



Note: A large state owned power (electricity and heat) generating plant, operating on natural fuel (usually gas and fuel oil).

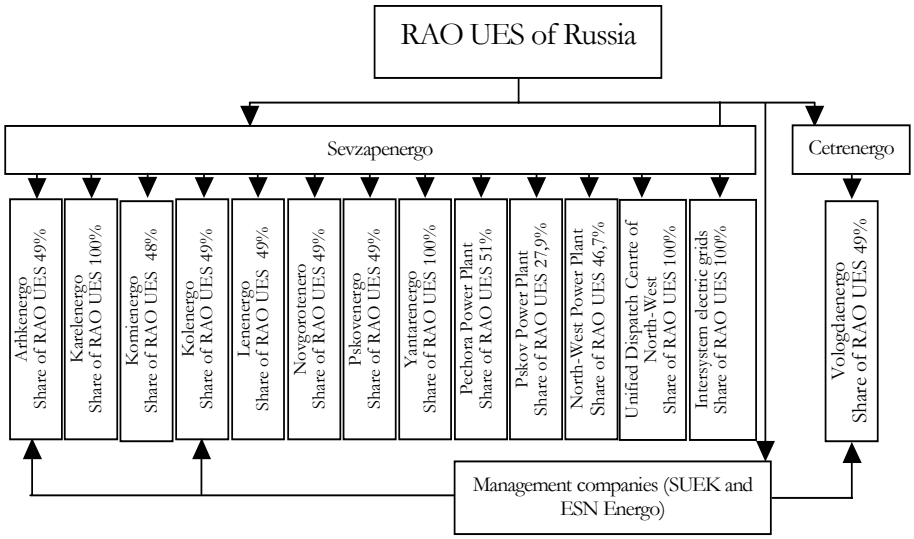
Sevzapenergo and Centrenergo represent RAO UES of Russia in the Northwest region, and coordinate and control the activity of its associated and dependent companies.

In order to improve the efficiency of the most problematic regional utilities and to prepare them for reforms, RAO UES of Russia established several power supply management companies in 2000 and 2001. The companies are 100% owned by RAO UES of Russia. The Northern Power Supply Management Company (the SUEK public corporation) and ESN Energo operate in Northwest Russia. The companies exercise the rights and fulfill the duties of general manager and board of power management companies. In this event, all management functions devolve from a natural person onto a juridical person. In Northwest Russia, Arkhenergo and Vologdaenergo are under the control of SUEK and Kolenergo is under the control of ESN Energo.

During the period from 1990 to 1996, the volume of power production in the Northwest declined by 24%. The fall in production was brought about by a decline in consumption of electric power, which fell by 31% during this period (from 104 TWh to 72 TWh). After 1997, the power production volumes in Northwest Russia began to grow as a re-

sult of an increase in the consumption of electric power by the public, industry, and the service sector. In 1999, power consumption in the region equaled 82.5 TWh. About 58% of this volume is consumed by industrial enterprises.

Figure 5.15 Management Structure of Power Production in Northwest Russia



Power consumption in Northwest Russia equaled 82.5 TWh in 1999, which was 10% of the total consumption volume in Russia. The large power consumers are regions where large industrial centers are concentrated, such as St. Petersburg, Murmansk, and the Leningrad and Vologda regions. Their share in the total consumption volume amounts to 63%.

The largest share in the structure of power production belongs to nuclear power plants. Today there are two nuclear power plants operating in Northwest Russia, Leningradskaya (the Leningrad region) and Kolskaya (the Murmansk region). Together they produce 41% of the electric power in the region. In essence, nuclear power is the foundation of the power industry in Northwest Russia.

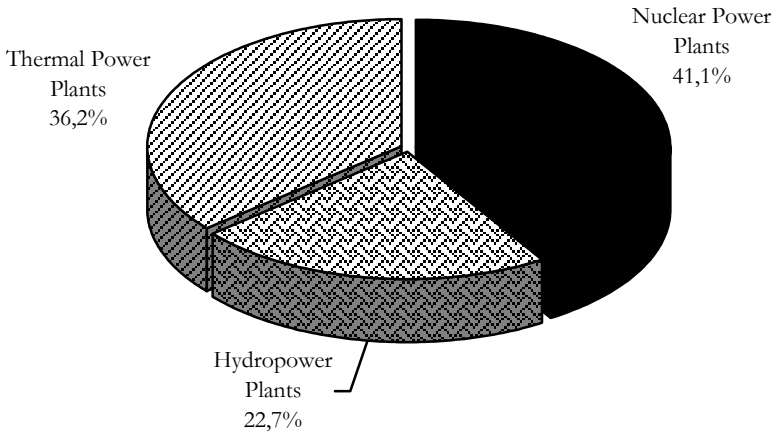
Some reactors at the nuclear plants have virtually outlived their service life and are quite dilapidated. Presently, projects to prolong the service life of reactors until 2010-2015 are being carried out at the plants. Thus far, there has not been a great deal of attention paid to the development of alternatives for power production, which increases yet more the risk of an imbalance in energy in the future.

Table 5.6 Power Production and Consumption in Northwest Russia (1999)

Region	*Total, GWh*		*Per capita, MWh*	
	Production	*Consumption*	*Production*	*Consumption*
Northwest Federal District	83,050	82,480	5.7	5.7
Leningrad region	31,368	12,050	18.8	7.2
Murmansk region	16,534	12,643	16.5	12.6
Republic of Komi	7,727	7,680	6.8	6.8
Republic of Karelia	4,299	7,293	5.6	9.5
Vologda region	6,187	11,996	4.7	9.1
Arkhangelsk region	5,549	6,909	3.8	4.7
Pskov region	2,297	2,029	2.9	2.5
St. Petersburg	8,014	15,577	1.7	3.3
Novgorod region	912	3,558	1.3	4.9
Kaliningrad region	163	2,846	0.2	3.0

Source: Goskomstat (2000)

Figure 5.16 The Structure of Power Production by Electric Power Plants



Note: Excluding small thermal power units of the municipality and industrial companiesSource: Company data (2000)

Thermal power plants account for 36% of the total volume of power production (60% in Russia on average) and represent 59% of the installed capacity. Most thermal power plants use natural gas as the pri-

mary fuel. In the structure of fuel inputs for power production, this fuel amounts to 50% to 96%, depending on the region. The exceptions are the Arkhangelsk, Vologda and Murmansk regions. Gas is not utilized for power production in the Vologda and Murmansk regions; as for the Arkhangelsk region, its share does not exceed 25%. There is no gas transport infrastructure and therefore gas is not available.

Fuel oil serves as fuel primarily in small power units and boiler houses. It plays a significant role (62%) only in the fuel balance of the Kaliningrad region and is important fuel for small, dispersed power generation in other regions.

Coal is the primary element in the power balance of the Murmansk region, its share forming 68%. In addition, coal is partially used by the power production companies in the Republic of Komi, and the Arkhangelsk and Kaliningrad regions.

Table 5.7 Fuel Mix of Electric and Heat Power Production in Northwest Russia, %

Region	*Natural gas*	*Fuel oil*	*Coal*	*Other kinds of fuel*
Republic of Karelia	41	38	12	9
Republic of Komi	60	7	24	9
Arkhangelsk region	23	30	30	17
Vologda region	60	2	8	30
Kaliningrad region	3	61	36	0
Leningrad region	74	15	5	6
Murmansk region	0	32	68	0
Novgorod region	no data	no data	no data	no data
Pskov region	50	50	0	0
St. Petersburg	83	15	2	0

Source: Goskomstat (2000)

Natural gas also prevails in fuel mix for heat generation in most of the regions of the district. Its share exceeds 50% in six regions. However, in the Murmansk region, where gas is not available, 85% of the fuel in heat power generation is fuel oil.

The Northwest possesses a significant hydropower potential, estimated at 380 TWh; it amounts to 1/3 of the Russian total volume. However, today only a small fraction of this potential is used. This may be explained in the first place by the low efficiency of the installed equipment, significant initial investments and necessity to build many smaller units instead of large ones such the hydropower plants of Siberia. Many

hydropower stations have been in use for more than 30 years (only minor maintenance and upgrading was carried out during this period) and the equipment at these stations is in a state of disrepair. Moreover, the installed equipment is obsolete and is inefficient. During the last decade several small and medium hydropower stations in the region were closed down due to lack of investment and lower attractiveness as a source of energy – compared to the other alternatives.

Another reason for which the existing potential is underutilized has to do with the low investment attractiveness of the energy sector in Northwest Russia. The high capital investment costs, the need for significant investments in transmission grids and other infrastructures as well as tariffs regulation by state discourage investments in the sector.

At the same time, the development of hydropower generation is the essential resource. The creation or renovation of small and medium-sized hydropower plants may offer a partial solution to the problem of power supply to sparsely populated and remote regions in Northwest Russia, as well as providing power to some captive customers. The possible role of smaller power plants in the retail power market created through industry reforms, as well as prospects for its development are discussed in the appendix "Energy Networks Development.".

On the whole, the regional energy system in Northwest Russia is well-balanced and currently power sufficient. However, the longer and medium-term balance is doubtful if the situation develops as it does today. This risk is defined by the following issues:

- Gas reserves in the gas-producing regions are depleted, while the new fields are being prepared at a slower pace. However, regional utilities in many regions continue to increase the share of gas in their energy balances. Hence there is a risk of unstable supplies of gas in the medium term.
- There is an uncertainty in the gas and coal pricing. The reserves of coal in the region are enormous, but it may become a competitive fuel only in the event of a significant rise in prices for gas. It must be noted that current prices for gas in the region are a small fraction of international market prices (≈ 15%). It is widely assumed by experts that such prices are not sustainable. However, it is expected that for the next few years they will remain low. This could result in further supplanting of other kinds of fuel from the regional fuel mix if the appropriate balancing measures are not carried out by decision-makers. As a result medium term risks associated with availability and cost of gas are aggravated.

- Investments in power production facilities, and above all in nuclear power (on other facilities significant in size), are very low - virtually not-existent (exception is the gas-fired Northwest Power Plant near St. Petersburg). By 2015, heat and hydropower production facilities that account for more than 7,800 MW will have run out of its operation life, and both nuclear power plants will end their standard operation life, as well. Under these circumstances, investments in creating new power production facilities, and restructuring and modernizing power units at nuclear power plants will become the major factor determining the sector's abilities to meet the growing demand for electric power in the region.[14]

- Increase in power consumption in the region is expected. During the next decade, the development of such power-consuming industries as non-ferrous metallurgy (the Republic of Komi, the Republic of Karelia, the Leningrad region), oil-refining (the Leningrad region) and other industries is expected in the region. These trends together with general growth of industrial production in the region will cause a significant increase in the demand for electric power. The regional concentration of this demand is also changing. If management of energy supplies does not follow these trends possibility of ensuring of sustainable supplies decreases.

Box 5.6 An alternative view on the state of the power industry

According to the majority of market analysts and executives at RAO UES of Russia, the large volume of worn-out equipment in the power industry and the growing demand for electric power on the part of developing industries may lead to an energy crisis in the medium-term perspective. This is likely to occur if investments for renovation of production facilities and networks are not made in the industry in the near future. Immediate restructuring of the industry is an imperative condition for attracting the necessary volume of investment. Some independent experts, however, suggest that there are no grounds for a pessimistic view of the production potential of the Russian energy industry and that there is no need to expedite restructuring. The quintessence of the arguments of the proponents of this point of view is as follows.

[14] At the present time there are many alternative views on the current state of industrial facilities in the Russian energy sector (see Box 5.4). The authors hold the moderate opinion, noting unfavorable condition of generating facilities in the electric energy industry on the one hand, and on the other hand calling in question high growth rates of energy consumption in the country forecasted by the Government and management of RAO UES of Russia in the coming years.

The wear-and-tear of the main production assets is purely a category of accounting practices, or wear-and-tear "on paper." It profits energy companies to consider overhaul as regular expenditures, which allowed them to be included in costs and, thus, a more rapid turnover. The results of overhauls were not accounted for in companies' balance sheets. It is obvious that power production facilities and networks created in the 1920s and 1930s are in operation today only because they have undergone repeated overhaul (also in the 1990s), which, however, was not reflected in accounting practices. Thus, the production potential of equipment in operation is far from being exhausted, and statistics on the high level of wear-and-tear are manipulated for political purposes, for establishing prognoses on the inevitability of major failures of production facilities and the subsequent energy crisis, as well as for proving the necessity for taking radical measures - in particular attracting strategic investors who will receive assets from RAO UES of Russia. As for prognoses for the rate of consumption, the starting point is the rate of growth of consumption in 2000 (four per cent), extrapolated for the coming twenty years. At the same time, in 2001 - 2002, the energy efficiency of the Russian economy began to grow, advanced technologies for lowering energy losses were introduced, and so on. Already in 2002, a significant decrease in the rate of growth of power consumption in the country was observed, and the average annual rate of growth in energy consumption in the future will apparently remain close to zero.

According to optimistic analysts, all this suggests that a deficit in electric power in Russia is unlikely in the foreseeable future. There is also no need to make extraordinary efforts to attract investors, in particular the expedited sale of the assets of RAO UES of Russia, which will be inevitably under-priced at the current level of development of the energy market in Russia.

These problems, according to the author's opinion, are not the crucial and will be gradually resolved by reasonable improvement of power efficiency of the regional economy, development of power transmitting networks and dispersed energy production, and up-grading of existing power production capacities as the prices for electricity goes up. Nevertheless this also point to the fact that major restructuring of the energy production and distribution is on the way and could be a long and painful process.

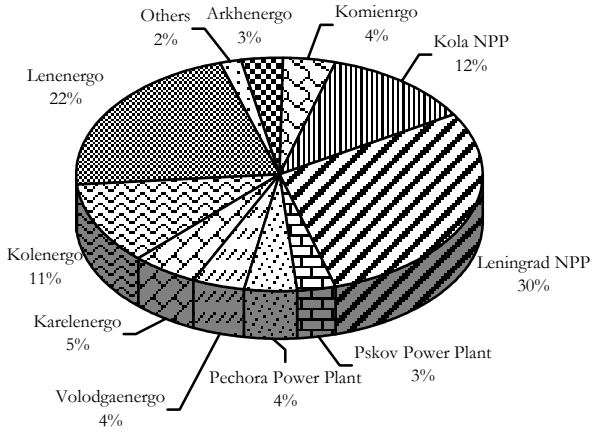
Power purchased on the wholesale market plays a significant role in the balance of the Northwest power production companies. In 2000, power utilities companies purchased 33.2 TWh on the FOREM. The share of the power purchased on the market amounts to 86.9% of the total volume. (See figure 29). The primary buyers of the market electricity in Northwest Russia are Lenenergo (10.3TWh) and Vologdaenergo (6.4 TWh).

Table 5.8 The Largest Power Producers in Northwest Russia

Company	*Installed capacity, MW*	*Electric power production, TWh*	*Turnover, million USD*	*Personnel, people*
Leningradskaya NPP	4,000	21.6	no data	5,778
Kola NPP	1,760	8.8	no data	250
Lenenergo	5,350	16.1	363.0	18,207
Kolenergo	1,928	8.5	123.5	5,623
Karelenergo	914	3.9	68.7	3,467
Vologdaenergo	665	3.2	147.0	5,760
Komienergo	788	3.1	126.9	10,025
Arkhenergo	1,058	2.6	106.5	5,905
Novgorodenergo	2,724	0.96	44.5	2,915
Yantarenergo	132	0.055	45.4	2,841
Pskovenergo	12.5	0.027	23.9	3,737
Pechora Power Station	1,060	2.9	30.9	1,392
Pskov Power Station	430	2.4	17.0	1,093

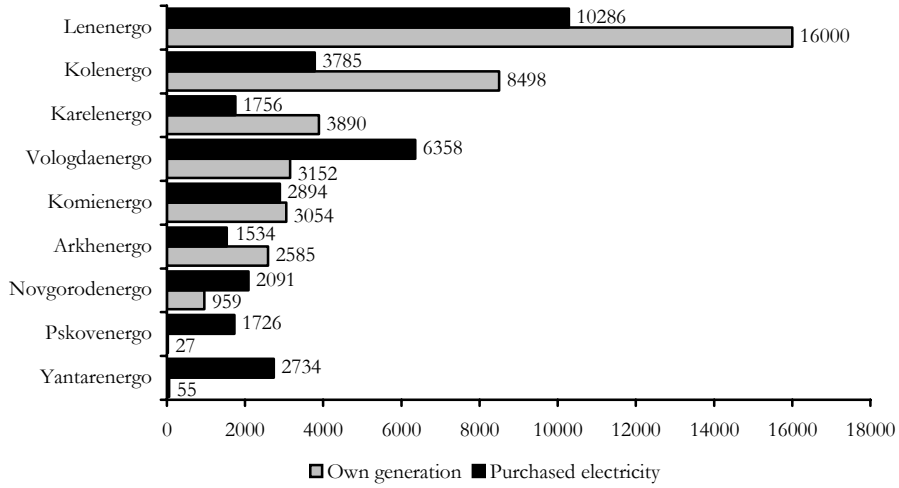
Source: Company data (2000), The Federal Securities Commission (2000)

Figure 5.17 Shares of Companies in Power Production in Northwest Russia



Source: Company data (2000)

Figure 5.18 Electric Power Production in Northwest Russia by Companies, GWh



Source: Company data (2000)

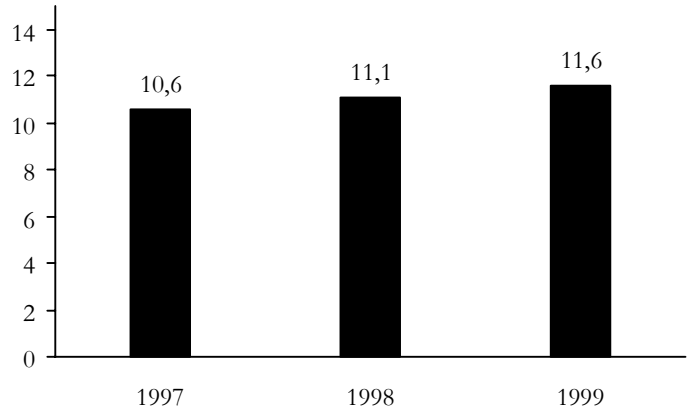
At present, there is a two-level tariff system in the energy market. The first level consists of energy rates in the FOREM market. The rates at FOREM are fixed by the Federal Energy Commission (FEC). In 2001, the rates at FOREM were changed twice. From January 1, the rates were raised by 20%, and from July 1, by 15% more. The electric power rate at FOREM averaged $0.01/kWh in 2001.

The bodies that regulates rates on the retail markets are the Regional Energy Commission (REC). RECs fix the energy tariffs taking as a base the calculations of costs and necessary investments presented by regional power utilities. The characteristic feature of the regional (and, of course, Russian as a whole) energy tariff policy is significant cross-subsidizing of households, budget organizations and agriculture, at the expense of industrial and other consumers, and underestimation of necessary investments.

The principles of the functioning of the wholesale energy market, as well as the energy tariffs for different consumer categories in the region, are examined in more detail in the appendix "The Energy Networks as a Marketplace." Nevertheless we would like to point out that existing system of tariffs is transitional by nature and needs to be changed as soon as possible into the more efficient.

One of the most serious problems that power production utilities companies face today is significant loss of electric power during transmission and distribution. This volume amounted to gross loss of 11.6% in 1999 and grows due to the high deterioration rate of capital assets and networks as well as out-dated billing and measurement systems.

Figure 5.19 Loss of Electric Power During Transmission, %



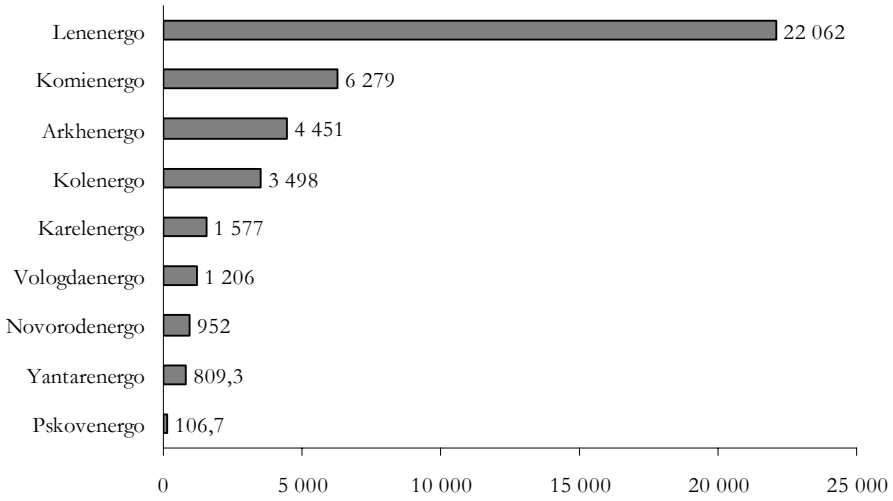
Source: Goskomstat (2000)

Heat Power Production

The production of heat power has recently increased in Northwest Russia. In 1999, 141.4 million Gcal of heat power was generated (the growth rate equaled 2.7%, compared to the level of 1998), which is 12.5% of the total production volume in Russia. The largest heat power producers in the Northwest are Lenenergo (22.1 million Gcal) and Komienergo (6.3 million Gcal). In addition to energy companies, local, municipally owned heat power production enterprises that produce heat at the smaller boiler houses play an important role in heat supply. These manufacturers produce over 70% of the total heat in the region. There is a tendency of increasing.

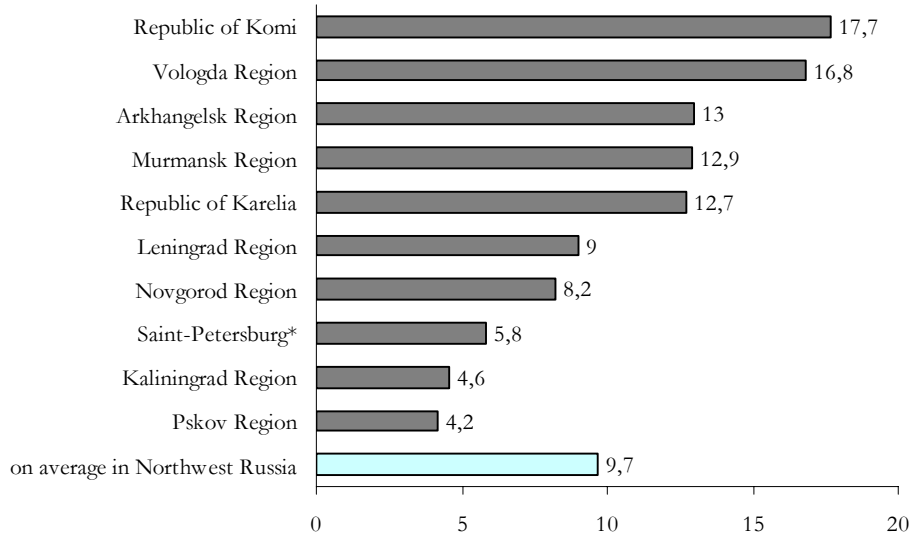
Heat supply system in the region is characterized by low efficiency. Today, the most relevant issues of the heat suppliers are poor conditions of heat distribution networks. The losses in heat supply amount to 40%, on average. As a result, there are enormous financial losses that result in high tariffs for heat energy. Nevertheless yet another problem is the lack of motivation of both producers and consumers to implement energy-saving technologies, caused by heavy subsidizing of heat power production by regional and local administrations. In other words many consumers do not feel this costs directly as they pay lower tariffs but do bear these costs through taxation. Yet another serious problem of heat production in the Northwest and throughout Russia is a structural one. During the Soviet period, facilities and networks were built to provide for a high concentration and volume of production at one site. Thus, large-scale heat power production plants were built that were intended to sup-

Figure 5.20 Heat Power Production in Northwest Russia by Companies, thousand Gcal



Source: Company data (2000)

Figure 5.21 Heat Power Production in Northwest Russia per capita, Gcal/year



Note: according to Goskomstat, heat power production per capita in St. Petersburg equals 5.8 Gcal per year. However, specialists note that these statistics are underestimated, whereas the real annual amount of heat power production in St. Petersburg varies from 8.5 to 9 Gcal per capita
Source: Goskomstat (2001)

ply large adjacent areas. Today, the scale of networks and their maintenance represents complex problem and requires substantial investment. As a result we envisage a gradual shift to dispersed heat generation as the existing facilities networks cease operating.

Still another problem associated with large networks and heat power production facilities is the lack of flexibility and stability (when there are cut-offs at the plant or network problems, large populated areas are deprived of heat for long periods of time). This also motivates consumers to change their preferences in favor of easy to control and maintain localized heat generating facilities. Thus, there is a growing demand and need for dispersed heat power production and smaller localized networks. Residential developments that are oriented on wealthier buyers normally offer their own systems of heat production.

As may be seen from the chart, today the per capita heat production in the region is 2.5–3 times greater than in the Scandinavian countries, i.e. countries with similar climate and weather conditions. It may therefore be concluded that there is an inefficient use of heat energy in the region. In order to improve the efficiency of the heat power supply, significant investments in modernizing and developing the heat transmission infrastructure and the application of energy-saving technologies are needed. Dispersed and localized heat generation may be one solution, the other is creating a favorable investment climate in this area of activity. These are not mutually exclusive activities – they could be carried out simultaneously and will strengthen and complement each other.

Unfortunately, the on-going restructuring of RAO UES of Russia does not include changes also in heat generation. The heat power tariffs will remain regulated, and there is, thus, no reason to expect significant investments in the sector in the near future, except in cases where heat generation will serve the needs of captive customers.

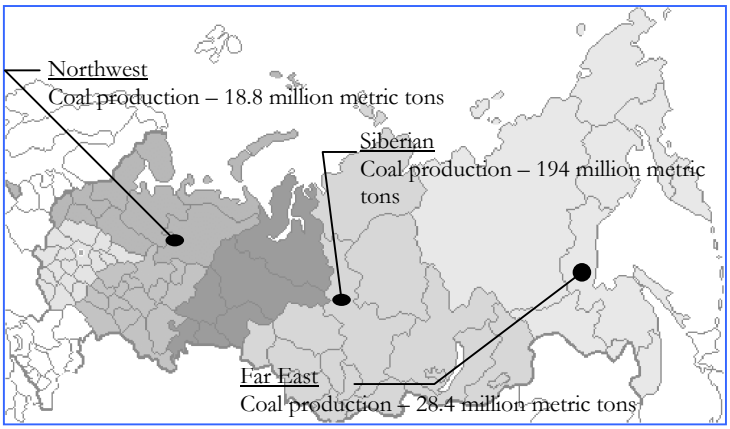
5.6 The Coal and Shale Oil Industries

The Coal Industry

The coal industry in Northwest Russia is concentrated in the Republic of Komi, where the coal deposits of the Pechora coal field are located. The Pechora coal field has large reserves that are used in the power industry and the by-product coking industry. Most of the territory of the Pechora coal field (83%) is located in the Republic of Komi. A considerable part of the field lies to the north of the Polar circle, i.e. in the permafrost area. It significantly increases coal production costs, but it is nevertheless

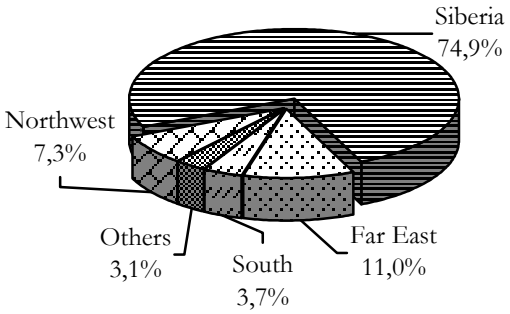
a significant additional resource for the future, when the costs of other fuels will grow. The total geological reserves are estimated at 203 billion metric tons. The resource potential of the Pechora coal field allows to increase the coking coal production capacity up to 35 – 40 million metric tons, and the energy coal production capacity up to 120 million metric tons a year, a level that could be sustained for decades. More than half of all reserves of conditioned coal are concentrated at a great depth, about 900 meters beneath the surface; and 37% at a depth of 300 meters. A total of twelve coal deposits have been explored in the region, five of

Figure 5.22 The Main Coal Production Regions in Russia (by federal district)



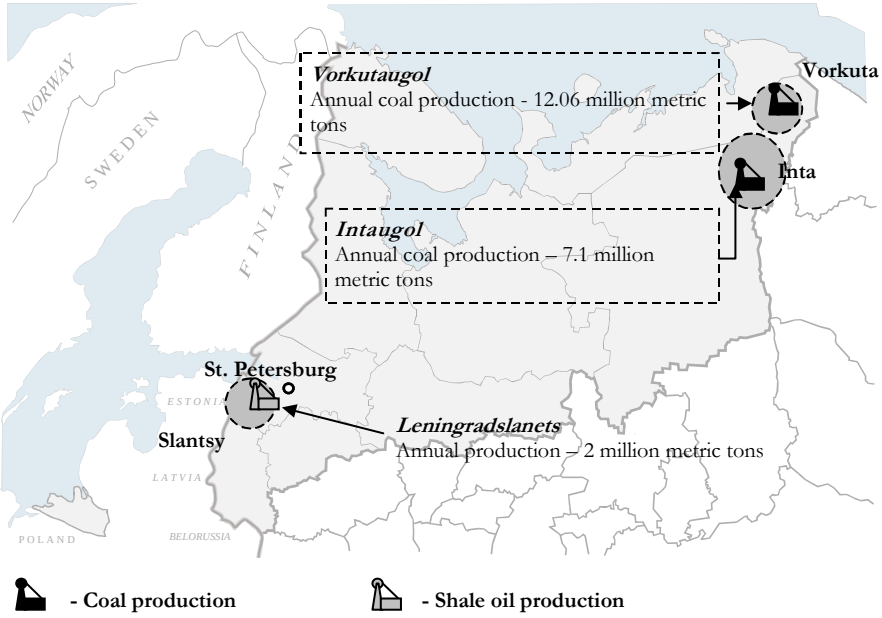
Source: Goskomstat (2001)

Figure 5.23 Coal Production in Russia (by federal district)



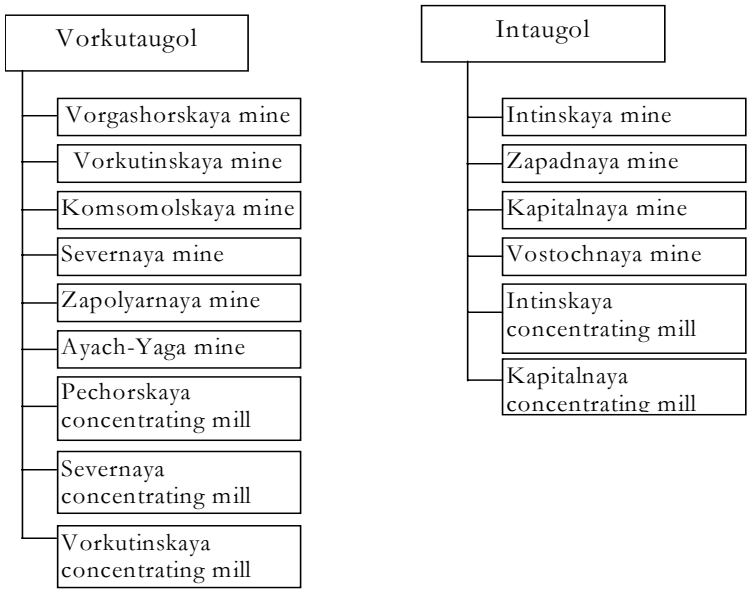
Source: Goskomstat (2001)

Figure 5.24 The Coal and Shale Oil Sectors of Northwest Russia



which are used for industrial production. Due to the infrastructure established and developed during the Soviet period, the feasibility of coal production could be somewhat better than widely accepted and gives a hope that these resources will continue to be used in foreseeable future.

Figure 5.25 The Structure of the Coal Industry in Northwest Russia



At present, two coal companies operate in the Republic of Komi – Vorkutaugol and Intaugol. They explore, develop, process and sell coking and power-generating coal. The structure of the coal industry is presented in Figure 5.25.

The contemporary structure of the coal industry in the Republic of Komi was formed in the 1990s as a result of the restructuring of the Pechora coal field mines, which led to the closure of the six most unprofitable mines.

Table 5.9 Coal mining Companies of Northwest Russia

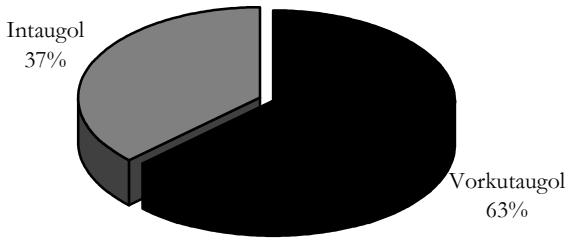
Company	*City, region*	*Extracting output, million tons*	*Turnover, million USD*	*Personnel, people*
Vorkutaugol	Vorkuta, Republic of Komi	12.6	205.6	27,900
Intaugol	Inta, Republic of Komi	7.1	37.7	8,924

Source: Rosugol (2000), The Federal Security Commission (2000)

These companies account for 7.9% of the total coal production in Russia, which amounted to 249.1 million metric tons in 1999. The development of the coal deposits is carried out with a mining method utilizing mechanized cleaning combines. Eleven mines with a total capacity of 20.6 million metric tons per year are mined for coal. There are five concentrating mills that process the mined coal. The output of coal concentrate equals about 5.8 million metric tons. Coal mining companies of the region are important suppliers of by-product coke and coal for power generation in Northwest Russia. In total, 88% of extracted coal is consumed within the region. Taking into consideration the on-going changes in the RAO UES of Russia and hesitancy of authorities to free prices for gas and heat one could expect that coal production will sustain on the present levels and continue to be consumed primarily in Northwest Russia in the near to medium term.

Vorkutaugol located in the Vorkuta industrial area, develop coking coal reserves. This company provides 18.8 % (1999) of the total volume of coking coal extraction in Russia. This company is among so-called strategically important producers for the Russian economy owing to its high market share in coking coal manufacturing in Russia.

Figure 5.26 Coal Production in Northwest Russia (by companies)

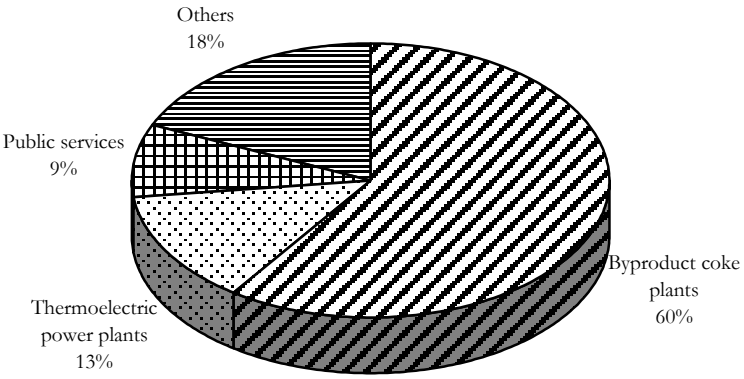


Source: Rosugol (2000)

According to the estimates of specialists, Vorkutaugol will be able to sustain the existing level of production until 2020. After that, three mines should be closed due to depletion: – Komsomolskaya, Zapolarnaya and Vorkutinskaya. It is expected that the production volumes of Vorgashorskaya mine will have increased by that time. However, the decline in production and the closure of mines are likely to occur much earlier, because of the lack of investments for modernizing the existing mines and the construction of new ones. The most promising coal fields as replacement are already defined; sources of financing have not yet been found, however. Finding financing for this changes could be among the major challenges for decision-makers in the region.

Vorkutaugol is one of the most important coking coal suppliers to metallurgy enterprises in Northwest Russia and in the Urals. Coking coals (Vorkutaugol) provide about 20% of the needs of Russian metallurgy companies (Severstal, Moskovsky by-product coke plant, Mechel, Nosta, Novolipetski metal factory, Nizhnetagilsky metal factory, and others). Severstal (Cherepovets, Vologda region) is the primary consumer of these coking coals. In Northwest Russia, the company consumes 80% of locally produced coke. At the moment, Severstal owns 15% of Vorkutaugol stock, and it is possible that in the future it will acquire the controlling interest. One could see that this move as an inevitable if Severstal is to secure supplies of the most essential raw material for its processes. This interest in the raw materials supplier is connected with the high quality of coal, which fosters high-quality steel production. In the future, Severstal is expected to maintain or even increase its consumption of Vorkuta coals. As for other consumers, the volume of their consumption will most probably decline owing to feasibility reasons.

Figure 5.27 The Structure of Coal Supplies of Vorkutaugol



Source: Rosugol (2000)

The production of coal for power generation is carried out primarily by the mines of Intaugol, and by Vorkutaugol in insignificant amounts, as well. In 1999, 8 million metric tons of coal for power generation were extracted, which is 41.2% of the total in Northwest Russia.

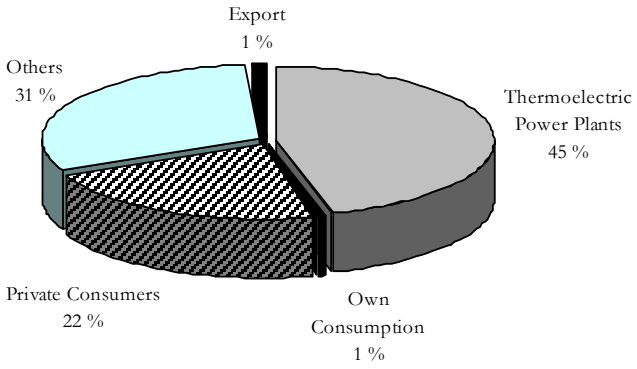
Intaugol is the major energy coal supplier to the electric power plants of the Northwest region. Such regions as the Republic of Komi, and the Arkhangelsk, Murmansk and Vologda regions are fully provided with power-generating coal from the Pechora field (mainly produced by Intaugol). About 45% of coal consumed in St. Petersburg, and the Novgorod, Kaliningrad, and Pskov regions, and the Republic of Karelia are also supplied from the Pechora coal field. The export share in the total volume of sales of coal companies today is not significant, but in 2000 it began to grow owing to development of port facilities in the Leningrad region and associated marketing efforts of producers.

In the medium-term significant changes in the structure of the demand for Intaugol coal are not expected. Alternative sources of energy are not available (gasification is developing at a slow pace) and their cost tends to grow faster than the price for coal. The other reason is that the access to new markets is inhibited by the fact that the transportation system is not likely to develop in the near future sufficiently enough.

Vorkutaugol operates under difficult mining and geological conditions, with high risk of gas explosions and rock bump collapses. This makes the development of the deposits rather expensive. The cost of one metric ton of coal mined by Vorkutaugol in 1999 exceeded significantly the average

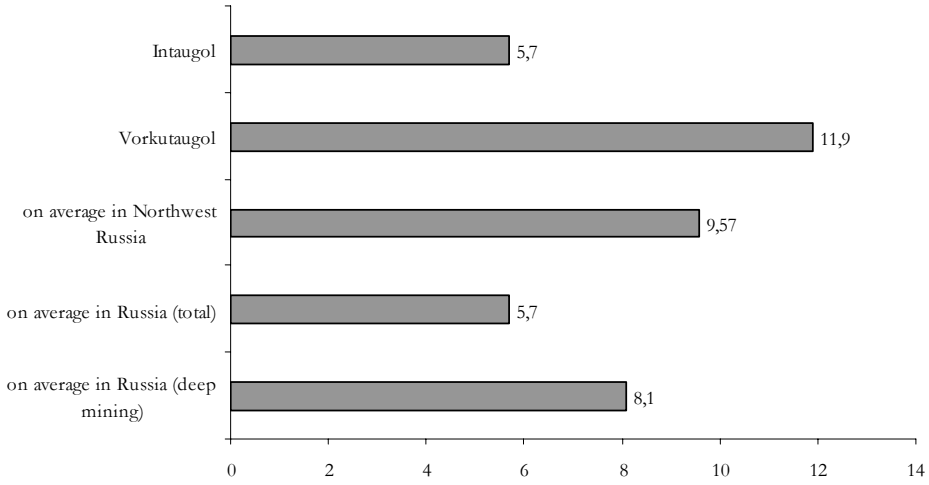
in Russia. High mining costs had a negative effect on the results of coal-mining companies in the region. On average (for the two companies), the costs per $1 of output (in sales) were 13.5% higher, i.e. $1,135 in 1999.

Figure 5.28 The Structure of Coal Supplies of Intaugol



Source: Rosugol (2000)

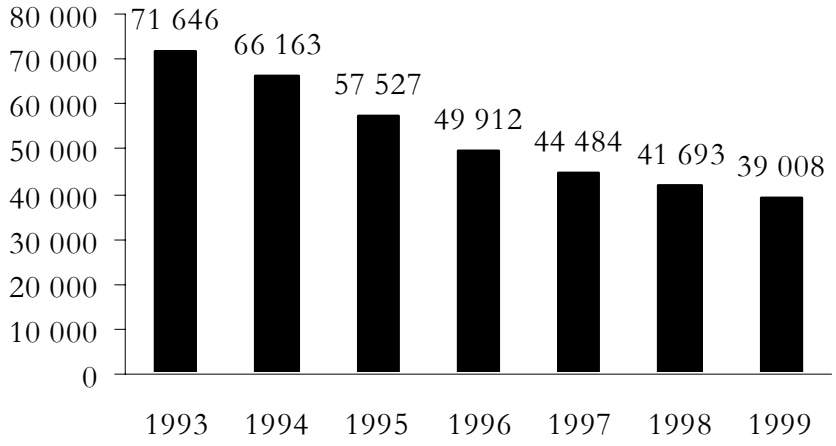
Figure 5.29 Coal Production Cost in Northwest Russia, by Companies, USD per metric ton



Source: Rosugol (2000)

A number of coal mines have been closed since 1995 during the restructuring of the coal industry, which led to considerable layoffs of industrial personnel. The average number personnel in the coal industry was 39,008 people in 1999, 54% of the number in 1993. Layoffs are still continuing at present and the overall efficiency of management and operations could still be substantially improved.

Figure 5.30 Number of Employees of Coal Companies in Northwest Russia

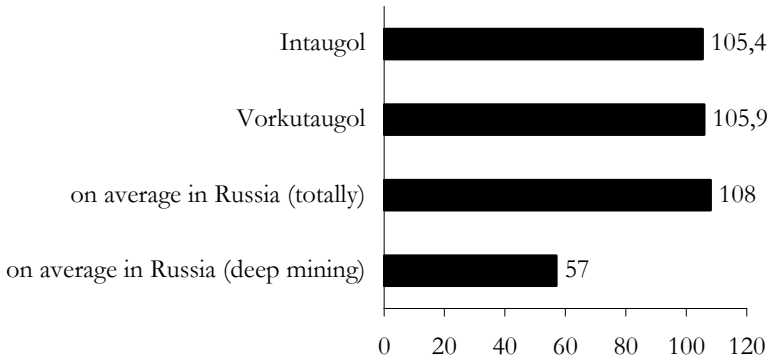


Source: Rosugol (2000)

The mines under exploitation are relatively well-mechanized. A high degree of mechanization and personnel layoffs determine the high indicators of labor productivity. Labor productivity at the mines of the Northwest is twice as high as the average level (deep mining) in the industry, and is close to the average productivity rate in Russia. This makes these mines almost competitive, taking into consideration the much shorter transportation distances between them and the Northwest Russian consumers.

At the same time, industrial facilities are highly depleted and amortized. In many cases, the equipment has served already more then two full life-cycles. The companies need considerable investment in the reconstruction and technical modernization of the mines.

Figure 5.31 Labor Productivity of Coal Production in Northwest Russia, metric tons per month



Source: Rosugol (2000)

The coal companies of Northwest Russia are supported by the federal budget. Government support is provided for the coal industry on the basis of an industrial tariff agreement for the following purposes:

- Compensation of loss;
- Support of social investments;
- Technical modernization;
- Measures to prevent accidents.

The budgetary financing of the Pechora coal field companies reached $60 million in 1999, which was 15% of the total amount of government support for the Russian coal industry.

Table 5.10 Budgetary Financing of Coal Companies in Northwest Russia in 1999

	On average in the coal industry	*Vorkutaugol*	*Intaugol*
The level of budgetary financing for 1 ton of output, $/ton	1.63	5.35	4.29

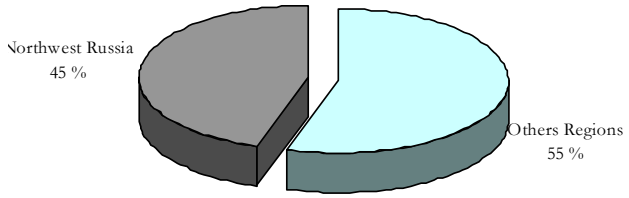
Source: Rosugol (2001)

Going away from state support of these operations is extremely difficult owing to importance of their products. Therefore it is envisaged that support will sustain for at least the medium term.

The Shale Oil Industry

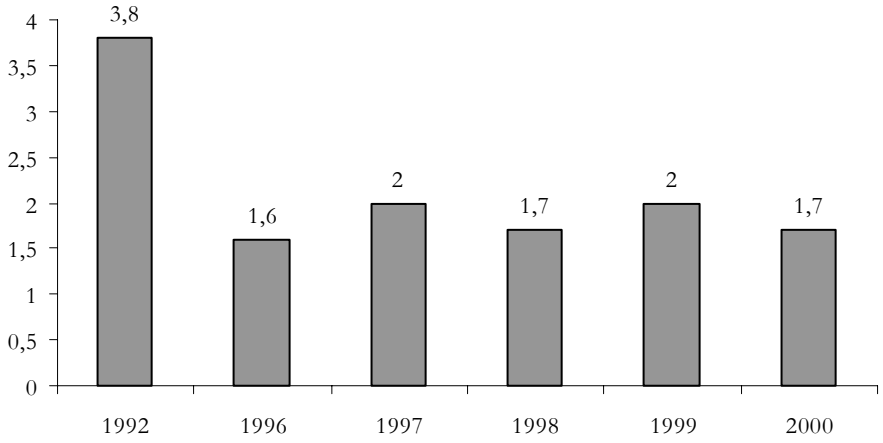
Considerable reserves of energy shale are located in Northwest Russia. They are concentrated in the Pechora and Vychegorsky shale fields in the Republic of Komi (estimated reserves – 6.5 billion metric tons) and in the Leningrad region (reserves – 1.1 billion metric tons). However, presently, the resource potential of the shale industry is not being used. Only one shale extracting company, Leningradslanets, operates in the district, and it is the only Russian shale producing company.

Figure 5.32 The Share of Northwest Russia in the Total Reserves of Shale Oil of Russia



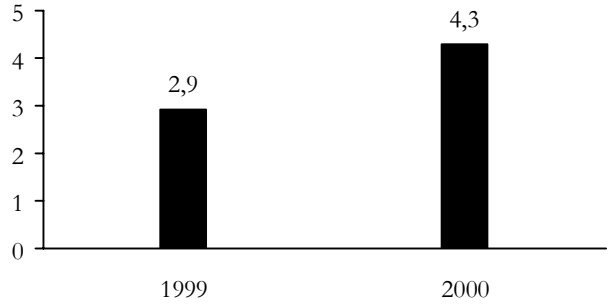
Source: Goskomstat (2000), The Ministry of Natural Resources of Russia (2000)

Figure 5.33 The Production of Shale Oil in Northwest Russia, million metric tons



Source: Goskomstat (2000), The Government of Leningrad Region (2000)

Figure 5.34 Shale Oil Production Cost, USD per metric ton



Source: Rosugol (2001)

The company has seen a sharp drop in its production volumes since the beginning of the 90s, which is first of all connected with the closing of two mines. Today, shale is produced by Leningradslanets at only one mine – Leningradskaya. The mine's reserves at the beginning of 1992 were equal to 130 million metric tons of shale. The production capacity of the mine is 3.5 million metric tons of shale per year.

Shale production decreased by 15% in 2000, compared to the level achieved in 1999. Presently, Leningradslanets produces 1.7 million metric tons per year. The utilization rate for production facilities is only 45.3% at the moment.

The average monthly costs of extracting 1 metric ton of shale in 2000 amounted to $4.3, which is higher than the costs of similar shale producing companies in Estonia. These companies in Estonia are the primary competitors for Leningradslanets on the energy market in the Baltic region.

Today, the only consumers of Leningradslanets products are the Estonian electric power plants located in the regions adjacent to the border. Shale processing in Estonia is carried out on the basis of barter supplies of power. According to the existing scheme, 55% of generated energy goes to Lenenergo, and the remaining 45% stays in Estonia. This agreement with the Estonian government is continually extended, because there are no other shale consumers in the region. In 2001, the deposit developed by Leningradslanets was included in the list of deposits, the development of which is possible only on the basis of the new law on Product Sharing Agreements regulating foreign investment.

The main problem of the Leningradslanets company is the lack of an adequate shale market. For this reason, the company plans to decrease its supplies of raw materials and to develop processing, in order to produce

more products with higher added value. The company plans to construct a shale processing plant, which would generate electric power and produce shale oil, char gas, gasoline and other shale products. This project today is in its initial stage of development.

Unfortunately, the prospects for realizing this project appear rather doubtful, due to its extremely poor financial state of the company. Today, Leningradslanets is operating at a loss, and is supported by the federal budget. The company employs a significant number of people (2,300). In addition to this, the company is responsible for urban development in its surrounding location and bears a heavy burden of related social costs. The implementation of large investment projects is possible only if strategic investors are found, which is unlikely unless the company is restructured in major ways. This in turn depends on the feasibility of such restructuring in the region, will of its owners and support of the authorities.

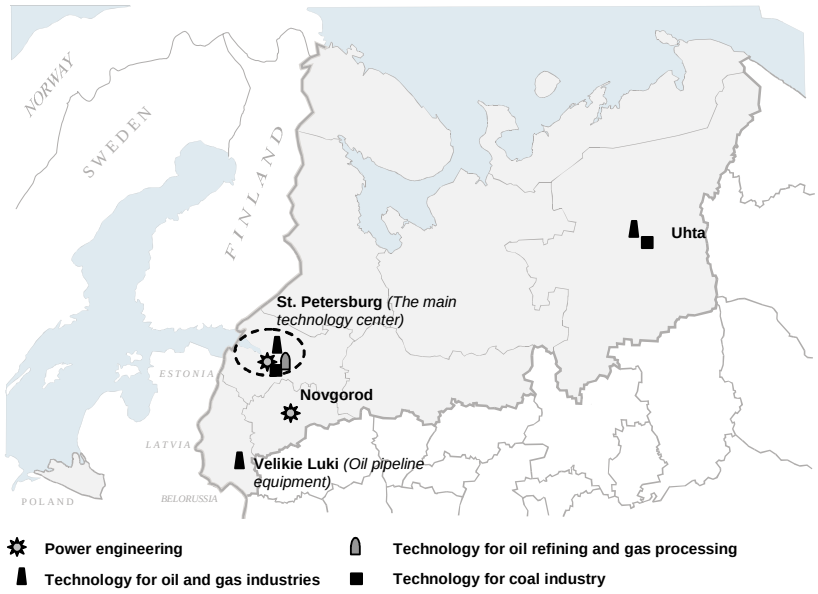
5.7 Technology

During the Soviet period, a powerful industrial agglomeration within the power engineering industry was created in Northwest Russia, with St. Petersburg as its center. It developed out of pre-revolutionary manufacturing enterprises that were subsequently nationalized and restructured for other purposes. This agglomeration is still one of the largest producers of energy equipment in Russia.

In addition to St. Petersburg, there are other industrial centers in the Northwest that form the network of the energy cluster. For example, Transneftemash, one of the largest manufacturers of equipment for oil pipeline-transporting, is located in the Pskov Region; there are small power engineering industry companies in the Novgorod Region; and the companies located in the Republic of Komi manufacture individual types of equipment for the oil and coal industries. In terms of production scale, however, these centers are significantly smaller than St. Petersburg. All these companies rely on the research and educational facilities of St. Petersburg, and are therefore closely connected to and influenced by developments in the city.

During the transition period, the machine-building sector suffered acute setbacks. The most serious was the loss of traditional markets, primarily defined by the Soviet planning system, which led to a sharp decrease in production volumes. This also resulted in the loss of a large number of highly qualified personnel, the reduction of R&D, and the curtailment of investment in technological upgrading and development of new products.

Figure 5.35 Technology Producers in Northwest Russia



Privatization resulted in major challenges for technology producers. In most cases, managers of these companies initially took over these companies. The newly-emerged private entrepreneurs who took over the industry did not have the investment resources for developing the companies, nor did they usually have the necessary knowledge and skills for managing complex manufacturing processes in the new environment. Although most of the companies changed ownership, in some cases becoming more efficient, the overall transition is far from complete.

One of the characteristic trends of the 1990s was the reorganization of large companies into numerous small companies, resulting in conflicts within corporations and property disputes. The unwieldy network of small, poorly coordinated facilities proved to be unable to fulfill large orders. All attempts at integration during this period failed and most of industrial facilities in this sector were fragmented.

The 1998 devaluation of the ruble opened new prospects for power engineering companies. Prices for imports rose dramatically, and domestic companies acquired a distinct, albeit temporary, competitive advantage. Large exporters (Gazprom, oil and metallurgy companies, and others) were the first to benefit from these advantages and began investing intensively in the modernization of their basic facilities. As a result, from 1999 to 2001 the volume of orders for domestic equipment manufacturers rose sharply, as did the viability of manufacturers. A number of strategic investors also emerged, instigating a new round of consolidation of

assets. This provided a major stimulus for restructuring and product development. The effects of these events have yet to be reflected in statistics.

Power Engineering

Companies located in St. Petersburg play a key role in the power engineering of Russia. These companies specialize primarily in the manufacture of turbines, electric machinery, technical power equipment, compressors, as well as equipment for nuclear power plants. They constitute an aggregate, with more than 70% of the domestic market share in power equipment and technologies.

Table 5.11 Production of Power Engineering Technologies in Northwest Russia

	Unit of measurement	*1990*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*
Steam turbines	MW	7,793	4,060	3,225	1,665	1,793	515	475
Hydraulic turbines	MW	347	887	519	278	356	1,005	730.5
Gas turbines	MW	n/a	n/a	n/a	150	150	n/a	n/a
Generators for Steam, Hydraulic and gas turbines	MW	6,331	1,939	1,212	1,626	3,182	2,193	1,600
Large electric machinery	piece	4,464	920	707	732	937	813	1,200

Source: Peterburgkomstat (1999)

The largest companies in the St. Petersburg agglomeration include the Leningrad Metal Plant (LMZ), Electrosila, and the Turbine Blade Manufacturing Plant, which are part of the Power Machines Concern (Concern Silovye Machiny), as well as Izhora Plants, part of the United Machine-Building Plants (OMZ). Today, these are the largest power engineering companies in Northwest Russia.

The products of the power engineering companies of Northwest Russia are utilized in a number of Russian industries (oil, gas, metallurgy, oil-refining, etc.), and are exported, as well. The main consumers of these products, however, are electric power companies.

Prospects for the development of the industry will depend on the domestic demand for power technologies in Russia, and on the ability of these companies to offer competitive new products. The restructuring of RAO UES, the anticipated rise of tariffs for electric energy, and the emergence of new strategic investors as a consequence, could lead to an

Table 5.12 The Largest Manufacturers of Power Equipment in Northwest Russia

Holding company	*Company, location*	*Products*	*Turnover, million USD*	*Personnel, thousand people*
United Machine-Building Plants	Izhora Plants, St. Petersburg	Equipment for nuclear reactors of Nuclear Power Plants	143.8	15.6
Power Machines	Leningrad Metal Plant (LMZ), St. Petersburg	Steam, hydraulic and gas turbines, ancillary equipment	71.5	5.6
	Electrosila, St. Petersburg	Turbogenerators and hydrotreaters, direct-current and alternating-current electric machines, low-voltage installation	43.75	4.9
	Turbine Blade Plant, St. Petersburg	Turbine blades for energy and technological turbines	14.3	1.45
	Novaya Sila, St. Petersburg	Electric machines	988	no data
	Baltic Plant, St. Petersburg *	Boilers	234.1	6500
	Nevsky Zavod, St. Petersburg	Steam and hydraulic turbines, compressors	8.53	0.88
	Proletarsky Zavod, St. Petersubrg**	Gas-turbine-generators, electric and turbo-pumps	8.58	2,511
	Russian Diesel, Vsevolozhsk	Diesel construction	0.28	no data

Notes: * The core expertise of the company is shipbuilding, ** The company has a military–oriented specialization
Source: Company data (2000), The Federal Securities Commission (2000)

upsurge in demand. To what extent the domestic companies will be able to exploit these opportunities depends on their ability to become more flexible and to improve their range of products. At the same time, domestic companies must be prepared for stiff competition from imports of products manufactured by global leaders. For the time being, the main market for Russian power engineering companies is replacement and maintenance. (For a more detailed description of power engineering technologies in Northwest Russia and trends in their development, see the Appendix "Energy Technologies Development").

Oil and Gas Equipment

Oil and gas companies have derived significant investment resources primarily from their exporting activities. They carry out technical mod-

ernization and create new production facilities more actively than other companies. This makes them especially attractive as customers to the machine-building sector. Many oil and gas companies themselves have begun utilizing some of their production capacities, such as repair workshops, for the manufacture of drilling equipment. Today, according to the Ministry of Energy of the Russian Federation, Russian industrial enterprises manufacture up to 95% of the equipment for the transportation and refining of gas and oil.

Industrial companies of Northwest Russia were not originally oriented toward manufacturing oil and gas equipment. Although a number of companies manufacture such equipment (for example pumps, measuring and monitoring equipment for oil refining, etc.), the production volume of this equipment is substantially lower than that of other regions, especially the Urals – the Chelyabinsk, Sverdlov and Tyumen regions - which are manufacturing centers for oil and gas equipment in Russia.

A significant share of the production of oil and gas equipment in Northwest Russia belongs to power engineering companies, although this is not their area of specialization. The following are three of the largest manufacturers:

- ***Transneftemash*** (the Pskov Region) is one of the largest manufacturers of oil-pipeline equipment. Transneftemach is a subsidiary of the Verkhnevolzhskiye Trunk Oil Pipelines Company, which in turn belongs to the federal company Transneft.

- Today, ***Izhora Plants*** is the largest manufacturer of oil and gas equipment in the Northwest. The company specializes in the manufacture of reactors for deep-oil refining, which have the best specifications among their counterparts manufactured by other Russian companies. Izhora Plants also manufactures special pressure vessels used for oil and gas processing.

- Until recently, the ***Nevsky Plant*** in St. Petersburg was the main supplier of pumping equipment utilized for transporting gas via gas pipelines for Gazprom. Over 60% of similar pumping equipment installed at main gas-pipelines throughout Russia were manufactured at the Nevsky Plant. (Today this share is below 40% and rapidly decreases owing to inability of this company to supply new more up-to-day products and overall instability at the company and in Gazprom). In addition, the company manufactures technological compressors used in oil-refining and power generating equipment.

Table 5.13 The Largest Manufacturers of Equipment for the Oil and Gas Industries in Northwest Russia

Company, location	*Oil and gas equipment*	*Turnover, million USD*	*Personnel, people*
Equipment for oil and gas transportation			
Nevsky Plant, St. Petersburg	Superchargers, special technological compressors.	8.53	880
Transneftemash, Velikie Luki, Pskov Region	Special machinery and equipment for the exploitation and major repair of oil-trunk pipelines.	4.9	300
Equipment for oil and gas processing			
Nevsky Plant St. Petersburg	Superchargers, special technological compressors.	8.53	880
Izhora Plants, St. Petersburg**	Pressure vessels for oil and gas processing. Special reactors for hydro-desulfarization of oil, hydrocracking, hydrorefining, hydroaromatisation. Gas separators.	70.18*	5,258
Equipment for oil and gas production			
Orbita, Ukhta, Republic of Komi	Production tree, plug fittings, cut-off plates.	2.58	no data
Kirov-Energomash St. Petersburg	Pumping equipment, utilities for dehydration of drilling fluids.	1.88	689
Arsenal Machine-building Plant, St. Petersburg*	Equipment for gas lifting and increase of well's productivity. Utilities for nitrogen production and pumping.	37.3	3,598
Geogidrotekhnika, Leningrad Region	Technologies for prospecting, well-boring, special pumps, diamond drill crowns.	n/a	102
Komineftemash, Usinsk, Republic of Komi	Drilling oil-field equipment and spare parts.	n/a	n/a
Transmash, Tikhvin, Leningrad Region	Utilities for repair of gas and oil wells.	16.4	n/a

Notes: * The company primarily has a military–oriented and naval specialization. ,
** Only machine-building subdivisions
Source: Company data (2000), The Federal Securities Commission (2000)

Many machine-building companies, especially those oriented towards the military industry, have also begun to manufacture equipment for the oil and gas industry at their production facilities. However, their produc-

tion volumes have thus far been insignificant. In spite of existing industrial and human capital and obvious market opportunities, these companies have found it difficult to carry out the necessary changes in management and marketing.

Mining Technology

Most machine-building companies that manufacture mining equipment have other core activities. Thus, the manufacture of mining equipment in the region is limited to a very narrow range of products (Table 5.14). According to the data of the coal companies in the Republic of Komi, no more than 3 to 4% of purchased equipment is manufactured by suppliers in the Northwest. The main supplies of new equipment for Northwest Russia are provided by machine-building companies located in the Kemerovo Region (Siberia) and the Sverdlov Region (the Urals).

Table 5.14 The Largest Manufacturers of Mining Equipment in Northwest Russia

Company, location	*Oil and gas equipment*	*Turnover, million USD*	*Personnel, people*
Arsenal Machine-building Plant, St. Petersburg *	Pumps, compressor plants, waste disposal equipment.	37.3	3,598
Izhorskie Zavody, St. Petersburg**	Auger separators, conveyor sifters, ball-tube mills.	70.18	5,258
Orbita Ukhta, Republic of Komi	Belt conveyors.	2.58	n/a

Notes: * The company primarily has a military–oriented and naval specialization, ** Only machine-building subdivisions
Source: Company data (2000), The Federal Securities Commission (2000)

Many industrial enterprises manufacture equipment, certain parts of which can be used in mining production: reduction gears, elevators, winches, various electric motors, etc., and take the role of sub-suppliers. In addition, machine-building plants, such as the Vorkuta Repair and Engineering Plant and the Inta Repair and Engineering Plant, are located in coalmining regions and carry out the necessary maintenance and repair activities. The existence of a wide range of sub-suppliers and a definite anticipated demand for mining equipment could provide an opportunity for domestic manufacturers to launch and develop successful operations based on domestic demand.

5.8 Education and R&D

Education

In order to meet the demand for professionals, a well-developed system for preparing technical engineers was created in the USSR. The system included several universities and institutes, as well as several hundred specialized colleges aimed at training personnel for energy industries.

St. Petersburg, which has a long history as the largest educational center, prepared specialists in a wide range of fields related to power engineering for virtually the whole of Russia, and was acknowledged to be an important R&D center by the Soviet state.

Unfortunately, the crisis in the Russian economy, as well as cutbacks in subsidizing education, led to a significant drop in the number and quality of well-trained specialists in engineering sciences. The educational system has been unable to react promptly to the changes in demand in recent years, and the number of highly qualified power-engineering specialists is now insufficient to satisfy even the needs of St. Petersburg (on the present level of labor productivity that is low and hardly sustainable for the longer term).

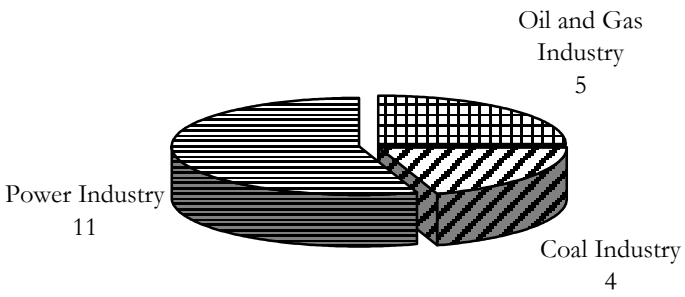
The training of engineers has changed dramatically during the last decade. Institutions of higher learning have gradually decreased the volumes but have diversified their offerings in terms of the variety of courses targeted to meet the needs of energy companies more adequately. Unfortunately, the quality of training has also deteriorated substantially during this period. As a result of a major decrease in manufacturing from the beginning to the mid-1990s and the consequent lay-offs and spin-offs, and the reduction of training activities, today all companies of the sector experience a lack of skilled personnel, the demand for which has been continually growing in the last two years. At present, the educational system is unable to meet the ever-increasing demand for specialists in certain areas (power engineers, for example). Such disproportion between the supply and demand for specialists will remain, or even increase, in the near future. This could become a major impediment for the development of companies. On the other hand, this may provide an impetus for increasing labor productivity.

The weakened ties between institutions of higher learning and companies of the industry, the faltering quality of educational training, as well as the lowering of the scientific potential of universities, are all responsible for the degeneration in the quality of training of specialists. According to research polls, managers of many companies of the energy cluster

call attention to the insufficient level of training of young specialists in the region. This should send out a call of alarm to the government to establish priorities and improve standards of education, as soon as possible. One of the possible ways of improving the quality of training is to distribute government support and financing among fewer institutions, in which the best resources could be concentrated.

Today, eighteen primary institutions of higher learning carry out specialist training.[15] (For the complete list of the primary institutions of higher learning in Northwest Russia, see the first Appendix). Six of these specialize in the education of power engineers. The others have departments of power engineering. A specific feature of Northwest Russia is that the educational system for the energy sector is oriented primarily towards preparing specialists for the electric power and power engineering industries. Personnel training for fuel extracting and processing enterprises is of secondary importance, although this specialty has already been adopted by a number of large institutes and universities.

Figure 5.36 The Specialization of the Main Institutions of Northwest Russia in Energy Industries



Source: The Ministry of Education (2001)

In recent years, collaboration between the educational system and industrial companies in terms of specialist training has stabilized and is now developing rapidly.

The main trends in the cooperation between energy companies and institutions of higher learning are:

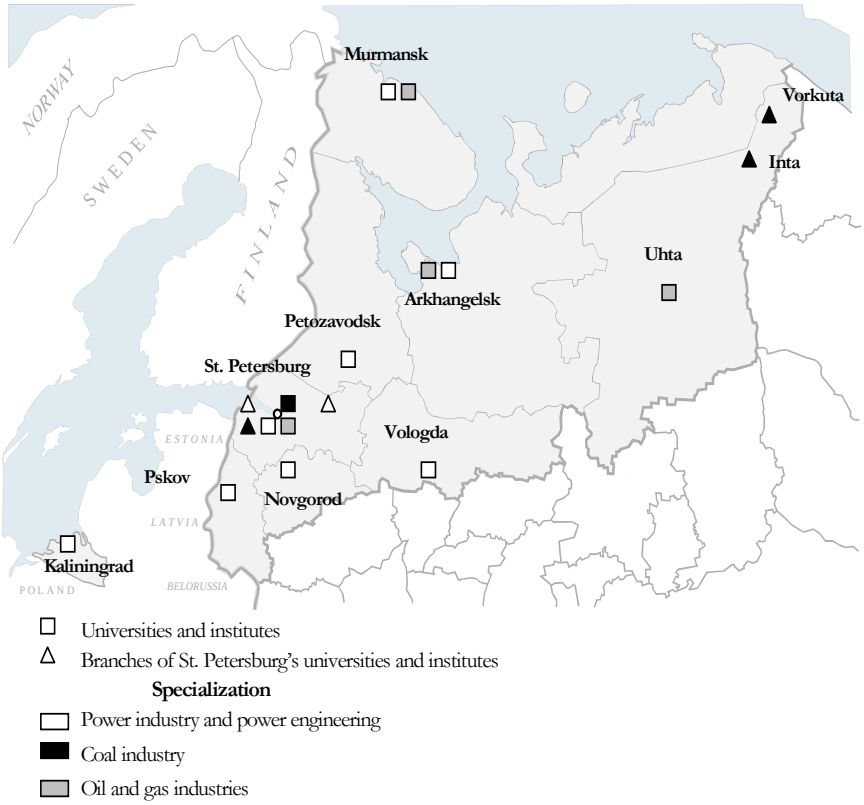
- **Targeted personnel training.** The low mobility of the workforce in the region, as well as the presence of formal barriers, such as registration and residence permits, force companies to

[15] The five largest institutions are located in St. Petersburg.

rely primarily on local personnel. The cooperation of regional institutions of higher learning and companies allows for carrying out personnel training according to the specialization of a region, as well as for a correct estimation of the needs of companies for specialists. For example, in order to meet the need for specialists in the development of oil and gas deposits, the technical universities of Arkhangelsk and Murmansk have established appropriate departments.

- **Sponsorship**. Energy companies traditionally provide financial support in the form of sponsorship to institutions of higher learning. Generally, they finance the institutes that provide basic specialist training and carry out specific research for those companies. For example, in the Northwest, Gazprom finances the St. Petersburg State Mining Institute, and Lukoil provides extensive support to the Ukhta State Technical University.

Figure 5.37 The Largest Educational Centers of Northwest Russia



Research & Development

A substantial R&D network was established in Northwest Russia during the Soviet period. It included a number of the centralized R&D institutions of the sector. Presently, the R&D potential of the energy sector in Northwest Russia is represented by fourteen large R&D and design institutions located in St. Petersburg, which is the only large R&D center in the region. In the beginning of the 1990s, some research institutes were privatized and became a part of large holding companies in the energy sector. These were primarily energy- and gas-engineering enterprises. The major R&D institutions of the sector are listed in the table below.

Table 5.15 R&D Institutions of the Energy Sector in Northwest Russia

Industry	*R&D institution*	*Specialization*
Oil and gas industry	Giprospetsgaz	Design of oil and gas pipelines, compressor plants, gas-turbine stations and underground gas storages.
	VNIGRI	Theoretical base of oil and gas deposits, estimation of oil and gas reserves, alternative resources of hydrocarbon, paleomagnetics, geoecological research.
Oil refining industry	Lengiproneftehim	Design of oil refining and petrochemical enterprises
	VNIIneftehim	Development and introduction of oil refining and petrochemical processes.
	Neftehimavtomatika	Laboratory and industrial equipment, industrial systems for environmental control.
Power industry	VNIIGR	Complex research of scientific validation of design, construction and exploitation of hydrotechnical and special constructions, equipment of hydraulic, thermoelectric and nuclear power stations.
	Lengirdoproekt	Design of hydrotechnical energy establishments.
	NIIPT	Technology and equipment for energy transmission. Development of energy systems. Automated control systems for the energy establishments.
	Sevzapenergosetproekt	Design of energy systems and power grids.
	Zapadnoselenergoproekt Institute	Design of power grids and transformer substations, exterior lighting.

Nuclear power industry	NIIEFA	Design, production and maintenance of laser plants, elementary particle accelerators and analysers.
	NPO RI	Engineering services and research of nuclear power.
Coal industry	Giproshakht	Design of coal enterprises.
Peat industry	R&D Institute of Peat Industry	Exploration of peat deposits, design of technology and equipment for peat extracting and processing.

Despite the fact that energy companies have always viewed the existing system of R&D as one of the key factors in the development of the sector, their cooperation with research institutes in designing new equipment and developing new technologies has weakened substantially. The main reason for such weak interaction between the manufacturing and scientific sectors is the lack of a clearly defined innovation policy in the energy companies, insufficient funding for its implementation, as well as the low potential of most R&D organizations.

Due to the curtailment of federal financing, branch research institutes decreased the volume of basic research. Today, most research carried out by R&D institutions concerns applied, custom-ordered research. The lack of financing forced R&D institutions to offer consulting and engineering services, and they now provide substantial R&D to a number of institutions, and are the leading consultants in the region in the field of energy technologies and equipment.

5.9 Related and Supporting Industries

A number of related and supporting industries and activities have an impact on the development of the energy cluster. These are prospecting, industrial services, information and communication services, environmental protection, financial services, and business consulting. Below, we review their state of development and their potential as a source of competitive advantages for primarily products manufactures.

Prospecting. The presence of significant resources in the region is one of the key factors in the long-term competitiveness of industries of the fuel and energy complex. For this reason, the growth of explored resources is one of the most important premises for the stable development of the extracting companies, as well as for the regions themselves.

Most of the deposits in the region were explored already during the Soviet period. In the 1990s, the amount of geological prospecting gradually diminished. Investment in geological prospecting in the region began

to increase again only in 2000, beginning with the exploitation of the Northern part of the Timano-Pechora oil and gas province (the Republic of Komi and the Nenetsk Autonomous District).

As a result of the structural changes in the sector, the structure of the prospecting industry also changed fundamentally. The network of specialized state prospecting enterprises, which had functioned effectively during the Soviet period, deteriorated almost entirely. Many enterprises closed down, while others lost a significant portion of their industrial and human resources due to unstable financing.

As the specialized prospecting companies weakened, the role of geological departments of extracting companies grew. In addition to carrying out their regular activities, the companies also began to carry out the government orders on occasion.

In the future, the market of independent prospecting will be shaped by a limited number of specialized prospecting enterprises, as well as by large companies that provide services in the area of geological exploration and other industrial services. Considering the losses of this sector during the past ten years, however, the recovery of the pre-reform levels of volume and quality of prospecting should not be expected in the coming ten to fifteen years. Poor conditions and a lack of focus in the development of this activity could impede the long-term growth of the Russian energy sector. This is one of the areas in which an elaborated policy and the commitment of the federal and regional government are urgently needed.

Industrial Services. The development of the services market, including such services as equipment repair and maintenance, the monitoring of exploration and exploitation of deposits, and others, is occurring at different paces in different sectors of the fuel and energy complex. For example, the services market in the oil industry is being formed fairly actively at present, while it is almost non-existent in the gas, electric power, and coalmining industries.

In 2001, the potential volume of the services market for companies of the oil industry amounted to 3 to 4 billion US dollars, and it will grow with the increase in volumes of production and specialization in the industry.

All participants may be divided into three basic groups:

- Multinational service companies that have established activities in Russia (for example, Schlumberger, Halliburton, Baker-Hughes, Deutag, BJ, and others);

- Service companies that are part of oil companies or are spin-offs from them, having contractual relations with customers (for example, the Siberia Servicing Company - Yukos);
- Specialized independent domestic service companies (PetroAlliance, Katobneft, Tyumenneftegeofizika, and others).

The leaders on the Russian services market are the international service companies Schlumberger and Halliburton, which provide a whole range of services in the area of oil production. The Russian domestic service companies are usually niche players. Their activity is most often limited within the borders of one region or oil-producing province (with the exception of PetroAlliance). The primary buyers of services at the present time are Lukoil, Yukos, TNK, and Sibneft, which prefer to outsource and concentrate on their core activities.

The development of the services market in the oil sector of the Northwest is occurring at a slower pace than it is in the main oil production regions. As Lukoil carries out its announced strategy of outsourcing of services, and as activity in the exploration of shelf deposits grows, the volume of this market will grow, as well.

The development of the market of industrial services in the gas and electric power industries is connected primarily with the anticipated restructuring of Gazprom and RAO UES of Russia. The singling out of service assets into independent business is planned as part of the reform of the electric energy sector. It is also expected to become an integral part of reform of the gas industry, which will to be carried out later. This will serve as an impetus for forming a market of services, and will also open opportunities for international companies to enter.

The coalmining industry has no services market whatsoever. All servicing is carried out by the companies themselves. The coalmining industry today cannot be considered promising from the point of view of outsourcing of services in the near future. Nevertheless, restructuring is also inevitable in this area, and outsourcing could be one of the first steps in this process.

Information and Communications Services. At the present time, the companies of the fuel and energy complex are the largest consumers of information and communications services. The need to build an effective system of management of continuous, complex, and geographically dispersed technological processes led to the active utilization of information technologies. Simultaneously, the companies made efforts to solve the problem of automation and formalization of processes of management and documentation turnover inside large holdings. All of this en-

couraged companies to invest in the acquisition and installation of integrated corporate systems of management[16] and monitoring.

In introducing comprehensive IT-systems, the companies of the energy cluster have encountered difficulties caused by the low traffic-carrying capacity of existing communications channels, the lack of quality services in regional communications networks, and the inefficiency of the market of software development services. These difficulties necessitated a number of powerful telecommunications solutions and led to the creation of IT subdivisions in the leading companies. Over the course of the last decade, the leading energy companies have also taken advantage of opportunities in newly emerging markets, which allowed them to capitalize on existing assets. They were able to build their own telecommunications networks along the electricity grid and the oil and gas transportation networks that were already in place, which was one of the priorities of the energy companies. Today, Gazprom, RAO UES of Russia, Transneft, and others have accumulated large telecommunications assets. The utilization and servicing of these networks is currently being carried out by the IT and telecommunications subdivisions of the energy holdings themselves. Negotiations concerning the sale of some of these operations to outside investors are underway.

Energy companies focus primarily on providing data and telecommunications traffic services, and they also need a wide range of special solutions from outside companies.

The existence of underused facilities and the effort to increase economic effectiveness force many companies to introduce their telecommunications subdivisions onto the domestic market of telecommunications and information services. The most widespread models of entry into the market of telecommunications services for the companies of the fuel and energy complex are:

- Independent entry into the market (Gazprom – see case box below);
- Renting out telecommunications networks to specialized companies (RAO UES of Russia – Rostelecom).

[16] The most popular information systems among the companies of the fuel and energy complex are SAP and R/3.

Box 5.7 Gaztelecom

Gaztelecom is one of the three ITT subdivisions of OAO Gazprom. The company was created for the purpose of commercial utilization of Gazprom's own telecommunications network. In 1999, the organization of a national communications operator at Gaztelecom was announced. In 2002, the number of the company's subscribers exceeded 250,000. Gaztelecom is licensed to provide communications services in 56 regions of Russia.

The further growth of commercial utilization of the corporate networks will probably be restricted by the limited capacity of the market of long distance communications, 65% of which is controlled by Rostelecom (the largest Russian telecommunications operator). The amount of territorial coverage by Rostelecom networks significantly exceeds the coverage of Gaztelecom corporate networks. In order to create an operator that would be able to compete on the market with the largest Russian telecommunications company, Gaztelecom is actively lobbying to promote a project for creating a united network for the fuel and energy complex utilizing the telecommunications structures of RAO UES of Russia, Transneft, MPS, and Ugoltelecom. According to experts, however, the probability of realizing this project remains small for a number of reasons.

In spite of the expansion of commercial utilization of their own network, serving the internal needs of Gazprom still has the highest priority for Gaztelecom. Gaztelecom's largest projects at the present time are the creation of main fiberoptic lines for serving Gazprom's domestic and international projects of, primarily communications lines between Moscow and Berlin, and Moscow and Istanbul.

Financial services and business consulting. Efficient financial markets and services are essential for the development of business. Unfortunately, these markets are rather poorly developed in Russia, although significant improvements have been observed recently. It must also be pointed out that companies themselves are not ready for the full-scale utilization of financial and consulting services, due to the lack of necessary skills and expertise.

At the same time, energy companies are the most effective users of the existing financial infrastructure. For example, RAO UES of Russia, Lukoil, Surgutneftegaz, Yukos, and Gazprom have been most active on financial markets during the entire period of financial reform in Russia, and have succeeded in raising substantial funds for their operations. The companies of the energy sector were the first to take advantage of the opportunities offered by financial markets for attracting investments and leverage.

The active role of energy companies on financial markets is to a great extent connected with the capital intensiveness of this business, as well as

the need to attract and accumulate significant resources for the implementation of new projects. In view of the fact that in the beginning of the 1990s there were virtually no markets for financial and insurance services (including banking), many companies created their own banks, insurance companies, and brokerage divisions, which were intended to solve specific tasks related to business of the mother company and to accumulate necessary expertise and skills. Up until now, most energy companies based their financial operations on structures that were created during that time and that now occupy highly influential positions on the Russian market.

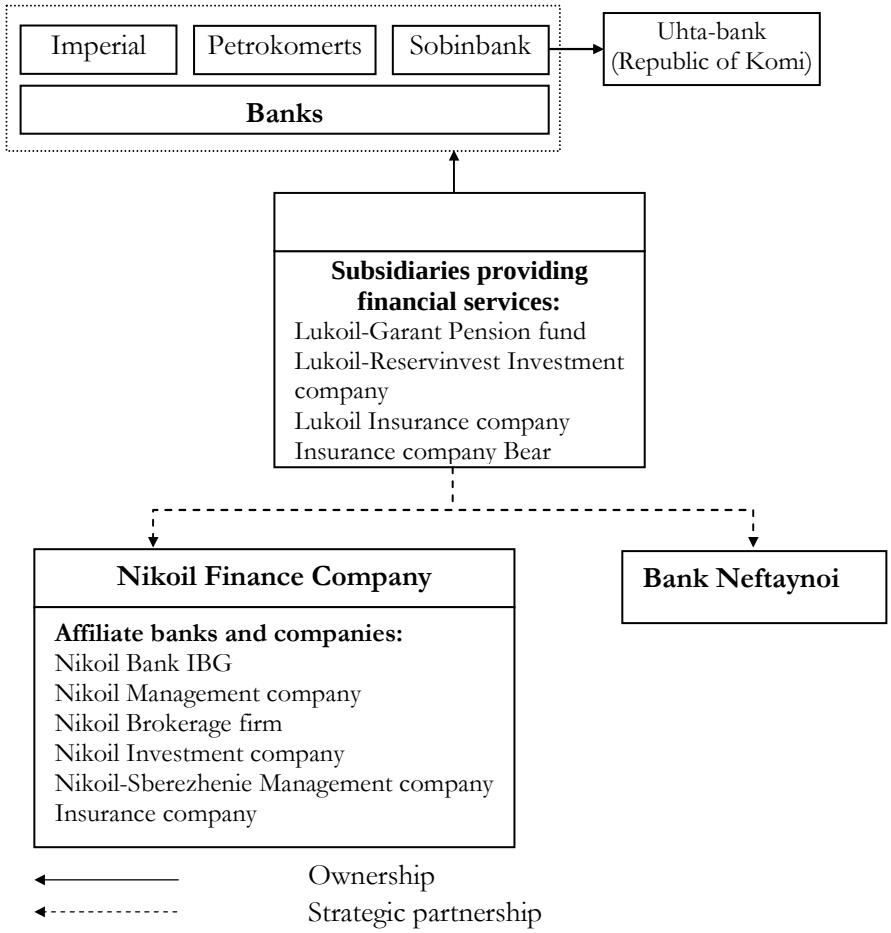
Table 5.16 Russian Banks Connected with the Power Industry

Rank in Russia by assets	*Bank*	*Head office*	*Related energy company*	*Assets, thousand*	*Equity, thousand*
3	Alfa-Bank	Moscow	TNK	4,230,029	752,778.3
5	Gazprombank	Moscow	Gazprom	3,653,115	809,626.2
11	Trust and Investment bank	Moscow	YUKOS	1,423,200	171,376.5
14	Surgutneftegaz-bank	Surgut	Surgutneftegaz	1,101,317	41,947.1
16	Menatep -St. Petersburg	St. Petersburg	YUKOS	973,605.9	82,412.6
17	Petrokommerts	Moscow	Lukoil	805,047.5	181,476.2
23	National Reserve Bank	Moscow	Gazprom	615,379.1	160,537.9
27	Nikoil	Moscow	Lukoil	481,488.8	87,728.3
29	Sobinbank	Moscow	Lukoil	465,583.7	129,084.7

Source: Rating Agency Expert (2002)

The services of professional consultants are in a similar situation. Energy companies have been the largest consumers of consulting services from the very beginning of the period of market reform, in comparison with other industries of the Russian economy. They were the first to appreciate the benefits of best practice and professional advice in their business activities. For this reason, energy companies have become the largest consumers of business consulting and auditing in Russia. In the beginning of the 1990s, auditing services (including the audit of resources) and tax consulting prevailed in the breakdown of services of third-party consultants. Now, the structure of the market has changed in favor of IT consulting, management consulting, and corporate finance. Strategy consulting, which requires the highest level of expertise, accounts for only a small portion of the market (no more than 5%), and this segment has only recently begun to develop.

Figure 5.38 Affiliate and Dependent Companies of LUKOIL That Provide Financial and Consulting Services



Source: Expert (2002)

Consulting companies of Northwest Russia are not significant in servicing regional energy companies. Most services are acquired from Moscow-based firms that usually have significant lobbying potential, a large scale of operations, and are located closer to the central offices of energy companies. The machine-building companies of Northwest Russia, which primarily use the services of regional consultants (for example, the partnership of the Alt company and Izhora Plants), are exceptions. There are also cases of long-term partnership between consulting companies and electric power companies of Northwest Russia, such as the Institute for Entrepreneurship Issues and Lenenergo, but this partnership primarily focuses on solving local problems and often has a traditional, rather than a commercial, character.

Environmental Protection. At the present time, almost all projects connected with environmental protection in the companies of the energy sector are being implemented by the companies themselves, or their affiliate structures, and the role of outsourcing is insignificant. In most cases, the functions of independent companies come down to the elimination of the consequences of accidents and providing ecology consulting services.

The problem of environmental pollution caused by the companies of the energy sector of Northwest Russia is acute. Due to the specific features of manufacturing, as well as the use of outdated equipment and technologies, energy companies are the largest polluters in the region.

Table 5.17 Emission of Polluting Substances into the Atmosphere in Northwest Russia in 2000 (by the largest polluters)

Company	*Region*	*Emission of Polluting Substances, thous. metric tons*	*% of the total pollution in the region*
KINEF	Leningrad	51.9	27%
Vorkuta Thermal Power Plant #2	Komi	51.0	27%
The subsidiary of Severgazprom	Vologda	46.8	9.8%
Severodvinsk Thermal Power Plant #1	Arkhangelsk	42.5	15.8%
Kirishskaya Thermal Power Plant	Leningrad	36.1	18.8%
Sosnogorsky Gas Processing Plant	Komi	30.0	4.4%
Cherepovetskaya Thermal Power Plant	Vologda	26.2	5.5 %
Apatity Thermal Power Plant	Murmansk	23.8	6.2%
Arkhangelsk Thermal Power Plant	Arkhangelsk	21.0	7.8%
Vorkuta Thermal Power Plant #1	Komi	19.2	2.8%
Murmansk Thermal Power Plant	Murmansk	12.8	3.4%
Pervomaiskaya Thermal Power Plant	St. Petersburg	7.7	13.2%
Thermal Power Plant #15	St. Petersburg	3.8	6.5%
Southern Thermal Power Plant	St. Petersburg	3.4	5.8%
Pskov Thermal Power Plant	Pskov	2.8	14.9%

Source: Government study "On the State of the Environment of the Russian Federation," Ministry of Natural Resources of the Russian Federation (2001)

Damaging effects of the energy industry on the environment have been lowered by measures that have been taken in recent years. This primarily concerns the increased volume of diagnostic and scheduled maintenance work on pipelines, which has lowered the number of accidents involving the leakage of gas, oil, and oil products. At the same time, the volume of investment by energy companies in environment protection remains low. The projects connected with lowering air pollution are few in number and are most often initiated by foreign investors or sponsors.

The existing system of environment management in the energy companies is anything but effective. It is fair to say that the managers of Russian energy companies view the neglect of environment protection as one of their cost advantages. The companies of the energy cluster have increasing opportunities and incentives for implementing full-scale environment protection measures as energy markets become more liberal, environment protection legislation becomes more stringent, and international partnerships develop. The achievement of levels of pollution comparable to those accepted in Western Europe will be a long-term process, however. Nevertheless, it is envisaged that the demand for technologies that are environmentally safe and less polluting will increase steadily in the near future.

Thus, the contemporary structure of related and supporting industries of the energy cluster is in many respects a legacy from the Soviet period. It is undergoing restructuring and adaptation to new economic conditions, but there is still a long way to go. Financial, consulting and ICT engineering companies develop fast but need to adopt their services to the factual needs of customers. Prospecting is experiencing very difficult time due to lack of demand. The outsourcing of industrial services remains an exotic activity nearly in all the subsectors of energy cluster, except oil production. Development of outsourcing activities is considered as an important strategy priority for energy companies in the coming years. This would allow them to focus on their core competence and to lower the costs of goods and services, as well as to offer more competitive and higher value added products.

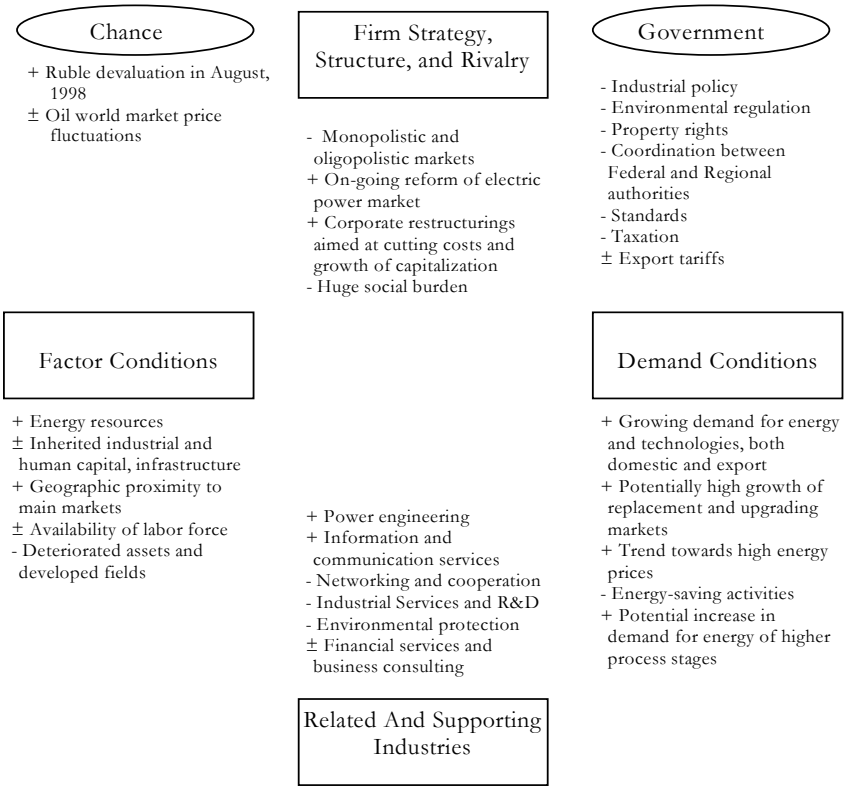
It is envisaged that development of related and supporting industries will to a large extent determine competitiveness of the energy cluster in the years to come. We believe that focusing efforts on developing these areas of activity could bring good results to state and business. There are many entry opportunities opening up for the foreign players in this area.

6 Factors of Competitiveness

In previous chapters, we described the energy cluster of Northwest Russia, systematizing information about its history, as well as its current state and specific features. Our goal in this chapter is to analyze the main factors that determine the competitiveness of the cluster, and to point out certain trends that could influence its development in the future.

Figure 52 shows the main determinants of competitiveness, grouped according to the principles of Michael Porter's Diamond Model.

Figure 6.1 Determinants of Competitiveness in the Northwest Russian Energy Cluster



During the period of reform, the companies of the energy cluster, with only a few exceptions, were the most financially stable, generated the largest cash flow, and were the leading investors in Russia.

The main production factors in the cluster (raw materials, industrial facilities, infrastructure, and labor force) were inherited from the Soviet period. It were these factors that determined the development of the cluster in the past decade. Individual segments of the cluster, in particular the oil production and refining industry, were successful and able to modernize after a sharp decline in the early 1990s, and have continued to thrive. The other segments of the cluster, especially the coal and shale industry, experienced a sharp drop in attractiveness and volumes of investment, and a virtual collapse of their former potential.

Demand was another important factor that undermined development in the energy cluster. The structure of demand for energy after the collapse of the socialist planning system changed dramatically. The domestic market contracted severely, due to the general decline in the Russian economy and purchasing power of the population. Local producers may encounter difficulties connected with the relatively small size of the domestic market, although it has registered growth in recent years.

Exports were the only monetary source that maintained production volumes at a feasible level in some industries of the energy cluster in the contracted domestic market. Only the oil and gas industries and the oil-refining industry could avail themselves of opportunities for exporting. These conditions have made it possible for the oil and gas industry to become the most successful and dynamically developing segment of the energy cluster of Northwest Russia. Exports of the electric power industry were limited, due to lack of infrastructure, although its prices are competitive and it has sufficient reserve capacity. The products of the region's coal industry have a rather limited viability on the world market, primarily due to high transportation expenditures.

The privatization and redistribution of property in the oil industry has for the most part been accomplished, and this has had an overall positive impact. Already today, a number of large-scale investment projects are under consideration or being executed: upgrading, the development of transportation infrastructure, and the investments in green field facilities.

The restructuring of the natural monopolies RAO UES of Russia and Gazprom is expected to stimulate the development of the electric power and gas industry. The government and the State Duma are actively deliberating ways of reforming RAO UES of Russia and a package of legislative acts concerning the new structure of the electric power industry. The goal of restructuring the gas monopoly is a medium to long-range prospect. The reform of these industries may give rise to dramatic changes in the corporate landscape of the Northwest Russian energy market, and significantly influence the investment climate and the overall dynamics of the cluster.

At the present time, the companies of the cluster are still burdened by the legacy of the Soviet period: low productivity and excess labor force (primarily in the electric power industry); the need to maintain a social infrastructure (oil, coal and shale industries); and general neglect of environmental protection issues.

The related and supporting industries are undergoing a process of reform and adaptation to new economic conditions. The reduction in prospecting, the rudimentary state of the Russian banking and finance sector, and the absence of an effective market for professional industrial services for the companies of the cluster are the primary problems of the present moment.

The high level of monopolization in the sector and its so-called "strategic significance" give rise to extensive government influence in the cluster. Participation in many of the key companies, the regulation of tariffs for electric power, gas, pipeline and railroad transport, export quotas, etc., provide the government with extensive leverage over the sector. At the same time, the government has no single strategy for the long-term development of the power industry, nor has it focused its efforts on achieving long-term objectives. The domestic industrial policy is characterized by a lack of clearly defined goals and poorly coordinated decisions of various authorities and decision-making bodies. The role of the government comes down to resolving various short-term economic issues. At the same time, this lack of a unified policy often leads to conflicts between federal and regional authorities and companies.

6.1 Factor Conditions

Northwest Russia has substantial resources of raw materials for the energy cluster. This concerns, in particular, its reserves of oil and gas products, which enjoy high liquidity and demand on the world market. Despite the fact that at the present rate of processing, the deposits of oil, gas, coal, and shale already under exploitation are sufficient for many years to come, the depletion of the richest and most accessible reserves confront the extracting companies with the need for substantial investment in further exploitation and prospecting. Still more funds are needed for exploitation of new deposits that were prospected during the Soviet period, but did not undergo exploitation. These deposits include, in particular, the reserves of the continental shelf (the Shtokmanovskoe deposit in the Barents Sea, and the Prirazlomnoe oil deposit in the Pechora area). There has been no significant increase of prospected reserves of raw materials during the past decade, due to the almost total shutdown of large-scale prospecting.

It is important to take into consideration the fact that most of the already exploited deposits, and all new deposits, are located in remote and sparsely populated regions with a severe climate. This requires significant additional expenditures for exploration and exploitation of deposits, as well as for transporting the products to markets.

The geographical location may be viewed as a relative advantage and positive factor for the long-term development of the cluster, in comparison with other energy–rich regions of Russia. Its relative proximity to the Western European markets, as well as the domestic market of the industrial regions in central Russia, provide for lower transport costs for energy produced in Northwest Russia.

Another geographical location related advantage of this region is its location at the new crossroads of international trade routes created by ports in the St. Petersburg and the Leningrad Region. The successful completion of ongoing projects (the construction of the Baltic pipeline system, the reconstruction of oil product terminal in St. Petersburg, the construction of an oil port in the Batareinaya and Varandeiya Bays, and the reconstruction of a port in Murmansk) will allow for further expansion of the export potential of regional companies, increase the flow of transit freight traffic, and create additional conditions for achieving economies of scale for the processing and service companies, thus lowering expenditures[17], and further developing the higher value added activities in Northwest Russia.

The density of the transportation infrastructure and its physical state are still fairly poor, however, preventing it from taking full advantage of the favorable location. The low density of the railroad network, persistent shortages of railroad cars, poor quality and reliability of services, and continually growing tariffs, are all characteristic of railroad transportation today, and undermine the competitiveness of the energy cluster. The pipeline transportation system is for the most part worn out, which accounts for the high rate of accidents on the pipelines of Northwest Russia (around 150 pipelines breakages per year according to expert estimates). The lack of an indispensable network infrastructure hinders the

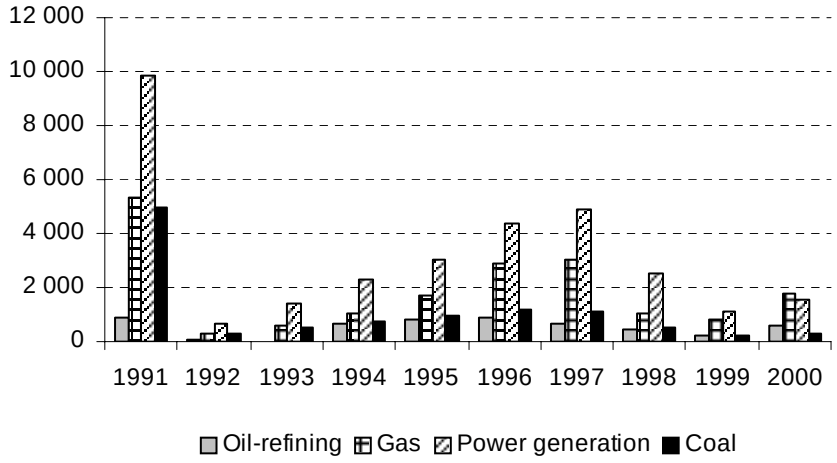
[17] This would resolve the problem of the quality of oil exported via the Baltic pipeline system, in particular. The characteristics of oil from the Timano-Pechorskaya province are comparable to those of Brent oil. However, when it enters the pipelines, it is mixed with oil with a high sulfate-content, supplied from such regions as the Republic of Bashkiria and Tatarstan. As a result, tankers are filled with Urals oil, which is sold on the world market at a discount of 1.5 to 3 dollars of the price of Brent oil. The construction of the region's own transportation system, which would include a terminal in the Varandeya Bay (implemented by Lukoil and CONOCO), would prevent these kinds of losses.

full utilization of the production capacities of power-generating companies and limits their competitiveness on the electric energy market.

The production facilities of the companies of the Northwest Russian power industry were, for the most part, inherited from the Soviet period. Only the Northwest Power Plant (a project that cannot be called unequivocally successful), and a number of oil production facilities, have been put into operation over the past decade and mainly with the participation of international investors. The utilization rate of the existing production facilities has decreased from nearly 100% in the beginning of the 1990s, to 70 - 80% and lower. Leningradslanets, for example, operates at 43.5% of its capacity.

The industrial assets of energy companies are characterized by low productivity in comparison with similar manufacturers of developed countries. This problem is especially acute in the electric energy, coal and shale industries. The technologies and equipment underwent almost no modernization in the 1990s. From 1991 to 2000, investments in fixed assets in the electric power industry decreased by almost 6.5 times, and in the coal industry by 16 times.

Figure 6.2 Investment in Fixed Assets of Energy Industries in Russia, million USD



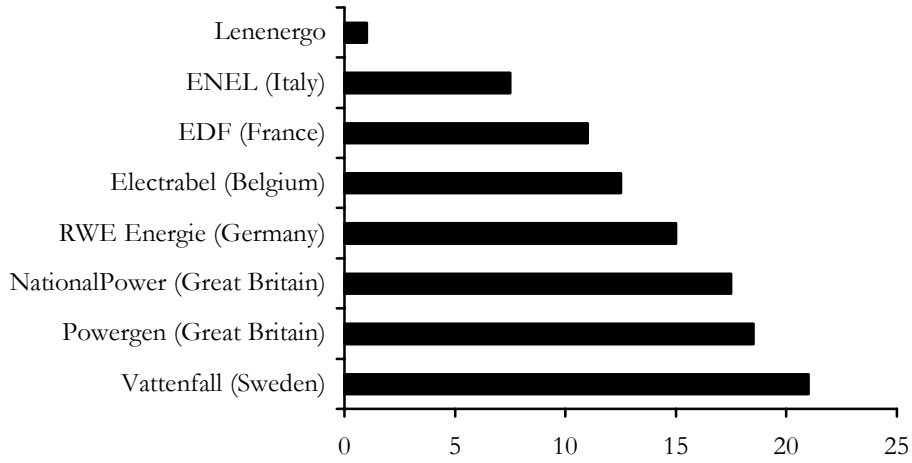
Source: Goskomstat (2001)

The oil and gas industries found themselves in a better position: high revenues from export of gas and oil allowed them to accumulate significant investment resources. The share of the oil and gas sector today is 45% of the total volume of investment in industrial facilities in Russia.

During the 1990s, however, oil companies directed their investments primarily at acquiring assets in order to expand their resource base and production facilities. Gazprom, in its turn, focused on developing the network of export-oriented main gas-pipelines and the expansion of its presence on the European markets. In addition, Gazprom is being forced to compensate for the losses incurred in domestic market sales (the regulated price of domestic gas is a mere 15% of the price of gas on European markets).

In general, the basic technologies utilized today in the energy cluster are characterized by a high rate of internal energy consumption, high outlay of raw and other materials, as well as high specific labor expenditures per unit of production. In other words they have low efficiency and productivity.

Figure 6.3 Comparison of the production of electric power calculated per one employee in a group of the largest electric power plants of Europe, GWh per employee[18]



Source: Computations, MarketLine (1997)

Thus, the general lag in technological development between Russia and developed countries at the present time is significant, and is increasing in all industries, with the exception of oil production and oil refining. The competitiveness of the energy companies is compromised by the low productivity and efficiency associated with relatively high transporta-

[18] Data on international companies as of the end of 1997; on Lenenergo, as of the end of 1999.

tion costs and poor quality and reliability of the logistics system. These inefficiencies are compensated by lower expenditures on raw materials, which is also an unsustainable approach (low state revenues and as a result minor investments in prospecting, infrastructure, etc.). To increase long-term competitiveness and wealth, major efforts must be made by companies and government bodies. Another legacy of the Soviet period is the high level of environmental pollution, brought about by technological inadequacies and the lack of effective environment protection legislation, without which companies have not implemented the relatively costly measures. In fact, the low environmental protection standards are currently used to provide short-term cost advantages for the Russian companies. This further undermines the long-term competitiveness of the energy cluster, as future generations will be forced to bear these costs.

The presence of a well-developed educational and R&D system in the region, which provides the industry with qualified employees and innovations, is considered to be one of the strongest advantages of the energy cluster of Northwest Russia. The largest agglomeration of the companies of the power engineering in Russia took shape in St. Petersburg, in part due to the strengths of the system of education and R&D in this city. During the past decade, however, the accumulated potential of the system for the most part disintegrated. Today, the main advantage of the workforce involved in the extraction, processing and machine-building segments of the energy cluster, is its low cost. The skills and knowledge accumulated in a prior era still play a crucial role, to be sure. In order to become a source of competitiveness, however, the local educational system needs to be reorganized in a way that will accommodate changes in demand for content and quality of training.

The educational system continues to graduate a large number of specialists; at the same time, the quality of their training is much lower than that of developed countries. In addition to a lack of the knowledge and skills necessary for modern high-technological manufacture, the low quality of personnel of Russian companies can be attributed in part to the country's low standard of living. All of this is a result of the low mobility of the population, the lack of local opportunities for improving skills, and the lack of incentives for the skilled labor force to leave big cities and resettle in areas where the quality of life is much lower. This is also a function of the remnants of the mentality of low-paid workers brought up in the Soviet period, who take little responsibility for the results of their labor.

The R&D system experienced a crisis due to a severe decrease in demand. Today its innovative potential is only partly used by domestic companies. The transition to the market economy imposed a substantial burden on R&D institutions, which were forced to adjust in order to survive. Those, which failed to adjust, either vanished altogether or were forced to change their areas of specialization. A few companies and engineers managed to accommodate themselves to the new situation. Others found it easier to leave the R&D institutions, some leaving the country, and some taking up other activities. On the other hand, there is now substantial delayed demand for R&D and new product development. The companies of the electric power, coal, and other industries are experiencing an acute need for improving their technologies. The largest power engineering companies of the region are for the most part oriented towards the market of after-sales servicing and replacement, which clearly does not stimulate the development of new technologies in the long run.

Summarizing the analysis of production factors, one can conclude that the natural geographical and infrastructural features inherited from the Soviet period favors (with some reservations) only the development of the oil and gas segment of the energy cluster. The scientific potential of the energy cluster, in particular the potential of power engineering, which is connected with R&D, is exhausted. The relatively low cost of the workforce is only a temporary advantage that must be enforced by building more sophisticated advantages.

The development of all factors of production will require significant investments already in the near future. Attracting and utilizing these investments in turn will require substantial improvement of the federal, regional, and industrial conditions for investment, restructuring of natural monopolies, as well as the formation of an effective financial infrastructure. This will require a better-trained and more efficient labor force for implementing new technologies. The key element in the formation of the long-term competitiveness of the sector is also a purposeful federal policy on setting the priorities of the educational system for carrying out specific tasks in industry.

6.2 Firm Strategy, Structure and Rivalry

The structure of the Northwest Russian energy cluster took shape during the Soviet period and was characterized by strong technological and geographical dependence of suppliers and consumers of energy within the framework of a centralized power-supply system. The enterprises created during that period had the following features:

- Large amalgamations of enterprises were created that were inflexible and difficult to change
- The companies were built to became maximally self-sufficient, which made them especially vulnerable after the transition to the market economy
- State planning, which centrally allocated inputs and outputs of the enterprises, precluded the possibility of competition
- Over-employment and low productivity were encouraged by the Soviet system, which had as its primary goal the achievement of 100% employment
- As a rule, the enterprises became population centers and had to sustain large social expenditures.

All the above-listed inherited structural problems have remained in place up to the present. The high entry barriers, and the matters discussed above, are the primary obstacles for the development of the industry.

In spite of the decade of market reforms, RAO UES of Russia and Gazprom are still the largest natural monopolies, virtually under the total control of the state. The coal industry of Northwest Russia is also under the government control[19]. Private capital currently prevails only in the oil industry, the privatization of which was accompanied by many conflicts, litigation, and criminal reprisals. Privatization, however, was not sufficient to stimulate competition. Even in the oil industry, which has better accommodated to the market conditions, there is still oligopolistic competition in many product segments. Oil is controlled by vertically-integrated groups, beginning from raw oil extraction, to distribution of products or exports. In the oil-processing industry of Northwest Russia, there is no competition between the two main independent participants, KINEF and LUKOIL-Ukhtaneftepererabotka. A similar situation reigns in other industries.

Thus, all primary participants of the energy market of Northwest Russia are regional monopolies and establish the rules of the game for smaller companies.[20.] In actuality, the only competitive market of energy resources today is the St. Petersburg gasoline market. Lack of competition is a significant long-term problem for the energy cluster. The com-

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19 In spite of the fact that the federal authorities have agreed to their privatization, 85%of Intaugol and 62% of Vorkutaugol belong to the government.

20 The government monopoly for railroad transportation should also be taken into consideration here.

panies enjoy a monopoly position, efficiently blocking entry to new participants, and lack incentives for improving their efficiency.

Table 6.1 Contemporary Market of Energy Resources of Northwest Russia

Industry	*Type of Market*	*Number of Independent Participants with a Total Market Share >75%*	*Companies**
Electric energy	Monopoly	1	RAO UES of Russia (≈100%)
Gas	Monopoly	1	OAO Gazprom (≈100%)
Oil	Oligopoly	1	OAO Lukoil (80%), OAO Polyarnoe Siyanie (13%) Severnaya Neft (6%)
Oil processing	Oligopoly	1	OAO «KINEF» (82%) Lukoil-Ukhtaneftepererabotka (18%)
Coal	Oligopoly	2	Vorkutaugol (63%), Intaugol (37%)
Shale oil	Monopoly	1	OAO Leningradslanets (100%)

Note: Approximate shares of companies on markets of corresponding products in the region are shown in parentheses

It should be noted that the dominant position of Lukoil does not have as negative an impact on the market as the monopoly RAO UES of Russia has, for example, since Lukoil competes on the national level. In addition, the federal property of the pipeline system[21] guarantees small companies the possibility of transporting the oil they produce. At the same time, RAO UES of Russia and Gazprom control not just the sphere of production (gas production and energy generation), but also transport systems (gas pipelines and electric power transmission grids). The emergence of new participants on the gas and electric energy markets today is hard to imagine without support and participation on the political level.

[21] The system of main oil-pipelines is owned by the Transneft company, of which 100% of the stock is owned by the government.

Box 6.1 Independent Oil Producers

Today, only a few oil companies of Northwest Russia can claim to be independent of Lukoil. These are for the most part joint ventures, where the controlling interest belongs to the foreign partner, and the rest of the stock is distributed among regional authorities and/or Russian participants.

At the early stages of creating small-scale oil companies in Russia, a traditional pattern included the participation of a large-scale vertically integrated company in their stock. This was explained by the fact that oil holdings owned the trade infrastructure, in particular transport, and efficient cooperation with them meant a significant savings in expenditures. Most small-scale oil companies in Northwest Russia were established on this principle, including KomiArcticOil, AmKomi, Kolvaneft, Polyarnoe Siyanie, KomiQuest, and others. Later, however, many of these companies were absorbed by Lukoil.

Today, joint venture enterprises show fairly high rates of development, despite the fact that they explore deposits with oil that is difficult to extract, and with small resources (up to 10 million metric tons). In addition, independent producers pay more in taxes per one ton of oil than Lukoil, which optimizes its taxes through the system of inter-holding transfer calculations. The latter is the subject of a permanent conflict between Lukoil and regional authorities. The higher labor productivity and growth rates of small joint ventures, in comparison with Lukoil, may be largely explained by the fact that they are free from the social burden and have a more efficient structure of production.

The process of corporate acquisition of independent oil companies on the part of large oil holdings in Russia in 2000 and 2001 was accompanied by wide-spread use of "non-market" methods of persuasion. In particular, notwithstanding the previously achieved agreements, companies were not given access to industrial power and pipeline infrastructure. This led to a situation in which small companies were forced to operate with maximum autonomy, virtually not interacting with large holdings. The pressure on the part of large companies, however, is growing stronger and a new wave of acquisitions can be anticipated in the future.

The Reform of Natural Monopolies

The government and all participants on the market have already understood the inevitable need for the reform of natural monopolies. Concrete results of the reform will begin to influence the development of the companies of the energy cluster in the next few years; the completion of this process is anticipated only over the long-term perspective, however.

Whereas the government and the State Duma are still actively debating the principles of reforming RAO UES of Russia and considering a legislation package on the new structure of the electric power industry, virtually all energy companies have already prepared projects for reform.

Some of them have already been approved by the project committee of RAO UES of Russia, and are awaiting final approval by the government, the Duma, and RAO UES of Russia.

Box 6.2 Restructuring of the Electric Power Market in Northwest Russia

The projects for restructuring electric power companies in Northwest Russia were elaborated in compliance with the "basic version" provided in the directive #526 of the Government of Russia, dated July 11, 2001, and the methodology recommendations by RAO UES of Russia. The main idea of this version is the division of competitive (generation and marketing of electric energy) and monopoly (electric power grids) components of the electric power business.

The ultimate goal of the reform of the energy industry is defined as the creation of independent and competing generating and marketing companies, as well as a federal network company that owns and controls the networks and is, in turn, owned by the government. Specially created managing companies must take active and optimal management of the process of reforming each of the existing energy companies until their ultimate separation is achieved and the government withdraws from competitive businesses. The second stage of reforming as described in the "basic version" implies the unification of generating companies into larger, inter-regional companies.

Despite the fact that all the formalities in the preparation of regional projects for restructuring were observed, by no means all of the developed concepts can be considered viable. A number of energy systems in Northwest Russia are characterized by a high degree of isolation, since the existing inter-regional network infrastructure is insufficient for effective interaction between systems. For this reason, the creation of a comprehensive, competitive electric power market in such regions as the Republic of Komi and the Arkhangelsk Region is hardly possible. These energy systems will preserve the structure of vertical integration, at least between the generating and marketing structures, in spite of the formal realization of the principles of restructuring proposed by the government. Due to the remoteness of the energy systems of the Arkhangelsk and Kaliningrad regions and the Republic of Komi, their inclusion into inter-regional generating companies is not planned.

There are many mutually exclusive opinions concerning the principles of realization and the consequences of reform in the electric power industry. These issues are examined in more detail in the appendix "Energy Networks as a Marketplace." In general, however, the restructuring has already demonstrated (and will hopefully continue to demonstrate) a positive influence on increasing the investment attractiveness and commercial effectiveness of the companies of the industry, the development of markets of related and supporting industries, and, ultimately, the growth of the competitiveness of the electric power industry.

Unlike the situation in the electric power industry, it is unrealistic to expect a full-scale restructuring of the gas industry in the near future. None of the existing alternative concepts for restructuring the Gazprom company has been approved by the government. (The existing alternative for restructuring Gazprom is presented in the appendix "The Restructuring of Gazprom.") In essence, the process of reforming the gas monopoly has currently come to a complete halt, and will most likely resume no earlier than when the first results of reforming RAO UES of Russia are analyzed.

Box 6.3 Why has Gazprom not been restructured?

In the opinion of experts, the main reasons for which the process of restructuring Gazprom is continually delayed can be summarized as follows:

1. The highest executives of the company actively resist any attempts to restructure Gazprom. This is partially due to the fact that they are interested in preserving control over the assets and the market, and partially due to their desire to pursue their own interests in the gas business.
2. The restructuring of the gas industry and the liberalization of the gas market would be directly connected with the growth of prices for gas. Since the factor of low prices for energy resources presumably lies at the base of the competitiveness of Russian industry, the simultaneous growth of prices for both gas and electric energy during the restructuring of the electric power market might have a very negative impact on the state of the Russian economy. Such a course of events is entirely unacceptable for the government, nor is it acceptable for industrial companies.

In addition, the privatization of gas production companies at the present level of prices for gas is not reasonable, since it will lead to their undervaluation and the loss of additional gain by the government and present stockholders of Gazprom. This will also fail to attract large strategic investors to the industry.

A number of market-oriented changes on the gas market of Russia are nevertheless taking place. On the one hand, the government is implementing a policy of gradually increasing the costs of gas on the domestic market, which increases the profitability of domestic sales (or, rather, lowers the losses of these sales). This, in its turn, renders the gas market strategically interesting for other large-scale participants, in particular the oil companies, which have already begun to invest in projects for exploring gas deposits.

As the process of restructuring natural monopolies continues, tendencies towards integration in the power industry can be expected. The formation of large inter-regional companies will be accompanied by the ac-

quisition of privatized companies, both on the part of foreign companies and large Russian industrial finance groups. Russian oil holdings will play the biggest role in this process, as they have already expressed their interest in electric power and gas assets. If the necessary conditions for the effective functioning of newly created companies are established by this time, it will automatically lead to growth in competitiveness and investment activity, as well as the transference of knowledge and technologies, i.e. to the formation of a long-term foundation for stable development of the industry.

Corporate governance and strategies

The process of consolidation in the industries of the energy cluster that are not natural monopolies has been virtually completed. This is the case primarily with the oil and oil-processing industries; similar situations can be observed in the power engineering and coal industries, although privatization can make significant changes in the latter.

The ending of property disputes and the emergence of large participants create favorable conditions for gaining advantages from economy of scale, the concentration of large investment resources, and the implementation of long-term strategies for growth. The restructuring of companies aimed at optimizing expenditures, and the concentration on core competence, are priorities in the development of the cluster.

The accumulation of experience in participating in the market economy, and the emergence of a new generation of professional executives, have had a positive impact on the quality of corporate management. Almost all companies of the energy cluster today are intent on building more efficient financial and management accounting, and are intensifying control of the activities of their affiliate structures by means of creating a stricter vertical hierarchy of management and a concentration of authoritarian powers. For example, Lukoil is gradually transferring all executive management functions from its affiliated structures in Timano-Pechora to the Lukoil-Komi company. All licenses for the development of oil deposits that were previously issued for several of Lukoil's affiliated structures in this region are being reissued for Lukoil-Komi, as well.

In power engineering, the Silovye Mashiny company is gradually accomplishing a merger and transition to a unified stock. As a result, such Northwest companies as the Leningrad Metal Plant, Elekrosila, and the Turbine Blade Plant, will entirely lose their independence, within the framework of the new company Energomashexport Silovye Mashiny. The united company is expected to be able more easily to receive and

carry out large-scale and comprehensive orders, as well as to attract investments from financial markets.

Box 6.4 The Restructuring of Lukoil

In the 1990s, Lukoil, with ambitious plans for its development, made large investments in acquiring a number of non-specialized assets, in particular, power engineering and construction companies, creating its own fleet of tankers, and so forth. The plummeting domestic power engineering industry and the lack of a somewhat effective market of related services and manufactures, as well as the low cost of assets at the time, made these investments appear rather attractive. As a result of the subsequent growth of expenditures, however, against the background of the overall deterioration of the geological and economic characteristics of explored deposits, by 2001 the cost of oil production for Lukoil had become higher than it was for its main competitors, YUKOS and Sibneft. These companies had by that time already carried out a successful restructuring of their business processes. The quality of management of Lukoil had been subject to numerous criticisms on the part of market analysts, which immediately affected the growth rate of capitalization.

In order to improve the situation, in 2001 the managing board of Lukoil initiated a process of restructuring scheduled to take place over a five-year period. The reforms will in the first place concern the central management structure, foreign subdivisions, as well as service firms and other non-specialized assets. The company's plans include the consolidation into a unified structure of all subdivisions that are currently involved in exports, the restructuring of the service business, during which all non-specialized manufacturing assets (including transport, agricultural enterprises, machine-building plants, etc.) will be sold, and the reduction of the number of personnel by 25%. The temporary closing of oil wells with low productivity is also planned.

The company anticipates that the cost of production of one barrel of oil will decrease from 3.5 to 3.8 US dollars today, to 2.5 US dollars in 2005. The expenditures for services will decrease by 20%. It is expected that these measures will increase the profitability of the company and facilitate the significant growth of capitalization.

One of the most important areas of strategic management in the energy cluster, and one which has great significance for enhancing the efficiency of manufacture, is represented by various cost-saving programs. Oil and gas companies are making significant investments into new technologies for optimizing the flows of goods and materials, increasing the efficiency of drilling, and increasing the debits of wells. Another important area of cost management is the divestiture of non-core activities, such as services and the corresponding outsourcing. These processes are being implemented most energetically in the oil industry, in which the market of services for well-drilling and servicing, as well as servicing and

repair of equipment, is actively taking shape. According to the plan for restructuring, all auxiliary and service manufacturers of the electric power industry must also be divested from the new energy companies.

The social burden still remains one of the most significant problems for the companies. Most energy companies are population centers and are bound to bear significant costs in social welfare. In fact, the local authorities often demand from companies that they finance social programs in exchange for permits for implementing investment projects. Although oil and gas companies are able to cope with such expenditures, coal and shale companies often find this to be an insurmountable obstacle.

Thus, the modern structure of the market and energy companies does not favor an increase in the quality of consumer services, investment attractiveness, and the enhancement of production effectiveness. In addition, the virtual monopoly position of the large-scale participants on all regional markets is too high a barrier for new companies wishing to enter the industry. Despite the rather positive tendencies in the sphere of corporate management, which are connected with the emergence of a new generation of experienced managers, only the development of competitiveness can spur development of the energy cluster.

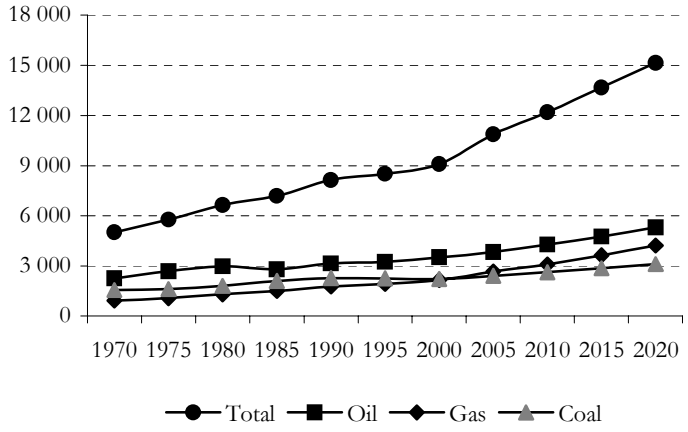
6.3 Demand Conditions

During the Soviet period, the main consumer of the products of the energy cluster was the domestic market, despite the significant export of both energy resources and equipment. In the 1990s, structural changes in the Russian economy caused an abrupt decrease in the domestic demand, and for many companies of the cluster, maintaining the volume of exports became the primary condition of survival. As a result, over 47% of the oil and 32% of the gas produced in Russia are being exported at the present time. Due to the discrepancy in price of these energy resources on the domestic and foreign markets, the share of exports in the total sales of some companies reaches 70% or more. The companies that for various reasons had no significant opportunities for export (the electric power and coal industries) are currently experiencing a period of technological decline and an acute lack of investment. The companies of the power engineering industry, which encountered an even sharper reduction of their traditional market than the extracting and electric power companies, were unable to realign themselves towards the foreign trade market. They were not even able to maintain their positions due to their lack of experience in offering competitive products, insufficient financial

resources for operating independently on the competitive international market, a multitude of inter-corporate conflicts connected with privatization, and so forth.

Global consumption. Despite the general tendency towards a slowdown in the rate of development of the world economy and progress in the development of new technologies, the consumption of energy resources continues to grow. Today, experts predict that primary energy consumption will grow 2.2% annually from now until the year 2020, and that the total amount of consumption may increase by more than 1.5 times, in comparison with the year 2000. Demand on the part of the developing Asian countries will account for almost half of the increase. The past decade was characterized by an intensive growth in the consumption of natural gas and renewable energy resources.

Figure 6.4 History and Projection of World Primary Energy Consumption (million tons oil equivalent)[22]



Source: BP (2002), Energy Information Administration (2002)

The growth of the world's consumption of energy resources is a favorable factor for Russian energy companies, since exports are of great importance for them. The developing countries of Asia and Eastern Europe, however, will be responsible for this growth, and this tendency might in the future change the geography of Russian exports, dramati-

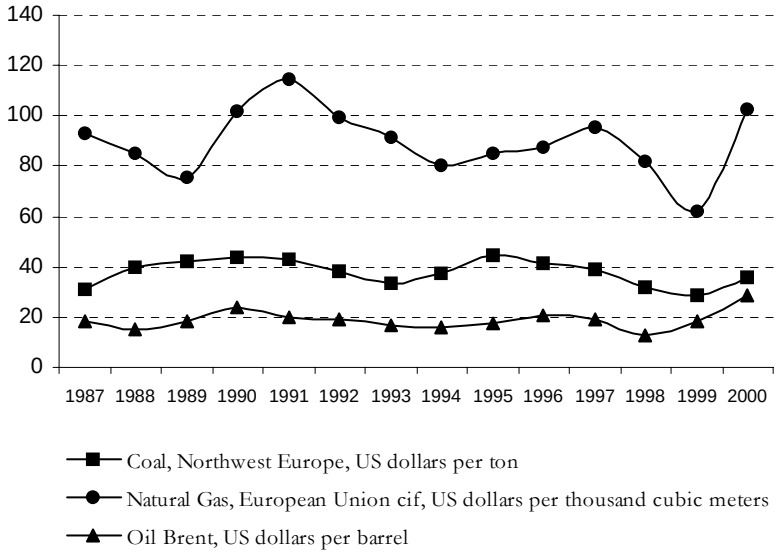
[22] Here and in the chapter "Demand," when converting data from different sources into a unified system of measure, the following coefficients were used: 1 million tons oil equivalent = 1.43 million tons coal equivalent (used in Russia), 1 million tons oil equivalent = 40.4 trillion British thermal unit (Btu).

cally influencing new investment in transport and infrastructure (the oil pipeline to North China, etc.). Today, Russia occupies stable positions (primarily in gas supplies) on the largest Western European markets. The tendency towards growth in the consumption of natural gas in Europe, and the resulting active development of the gas infrastructure (oriented towards Russia in many respects) will provide opportunities for Russian exports in the future.

Russia also has a number of possibilities for participating in the European wholesale electric power market, primarily in the market of the Baltic countries. In this region, there is a steady growth in the consumption and the development of the over-the-border electric power trade. Russian electric power companies have the necessary pre-conditions for participation in this market: both price competitiveness and surplus energy capacity. Today, however, an essential part of the technological infrastructure, i.e. transmission grids, is missing.

The level of prices on the world market of energy resources strongly influences the investment capability of Russian exporters of energy resources. Because of sharp fluctuation in oil prices during recent years, Russian oil companies have been repeatedly forced to revise their investment budgets. According to the calculations of experts, when the price of oil drops to the level of 16 US dollars per barrel, Russian com-

Figure 6.5 Dynamics of prices for oil, gas, and coal

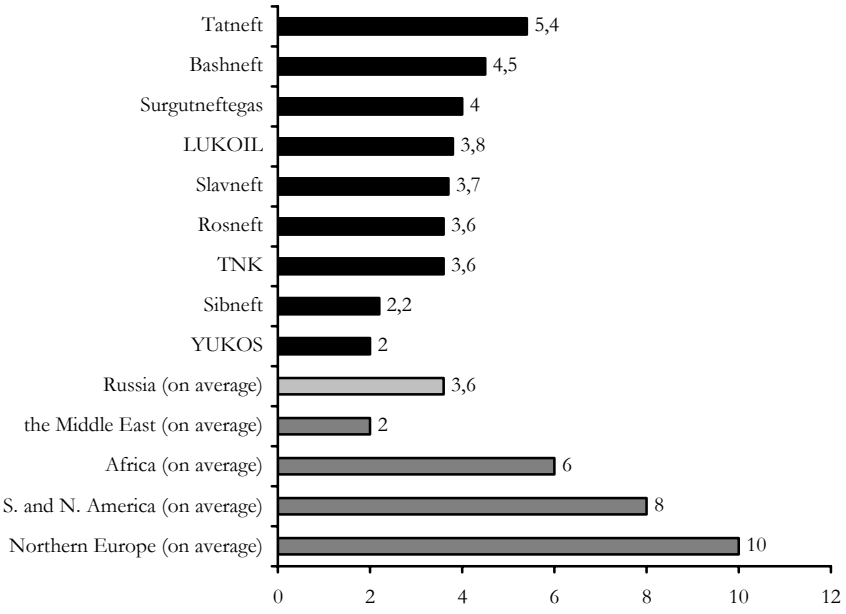


Source: BP (2002)

panies resort to significant adjustment of their investment budgets; when the price drops even further, to 10-12 US dollars per barrel, investments virtually come to a halt.

For the past four years, Russian oil companies have significantly lowered the cost of oil production, due to the reduction of expenditures and the introduction of modern extracting technologies. The average cost of oil at the mouth of the oil well in Russia is 3.6 US dollars per barrel, and including its transport and exporting, it rises to 8 to 12 US dollars. According to estimates of experts, its cost will continue to grow, primarily due to the increase of the share of oil that is difficult to extract and the growth of expenditures for electric energy, labor and other factors.

Figure 6.6 Cost of oil production at the mouth of the oil well in 2001



Source: Rosbusinessconsulting (2002)

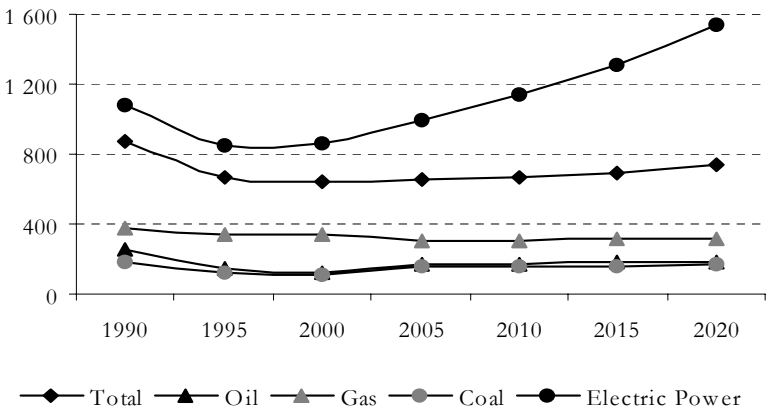
In the future, the price of oil is anticipated to undergo even greater fluctuations than those of the past decade, due both to the instability of the world economy and possible international conflicts. The average cost of one barrel of oil on the world market could be within the range of 23 to 27 US dollars until 2020, according to estimates. As mentioned above, these prices will enable Russian oil exporters to remain feasible and sustainable.

Domestic consumption. After the decline in the 1990s, beginning from 1999 the demand for primary energy in Russia has grown, due to the growth of industrial production. Today, the primary fuel on the domestic market is gas, the share of which is 53% of the total. The share of gas in the fuel balance of the European part of Russia is even higher - 55%.

The difficulties in making a prognosis for the consumption of primary energy in Russia are connected with a high indeterminacy; the estimates of experts diverge significantly. The official prognosis for the consumption of energy resources will be presented in "The New Energy Strategy of Russia Until 2020," which is expected to be published in the beginning of 2003 (see the case-box below in the chapter "Government.")

According to the preliminary draft of this document, published in 2000, the consumption of primary energy in Russia should increase annually by approximately 0.8%,[23] and the consumption of electric energy by 1.8% annually. This should lead to profound changes in the fuel balance. The share of gas will decrease to a level of 40 to 45% due to an

Figure 6.7 Consumption of primary energy (million tons oil equivalent) and electric power (TWh)[24] in Russia



Source: BP (2002), Primary Goals of the Energy Strategy of Russia Until 2020 (2000)

[23] The pessimistic scenario of development, based on an annual rate of growth of 3.5 - 3.7% in the Russian GDP. The optimistic scenario presumed an annual rate of growth of 5.0 - 5.5% in the Russian GDP. According to estimates of the Russian government, the rate of growth of the GDP in 2002 is 4%; this rate will be sustained in 2003.

[24] Pessimistic estimate

increase in consumption of oil and coal, primarily in eastern parts of Russia, and the role of the nuclear power industry will increase. The capacity of nuclear power plants is planned to increase by more than two times its present level by 2020. The sources of financing for implementing these large-scale structural changes are uncertain, however, and it is highly unlikely that many of these plans, such as the construction of new nuclear power plants and rebuilding of old facilities, will ever be implemented.

In any case, however, the steady growth that the Russian economy registers at the present time, and favorable prognoses for the future, suggest that a significant increase in the domestic demand for electric power and primary resources is inevitable. The problem remains that energy companies are not prepared for such growth. If oil companies are able to react quickly to the increase in demand, many electric and thermal power companies, on the other hand, need large-scale technical modernization, and gas companies encounter serious limitations in their infrastructure. Some other electric power companies, as well as coal companies, occupy an intermediate position. They still have surplus capacity, but their existing financial state and technological level prevent them from making adequate use of their excess capacity.

The main issue, and the cornerstone of the development of the Russian power industry, is the level of prices for energy resources. The main element of the Russian industrial policy today is the subsidization and regulation of prices on the domestic market. It is assumed that this will give additional competitive advantage to Russian industry, which will allow it to strengthen its positions during the transition period. Experience has shown, however, that this thesis is only partially correct in the short-term perspective, and will be damaging in the medium-term perspective. In a situation of unprecedented low prices for energy resources, Russian companies have ignored the issues of energy saving and energy efficiency. As a result, the energy consumption of Russian manufacturing, as well as the consumption of energy in the private sector, is many times higher than that of developed countries with similar climatic conditions. Enormous losses of energy at all stages from production to consumption have actually undermined the policy of low prices for energy resources today.

The necessity of increasing prices for energy resources to a level close to that of the global market (in other words, lifting restrictions and freeing prices) has now become crucial for the modernization of out-dated equipment, as well as for the creation of conditions for attracting large investment capital into the industry. The major problem that is under discussion today is how to avoid monopoly rents and create an efficient

energy market when prices are freed. This would require enormous additional investments in the infrastructure, which are not likely to take place. The alternative is regionalization of the development of the energy market, in which some regions will have open and efficient markets, and others will not, and substantial development of dispersed energy production. The power companies are no longer able to subsidize internal supplies from their export gains, and the "bad debts" that accumulated throughout the 1990s ought to be written off. However, the process of increasing prices will require many years in order for the industry to be able to accommodate itself to changes in the market conditions.

Table 6.2 Price Projection for Energy Resources in European Russia

Energy Resources	*For European Russia*		
	2000	*2005*	*2010*
Oil, USD per ton	46-48	65-75	100-120
Natural Gas, USD per thousand m^3	13-14	40-45	48-55
Coal, USD per ton	16-18	23-26	35-38
Electric Power, cents per kWh	1.1-1.15	2.7-2.9	3.6-3.9

Source: Primary Goals of the Energy Strategy of Russia Until 2020 (2000)

Box 6.5 Power Consumption of the Russian Economy

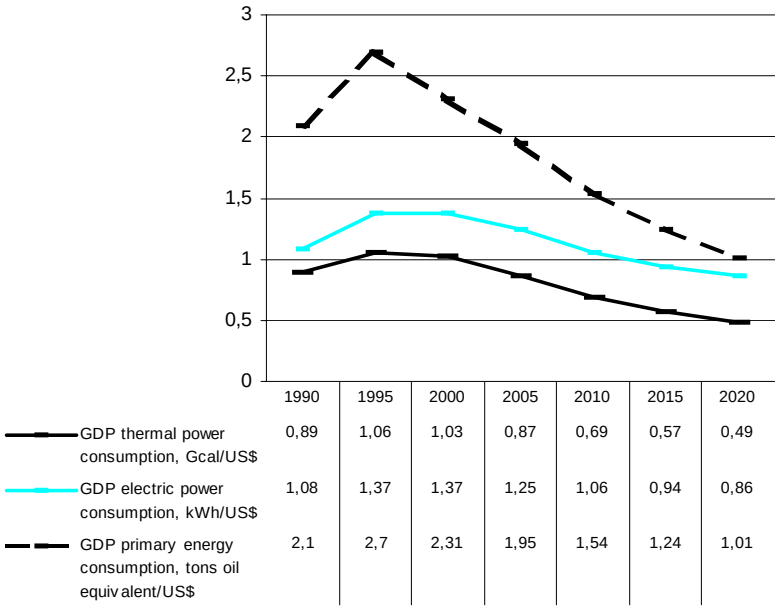
Price formation on the energy market has traditionally been the cause of much dispute in Russia. On the one hand, the costs of gas and energy in Russia need to be radically increased, and the growth in these prices is an objective process, necessary for the development of energy companies. On the other hand, a sharp price hike will impact the processing sector of the industry, due to the lack of energy-saving opportunities. In keeping with the interests of Russian industry, the government restrains the increase of tariffs for energy resources (gas and electric power), and their low cost is defined as a "natural competitive advantage of Russia."

At the present time, the power consumption in the Russian economy surpasses the level of developed countries by 3 to 4.5 times, according to various estimates. This leads not only to the increase in costs of end products manufactured in the country, but also undermines the long-term competitiveness of power industries and nullifies the positive effects of low energy prices on domestic manufacturing competitiveness.

In the future, with the expected growth of the GDP, the excessive power consumption of the Russian economy will require a significant increase in the produc-

tion of energy resources, which energy companies will not be able to deal with. The rapid depletion of deposits increases the share of capital investments (into the exploration and development of new deposits, and the creation of a transport and social infrastructure) in the cost of energy resources. It also negatively influences the business performance and the competitiveness of companies. The anticipated shortage of low-cost labor in industrially developed regions of Russia will motivate investments in more efficient technologies, which are normally not only labor efficient, but also energy efficient.

Figure 6.8 Russian GDP Energy Consumption



	1990	1995	2000	2005	2010	2015	2020
GDP thermal power consumption, Gcal/US$	0,89	1,06	1,03	0,87	0,69	0,57	0,49
GDP electric power consumption, kWh/US$	1,08	1,37	1,37	1,25	1,06	0,94	0,86
GDP primary energy consumption, tons oil equivalent/US$	2,1	2,7	2,31	1,95	1,54	1,24	1,01

Note: The GDP energy consumption index has been recalculated from tons coal equivalent used in Russia into tons oil equivalent

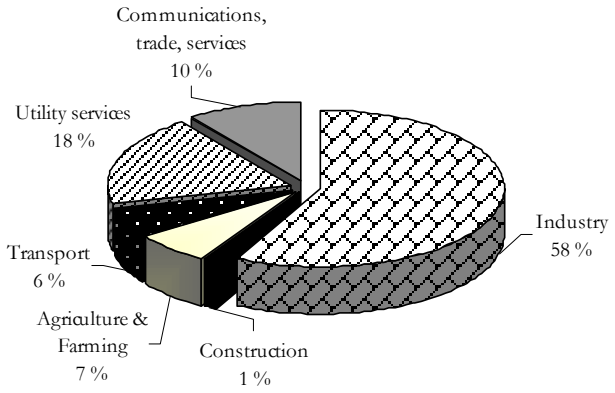
Source: Primary Goals of the Energy Strategy of Russia Until 2020 (2000)

The only solution to the problem is an active and broad implementation of modern energy-saving technologies. This requires large-scale and purposeful investments.

Energy Demand in Northwest Russia. The demand for primary energy in Northwest Russia has been unstable for the last five years. Prognoses show that the demand for energy in Northwest Russia will increase by 0.7 to 1.0% annually. The demand for electric energy will grow most rapidly; this is connected with the specialization of the region's economy on processing and much higher increase owing to fail-

ures to provide sufficient heat supplies leading to increase of electrical heating. Since 1998, the rate of growth in demand for electric power in the region exceeded 4%.

Figure 6.9 The Structure of Demand for Electric Power in Northwest Russia



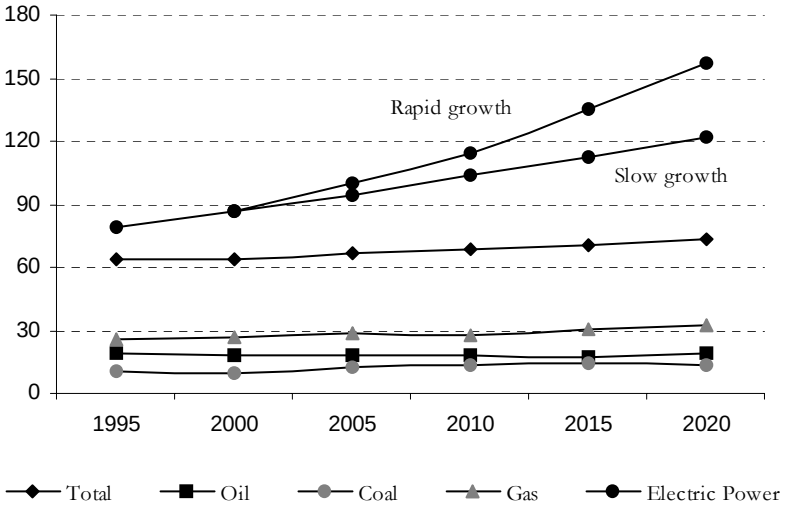
Source: Goskomstat (2001)

Industrial enterprises, especially metallurgy and machine-building, will remain the primary consumers of energy. The growth in consumption will also be related to the development of the food and chemical industries.

According to estimates, gas should remain the main energy resource in the consumption of primary energy in Northwest Russia. The share of gas in the total demand for energy will remain at 42%, and may possibly reach 44% by 2020. The consumption of coal in such regions as the Republic of Komi and the Arkhangelsk Region should grow, and its share in the total demand for energy in Northwest Russia could grow from 15% in 2001 to 20% in 2010. At the same time, it is estimated that the demand for oil will remain at the present level, and its share will gradually fall from 30% in 2001 to 26% in 2020.

The unevenness of the electric energy infrastructure, as well as the wear and tear of existing facilities, will soon give rise to the problems of power supply in some territories of Northwest Russia. The Republic of Karelia, and the Vologda and Arkhangelsk regions, for example, are already experiencing difficulties in meeting the growing demand for electric energy.

Figure 6.10 Demand for Primary Energy (million tons oil equivalent) and Electric Power (TWh)[25] in Northwest Russia



Source: Primary Goals of the Energy Strategy of Russia Until 2020 (2000).

Expanding electric power capacity and developing electric power networks are tasks of the highest priority, if economic development is to be sustained in these regions.

At the same time, the production of primary energy resources in Northwest Russia exceeds the level of local consumption. International markets are of primary importance to the oil industry of Northwest Russia, since most of the oil produced in the region is exported. Export markets will remain significant for oil production and processing. This is especially relevant for the KINEF refinery. For Leningradslanets, there is no domestic market at all, and even over a long-term perspective, Estonia will remain the only market for this company.

Northwest Russia will remain the primary market for producers of electric energy, coal and gas extracted in the region. Both the demand and the level of development of transport systems limit the possibilities for significant growth of export and supply to other Russian regions for these industries.

Power engineering. Russia has one of the largest energy systems in the world; during the Soviet period, a significant electric power-engineering agglomeration was created in Northwest Russia, which also

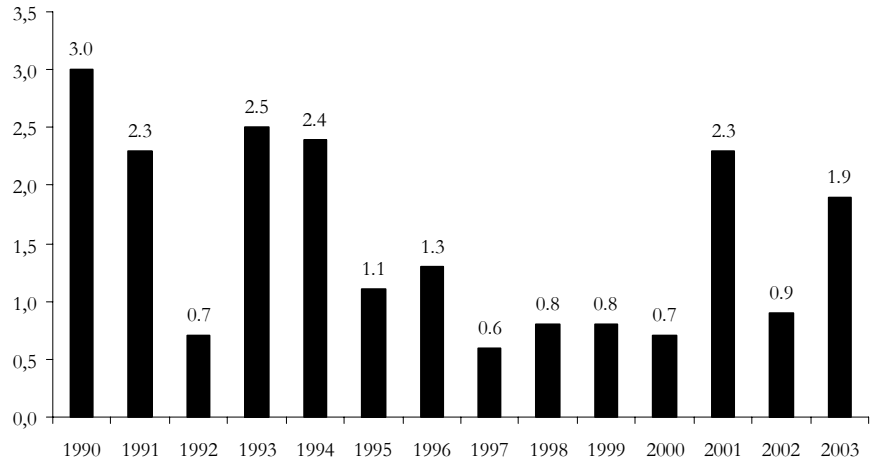
[25] Pessimistic estimate.

had significant export potential for its time. Today, the export of products of the Russian power engineering sector has been sharply curtailed, but the primary markets have remained unchanged: Asia, the Middle East, Eastern Europe, and South America. The primary markets for the engineering companies of the Russian energy sector have traditionally been Iran, China, India, Argentina, and the former Yugoslavia. It is easy to foresee that sales on the developing Asian markets will grow in the coming years if Russian products sustain their prices and are able to offer reliable after-sale service and attractive financing packages. The share of the Eastern Europe markets could drop as a result of the increasing influence on these markets of producers from the EU countries.

The growth of the domestic market offers opportunities that could spur the development of power engineering in Russia. According to RAO UES of Russia, 80 GW of power facilities will be worn out entirely by the beginning of 2005. This means that one third of all power facilities will have to be replaced. If the retirement of facilities continues at the same pace, by the year 2010 more than half of all of the thermal and hydropower plants in Russia will have to be replaced.

According to the estimates of experts, if the current need for renewal of power facilities and transmission networks persists, an investment of 70 billion US dollars will be required before 2010 for this purpose alone.

Figure 6.11 Introduction of New Power Facilities in Russia, GW



Note: 2001 and 2002 – assessment. 2003 – forecast

Source: Rosenergoatom (2002), RAO UES of Russia (2002), Primary Goals of the Energy Strategy of Russia Until 2020 (2000)

In addition, judging from the projected level of demand for electric power until 2010, the construction of about 30 GW of additional facilities is necessary . This could require an additional 9.5 to 15 billion US dollars. Thus, for the efficient renewal and development of the electric power industry, Russia could generate demand equal to 11 to 12 billion US dollars annually.

It is apparent that under existing conditions, it was not possible to provide this level of financing: the investment budget of RAO UES of Russia in 2002 was approximately 750 million US dollars, and that of the Rosenergoatom Consortium 950 million US dollars (2003). At the present level of tariffs, the returns of investment in new generating facilities are very low, or even negative. The retained earnings of electric power companies are hardly sufficient for maintaining their existing assets. As a result, the domestic power engineering sector today focuses on supplying spare parts and maintenance services, which adversely affects their longer-term competitiveness. The emerging huge gap in the need for modernization and available financing will most probably be transferred to regions and consumers and will be covered partly by rapid increase in prices partly through implementing more efficient generating and location as well as energy saving.

During the past ten years, the primary source of income for the companies of the power engineering industry has been after-sale servicing, repair, and replacement. Today, the increase of volume and the growth in the requirements of the domestic market are the deciding factors in raising the competitiveness of power engineering. Only the domestic market can create the prerequisites for restoring the volumes of production, raising the level of manufacturing productivity, and increasing the share of more advanced products, which will in turn facilitate the growth of exports of the products of power engineering companies. The existing competitive advantages of Russian manufacturers, in particular, costs, technological dependence of domestic consumers, close and sometimes personal relations between manufacturers and consumers, will eventually forfeit their significance to high quality and the comprehensiveness of market offerings. In the opinion of the authors, successful restructuring of natural monopolies, the improvement of the investment climate, and the growth in demand will ease international companies to make active attempts to strengthen their positions on the Russian market by means of creating new enterprises in Russia, consolidations, and forming corporate alliances. This will also facilitate an exchange of knowledge and skills, and perhaps the emergence of new products and successful domestic manufacturers.

At the same time, as environment protection requirements become more stringent in Russia in the near future, accompanied with growth of demand for energy saving, and for dispersed energy technologies, demand for new technological solutions will also grow. This will also facilitate the strengthening of imports and potentially investments in import substitution manufacturing, since the domestic manufacturers of equipment in these segments cannot compete with their international counterparts.

Thus, it is possible to observe that the conditions on both the domestic and foreign trade markets favor the development of the companies of the energy cluster. At the same time, domestic demand will become an even more powerful incentive for the development of electric power, and the power engineering and coal industries, whereas the oil and gas industries will gain advantages from the increase of exports. The prices for energy and fuel on the domestic market will remain at levels lower than European, although their significant growth is inevitable in the coming years that will bring some more challenges and difficult times for domestic energy producers.

6.4 Related and Supporting Industries

An advanced level of related and supporting industries is a necessary condition for the competitiveness and stable growth of industrial clusters. Importance of related and supporting suppliers was also understood in the Soviet period.

During the Soviet period, a complex of related and supporting industries of the energy cluster was formed in conjunction with the priorities of the planned economy, with all the characteristic features of such processes. Enormous enterprises were created that were self-sufficient and therefore were exceptionally vulnerable as regards the marketing system, logistics, supply, and financing after markets opened in the 90-ies. Generally, the enterprises were not able to choose equipment suppliers themselves, and worked closely with specific Russian manufacturers. The realities of the market economy forced companies to revise the role of auxiliary and service subdivisions, and opened an opportunity to buy competitive supplies not only domestically but also globally. In the past decade, radical changes have taken place in the sphere of related and supporting industries; however, an effective domestic market for their products and services, which would assist the companies in lowering costs and concentrating on their core competence, has not yet taken shape in Russia.

Prospecting. During the Soviet period, geological prospecting was a strategic economic priority. In order to insure resource self-sufficiency,

the Soviet government invested heavily in geological prospecting. These efforts resulted in the creation of a base of raw materials that would still last for several decades. During the past decade, the volume of government investments in prospecting has gradually decreased. For many reasons, the extracting companies also do not see prospecting as an important issue, today. These reasons include overall political instability, a legal environment that does not encourage investments in projects with long payback periods, etc. Having once gained control of significant supplies of raw materials, they preferred not to invest in risky, capital-intensive and long-term geological prospecting projects. Up until now, the primary means for increasing supplies for extracting companies was either purchasing licenses for already prospected deposits from the government, or absorbing other companies.

The lack of stable demand led to a decline in geological prospecting. The industrial assets and human potential that were lost in the recent past, sometimes irretrievably, have significantly lowered the effectiveness of geological prospecting.

In the course of the coming ten to fifteen years, this accumulated resource base will be depleted, and oil and gas companies may encounter serious difficulties in securing future supplies. Nevertheless, no measures are being taken at the present time to increase geological prospecting. By abolishing the tax earmarked for the purpose of financing geological research, the government virtually abandoned the industry, leaving the extracting companies to fend for themselves in financing their activities. In light of the present legislation and the level of investment risk involved, however, significant growth in private investment in geological prospecting in the short- and medium-term perspective is unlikely to take place.

The geological prospecting industry, having lost most of its accumulated potential, is at present unable to increase the prospected supplies of energy raw materials, thus putting the long-term development of extracting companies seriously at risk. At the same time, even partial replenishment of the lost potential of the industry is highly unlikely in the near future.

Technology Producers. Although the manufacture of power equipment is viewed as the basis of the cluster, the interrelations of this segment with all other branches of the power industry cluster require separate analysis. This section of our research stresses the factors of competitiveness of the manufacturers of power equipment, which makes up the largest share of machine building in Northwest Russia.[26] The authors of this study are certain that, in fact, the issues and problems under exami-

[26] Technologies for electric power plants, gas pumping equipment and power utilities for industrial companies (compressors, etc.).

nation are relevant in other branches of the machine-building industry, and our conclusions may be applied to other developers of technologies and manufacturers of equipment as well.

Today still the domestic manufacturers of power equipment occupy a fairly secure position on the domestic market. This is due to the fact that, first, in spite of overall decline, manufacturers have preserved the strong "brands" inherited from the Soviet period and the ability to produce all basic kinds of equipment for the energy sector. Second, they are price competitive. Third, there is a continuity in technological standards, which gives Russian manufacturers certain advantages.[27] Finally, the traditional and often personal ties between equipment manufacturers and energy companies remain strong.

In spite of this, power engineering companies experience ever-increasing competition from international manufacturers. This is related to a whole range of current issues, and overcoming them must become the topmost priority for the development of companies. The most significant of these issues are:

- *The low quality of manufacturing.* The low quality and sense of responsibility of manufacturers for the results of their work have already contributed to a negative image of domestic manufacturers. The absence of a systematic approach to quality management at all stages of manufacturing at the present time undermines still more the position of Russian power equipment manufacturers on the domestic and the foreign trade markets.

- *The absence of an effective system of marketing.* At the present time, Russian power engineering companies generally do not have a system of marketing in the Western sense of the word, i.e. a structure that would systematically analyze the business, the needs and views of the clients, make recommendations and create new products, organize services, elaborate programs for company assessment and positioning, predict the volume and structure of demand, etc. Most companies continue to view themselves as being on the "seller's market," whereas the market has long belonged to the buyer.[28]

- *The low level of services.* The services provided by machine-building companies primarily come down to the replacement of equipment that is

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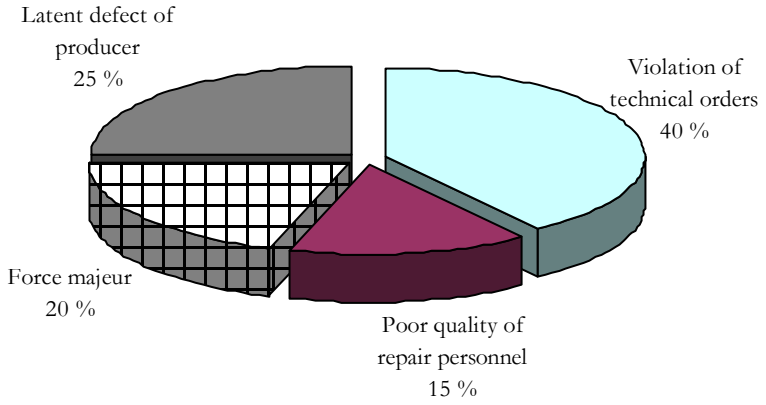
[27] Insofar as energy companies cannot always afford comprehensive technological solutions and complex engineering services.

[28] It is worth noting that a number of large corporations, such as Silovye Mashiny and Obiedinennye Mashinostroitelnye Zavody, already show significant progress in their marketing policies.

out of order. Monitoring of the operating modes of equipment and regular servicing are usually not included in the market offering of equipment manufacturers. This may be explained by the absence of easily accessible service centers, warehouses, and representatives.

Figure 6.12 Causes of Failure of Power-plant Equipment



- *The absence of leasing financing.* The practice of leasing in Russia is highly limited as a consequence of the inability of banking system to secure affordable financing solutions, flaws in legislation, undeveloped corporate lending market, and lack of experience and skills. This significantly narrows the opportunities for Russian manufacturers that do not have financial resources, sufficient liguidity and profitability for commercial credit, and moreover are in need of renewal of their main assets and, thus, itself require all the cash that is available for the investment.

Thus, the power engineering industry has a number of insurmountable problems in the interactions between the manufacturer and consumer of equipment, and these have a negative impact on the competitiveness of the energy cluster as a whole.

Industrial Services. Today, more and more energy companies are trying to increase the value of their business and competitiveness by means of restructuring, the main aspect of which is the singling out and sale of service and other non-core subdivisions.

Oil companies have come a greater way towards forming a market of independent services (drilling and servicing of wells, geophysical exploration, etc.). As mentioned above, the largest participants in this market are international companies (Schlumberger, Halliburton, Baker-Hughes, etc.).

They were originally well-positioned as large, independent companies and are now the main importers of new technologies to the Russian oil sector, surpassing Russian competitors in both quality and range of services. Obviously, their influence on the market of industrial services will grow in the future. Further growth of the market of industrial services in the oil industry will be determined by a clearly formulated strategy on the part of large oil holding companies, in terms of specialization and the minimizing of expenditures. The formation of this market can also be beneficial for companies of the gas industry, due to their similar technologies and methods of work. It can be assumed that during the restructuring of Gazprom, the transition to outsourcing of services will take place relatively rapidly.

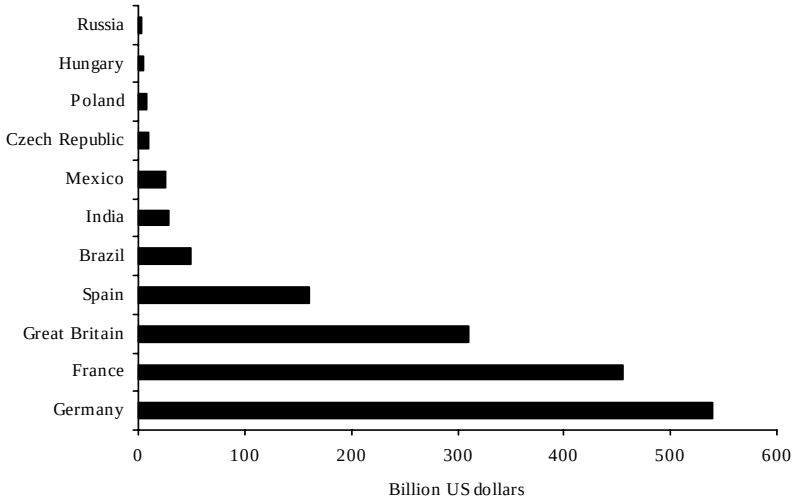
Today, however, both in the gas and the electric power industry, the outsourcing of services is developed to a much smaller degree, ensuring the security of supplies. Management continues to be oriented towards its own services and auxiliary departments, which usually lack motivation for increasing the quality and effectiveness of their work. The reform of RAO UES of Russia, with enforced singling out of service assets, will probably create the premises for forming a respective market of industrial services, but the market will become a conductor of added value only after the appearance of effective proprietors.

Financial services and business consulting. The development of the energy cluster is also hampered by the underdeveloped state of the Russian banking and financing sectors, as well as industrial insurance. This is a consequence of the rudimentary state of the respective markets. During the Soviet period, one part of the function of the sectors (banking and insurance) was monopolized by the state, while the other part (the financial market) did not exist as an element of the infrastructure at all. The complete instability in the development of those industries in the 1990s, due to the lack of long-term priorities in government policy, also severely weakened the Russian suppliers of banking and financial services, and undermined trust in them.

At the present time, insufficient capitalization is the main problem of the Russian banking sector. At the end of 2000, the average assets of the five largest non-government Russian banks were less than 2 billion US dollars, whereas the average assets amounted to 3.5 billion US dollars for the five largest Polish banks.

This determines to a large degree the inability of Russian banks to provide credit for long-term and capital-intensive energy projects. Practical experience has shown that companies receive large loans primarily from international banks, although this involves considerable transaction expenditures.

Figure 6.13 Average Assets of the Five Largest Non-government Banks, 2000



Source: McKinsey & Company

Box 6.6 Captive banks

Many Russian banks, strictly speaking, do not comply with marketing principles. They do not have to compete with international financial institutions, nor with alternative providers of financial services: capital markets, venture capital funds, cooperative crediting organizations, and others. They are also not especially competitive with one another. Most of them have one or several so-called captive clients, and providing them with services constitutes a large part of their business. The market of insurance services operates in a similar manner. Large companies or holdings that own such banks do not fully understand the true costs connected with conducting banking business, and in actuality subsidize banks that merely play the role of their treasuries.

Most of the largest Russian oil and gas corporations, Gazprom, Lukoil, and Yukos, have their own banking, financial and insurance institutions that occupy the leading positions on the market of these services in volume of assets. These institutions are fully aware of the business realities of the head companies and closely interact with them on various levels. The effectiveness of this interaction, motivations for development, and the ability of such semi-subsidiaries to self-adjust in accordance with the requirements of the market are open to dispute.

An alternative to credit financing is to attract funding through the equity market, primarily by issuing stocks and bonds. At present, however, the stock market in Russia is only in its initial stages of development.

Table 6.3 Volume of Stock Exchange on Global and Russian Stock Markets in 2001, billion USD

Stock exchange	*Turnover*
Helsinki	181.6
Moscow Interbank Currency Exchange	23.9
Russian Trade System	4.4
St. Petersburg	0.3
Russian Total	**31.8**

Source: Valutni Speculant, (2002)

The Russian stock market today is weakened by an inadequate institutional structure, the low level of activity of such potentially large sources of investments as non-government pension funds and insurance companies, and underdeveloped systems of private equity and venture capital financing.

According to the data of the Association for the Protection of Investors' Rights, in order to attract capital, 91% of Russian companies use profit reinvestment, 59% resort to debt financing, and only 14% employ emission of stocks. Today, only stocks of blue-chip companies - RAO UES of Russia, Yukos, Lukoil, Gazprom, and several others - have a considerable degree of liquidity on the Russian market. Recently, the attraction of means by issuing of corporate bonds has become more and more widespread. In 2001, the volume of the Russian market of corporate bonds exceeded 1.5 billion US dollars. This, however, is insufficient for meeting the demand for capital on the part of Russian companies, and even more for energy companies.

Lacking the opportunity to attract sufficient financial means from within the country, Russian companies are forced to turn to foreign markets, where the most popular tools are eurobonds and ADRs (American Deposit Receipts). It must be said, however, that the cost of the higher liquidity and reliability of these tools is also high.

The inadequacy of the Russian insurance business also has a negative impact on the energy cluster development. On the one hand, Russian insurance companies have no opportunity to insure large-scale industry with their own financial means, and without attracting international partners, and on the other hand, Russian companies themselves are not always ready and able to pay insurance rates sufficient to cover their risks.

The Russian consulting business, although it has made significant progress towards improving the quality and range of services it offers, does not yet play the same role it plays in developed countries. Until the mid-1990s, in part due to the consequences of the planned economy, and in part to objective factors, companies reluctantly used the services of

third-party consultants, preferring to entice employees from consulting firms to their ranks, rather than to pay for consulting services. Today the situation has changed for the better: the quality of consulting has improved, principles of interaction between the consultant and the client have been laid down, and the tasks and quality standards of consulting work have been outlined. Thus far, however, the abilities of Russian consultants, apart from the members of the Big Five, McKinsey & Company, and several other companies, whose services are available only to a narrow circle of large clients, are very limited. The presence of foreign specialists does not solve the problem of the quality of services offered and the degree of responsibility of consultants. In addition, Russian companies are for the most part ill-prepared for implementing comprehensive management and information solutions, since this requires reforming the whole structure of manufacture and retraining thousands of people.

Information and communications services. According to experts, the IT services market in Russia has been growing at a rate of 20 to 25% annually in recent years. Information and telecommunications technologies in Northwest Russia have developed at an even greater pace. In St. Petersburg, conditions for the development of a fully competitive IT industry have taken shape, due to inherited human resources, a powerful educational infrastructure, and a considerable head start in relevant areas of scientific potential. Today in this sector, several dozen high technology companies that have close ties with educational institutions of the region and export a large number of their services are operating with great success. The value of a highly qualified IT specialist on the regional market has increased with the opening in St. Petersburg of software developing centers of such companies as LG, Motorola, Siemens, Lucent Technologies, Scala, and others, although it is still significantly lower than in European countries. This segment of the market is actively developing and can be viewed as one of the long-term factors of competitiveness of any consumers of IT services in the region.

Telecommunications technologies in the Northwest region are considerably less developed; however, using the inherited industrial and human resources, the region occupies the leading positions in Russia in a number of segments, and is already well on the way toward operating at an international level. The decision of such companies as Lucent Technologies, Elcoteq and Alcatel to locate their assembly plants in St. Petersburg is indicative of the cost advantage of producing telecommunications equipment in the city. Regional companies specialize in both manufacture of equipment and in engineering, and have usually carried out successful projects for companies of the energy sector. In the future, the intensity and effectiveness of such cooperation will steadily grow.

In spite of this, however, the utilization of information and telecommunications technologies in the operating activity of companies remains low. There are, without doubt, internal reasons for this: the low quality of management, limited financial resources, etc. The main reason, however, is the low quality and density of the necessary telecommunications infrastructure, especially in remote areas. During the implementation of large-scale projects of computerization of production facilities, companies are often forced to create their own infrastructure from scratch, or to modernize it fundamentally. This leads to disproportionate investment expenditures and subsequently to excessive expenditures for maintaining the vast telecommunications assets. All attempts to increase the effectiveness of their own telecommunications networks and servicing departments by entering the Russian market of data transmission services have very few chances for success, due to the limited capabilities of corporate networks.

The prospects for increasing the density of telecommunications networks in Northwest Russia and the emergence of independent operators today is highly unlikely. In this regard, energy companies of the region will still bear additional expenditures for a long time to come, because of the lack of an effective market for telecommunications services.

The Transport Infrastructure. The favorable geographical location of Northwest Russia encourages its development. The most actively developing segment of the transport system is oil pipeline transport. Northwest Russia is one of the most attractive Russian regions for exports. For this reason, the government and oil companies currently direct significant amounts of investments into the expansion of existing exporting facilities and the creation of new exporting facilities in the region. The implementation of such projects as BTS and Severnye Territorii may radically redirect export flows from the Baltic countries to Russian seaports, which would lead to further expansion of the export potential of regional companies, increase the flow of transit freight traffic, and create additional benefits for achieving economy of scale in oil-processing.

The investment programs for the development of processing and transport facilities announced by Lukoil, Surgutneftegaz, Rosneft, Transnefteprodukt, and the St. Petersburg Seaport are also capable of creating new opportunities for Russia, both in international trade of energy resources[29], and in creating conditions for the manufacture of goods with high added value.

As for the other segments of the transport infrastructure of Northwest Russia, their development is proceeding at a noticeably slower tempo.

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[29] These projects are unlikely to be fully realized, however.

Up until now, there have been a number of "bottlenecks" in the transport system that have restricted the development of the region's economy. The road network in Northwest Russia is not developed sufficiently for meeting the requirements of contemporary industrial realities. Many trade flows and investment decisions are still subject to the limitations of existing waterways and railroads, which prevent vast areas from economic development. The absence of the necessary infrastructure hinders the full utilization of the production facilities of power-generating companies and limits the possibilities for their competitiveness on the electric energy market. Due to a number of reasons, the above listed segments of the transport infrastructure are the least attractive for investment, and their development is to a great extent retarded by the lack of both private and public financing, as well as political will (see Case Box Belkomur). In view of the strengthening of the position of Northwest Russia as the largest Russian trade hub and gateway to global networks, however, these segments of the transport infrastructure will experience incentives for growth.

Thus, the existing state of the transport infrastructure and its future prospects will create, for the most part, favorable conditions for the development of the oil processing industry. At the same time, the poor state and lack of investment in the development of the electric power grids and the railroad infrastructure have an extremely detrimental effect on the power and coal industries. The development of the border-area electric power grids, which is now limited, will help to realize the export potential of the electric power industry in Northwest Russia. As for other segments of the transport infrastructure of the region, their active development will most likely be connected with large-scale industrial and transit centers of the region, or with large-scale investment projects (in particular, the exploration of the Shtokman Deposit).

Metallurgy. The energy cluster is one of the largest consumers of the products of the metallurgy and metalworking cluster, primarily steel pipes and aluminum and copper wire. At the present time, Russian metallurgy and metalworking facilities are capable of meeting the existing and potential demand for all articles except large-diameter pipes for gas pipelines. (These are imported from Germany, Japan, Ukraine and other countries.)

The domestic products are distinguished by lower quality and a narrower assortment, however. This concerns primarily casting[30], and pipes

[30] Research has revealed that it is not uncommon for Russian metallurgy companies to include the probability of defectiveness in the cost of work when carrying out custom orders for casting. This increases the cost of such work by 2 to 3 times. In order to avoid this, Russian consumers often custom-order casting from abroad, which turns out to be cheaper, and guarantees high quality at the same time.

and wires with modern special coatings. The rate at which the modernization of Russian metalworking facilities is taking place is insufficient, and may soon lead to an increase of imports of metal products with high added value on the part of the leading Russian energy companies.

Environmental protection. Energy companies have the greatest impact on the environment in the region. Insufficient concern about environmental protection issues is to a great extent a legacy of the Soviet period. The enterprises of the energy cluster to this day utilize technologies that were long ago abandoned in developed countries, due to high ecological risks. The practice of independent ecological monitoring has not received due consideration in Russia, and the government closes its eyes to the adverse ecological situation and environment pollution.

The development of the services market in the area of environmental protection is inhibited by the lack of economic incentives for investing in measures for protecting the environment, and for lowering expenditures on implementing current ecological measures in industrial enterprises. Inexpensive sources of energy, an inefficient system of ecological monitoring, and a lack of sanctions against infractions of ecological norms encourage companies of the cluster to conceal their environment pollution problems, rather than to invite specialists to aid in dealing with them.

The lack of sanctions against energy companies in the sphere of environmental protection may be classified as a factor of their cost competitiveness in a short-term perspective. Such an approach to environmental protection, however, creates fundamental long-term ecological risks for energy companies, in view of the anticipated stringency of requirements for observing ecological legislation and implementing international agreements, in particular the ratification of the Kyoto Accord.

Box 6.7 The Kyoto Accord and the Russian energy industry

In 1997, in Kyoto, Japan, an agreement was signed that limited the quantities of gas emissions (above all CO_2) into the atmosphere. It stipulates a definite permissible quota of CO_2 emissions for each country, as well as the possibility of transferring unfulfilled quotas among various countries. Russia, occupying the second place in the world in volumes of gas emissions into the atmosphere, plays an important role in this agreement. Currently in Russia, the process of ratifying the Kyoto Accord has already begun.

The ratification of the Kyoto Accord does not impose serious obligations on Russia for lowering gas emissions in the near future. At the same time, it will have palpable economic consequences. First, it will allow for the trading of

these quotas. According to various estimates, the total Russian potential for offers of quotas amounts to 1 to 3 billion metric tons of CO_2 equivalent over a period of five years (2008 - 2012), and is valued at several billion US dollars. Second, this agreement may facilitate the growth of foreign investments in the Russian fuel and energy complex, and primarily in the gas industry. Satisfying the growing demand of the European gas market for Russian fuel will require significant investment, both in gas production and in the gas transport infrastructure. Thus, in consequence of the shortage of internal domestic resources, the increase in production and export of gas will greatly depend on the volumes of foreign investment in the industry.

In addition to economic consequences, the ratification of the Kyoto Accord will also invoke changes in the area of environmental protection in Russia. The growth of investments in environmental protection will facilitate the forming of the domestic Russian market of energy saving and environmentally friendly equipment and technologies.

In light of the fact that such technologies are almost non-existent in Russia, we can safely assume that the demand for these technologies will be satisfied by means of imports. For this reason, Northwest Russia may be viewed as a relatively large market for European manufacturers of contemporary powerequipment and developers of technologies. In addition to the development of the equipment and technology market, the Kyoto Accord will also facilitate the development of the Russian market of environmental services. This will primarily concern the creation of institutions that practice independent ecological monitoring, which at the present time are conspicuously absent.

Only the consistent enforcement of environment protection legislation can provoke companies to take such unprecedented or *force majeure* measures as the outsourcing of services, insofar as it would be too expensive and complicated to run waste treatment and other environment protection facilities. Another determinant that would facilitate the growth of investments in environment protection projects is the forming of an "environmentally friendly" image for a company.

Today, the factor of low environment protection costs plays such a crucial role in the economy of the energy companies, that fundamental change in the existing situation could significantly undermine their financial performance if more stringent ecological requirements are applied at a more rapid pace than the growth of prices for energy sources.

Thus, in spite of a range of positive tendencies and a general understanding by large strategy-oriented market participants of the notion of the independent market of related and supporting services and goods, the development of this market is occurring very slowly, and none of its segments has developed fully, either in Northwest Russia, or in Russia. This undoubtedly lowers the long-term competitiveness of the compa-

nies of the cluster, since it does not allow them to minimize their expenditures and optimize their resources in the manner of their international competitors.

6.5 Government

The privatization in the fuel and energy complex of Russia has been a fairly uneven process. In the oil industry, the government retains only a modicum of ownership; in the gas and the electric power industries, however, the government is still the major stockholder.[31] This may be explained by the fact that the energy complex plays the key role in the Russian economy - it is the major source of tax-money inflow into the budget. It also, in fact, determines the processes of industrial development in the country through the prices for energy sources.

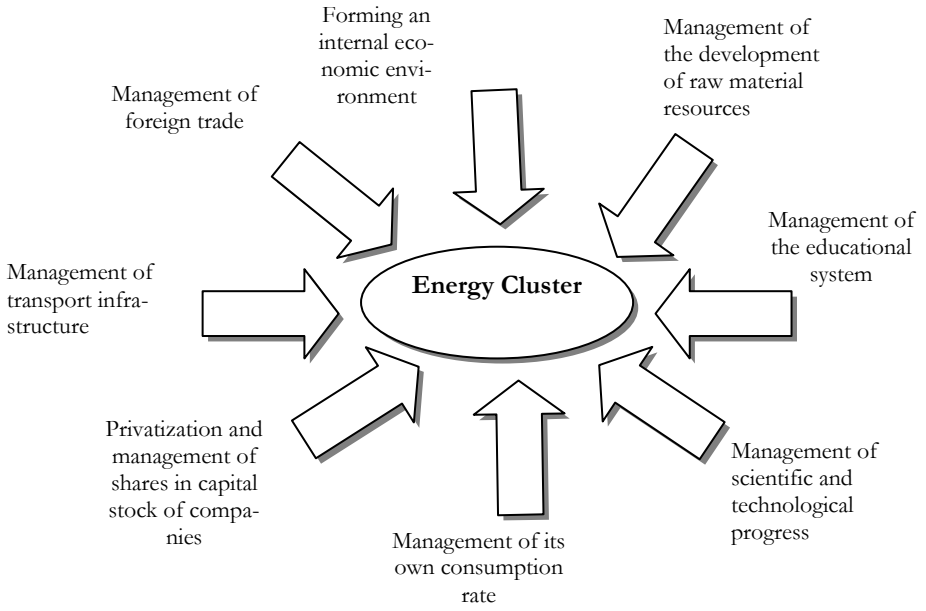
The strategic significance of the fuel and energy complex has influenced the government's efforts to preserve maximum control over the development of the sector. At present, the government has a large number of control levers: its corporate participation in all large companies; the regulation of tariffs for electric power, gas, pipeline and railroad transport; the tax policy and control of export taxes and quotas; the management of the development of the resource base; and so on. A sober and well-balanced strategy for long-term development of the energy industry would allow for "fine tuning" of relations between the industries of the energy cluster, and for maximizing the effects of such inter-cluster cooperation. Unfortunately, there is no such strategy today, and under these circumstances, the excessive amount of monitoring and control is strangling the development of the sector, rather than promoting it.

The domestic industrial policy is characterized by a lack of clearly defined goals, and poorly coordinated actions of different institutions of power. The government uses the companies of the cluster to resolve pressing general economic issues on a regular basis, often undermining the long-term competitiveness of the companies. It is a known fact that Gazprom has more than once transferred money to the budget in order to cover various current deficits, and has even taken loans from international banks for these purposes. Its ways of managing the sector's activity have often been noted for their ultimate contradictions and inconsistencies. For example, more than once, the level of customs duties for oil

[31] In Northwest Russia, the government also has full control over stocks of coal assets.

export, determined by the government, has been higher than the level stipulated by law.

Figure 6.14 Government controls over the development of the fuel and energy cluster in Russia



During the past decade, many programs concerning various directions of the development of the cluster have been approved on both federal and regional levels: the development of dispersed energy production, the coal industry, resource conservation, etc. None of these programs, however, has been fully implemented, due to the fact that, first, they were not coordinated with those who were actually supposed to implement them; and, second, an effective means of supervising their implementation has not been elaborated. Many of the programs of the government are of a rhetorical character, contradict one another, and are weakly coordinated with investment abilities and the previously formed investment budgets of both the government and the corporate sector. As a result, the significance of the role of these programs in industrial policy decreases, and companies do not use them as a basis for making strategic decisions.

Box 6.8 The Energy Strategies of Russia

Several attempts to develop an energy strategy in Russia have been made over the course of the last ten years. During this period, the government has published a number of documents, each of them with the purpose of determining the directions for development of the Russian energy industry:

1992 – The Concept of the Energy Policy of the Russian Federation under New Economic Conditions

1995 – Primary Directions of the Energy Policy of the Russian Federation Until 2010

2000 – Primary Goals of the Energy Strategy of Russia Until 2020.

Each new version of this document proclaimed the necessity of raising the productivity of energy companies, of creating conditions to increase the amount of investments in the energy industry, and lowering the energy intensiveness of the Russian economy by means of energy-saving measures. At the same times, it was estimated that the GNP of Russia would grow, as would the consumption and production of primary energy. Nevertheless, as further events have shown, none of the documents facilitated fundamental changes in the energy industry, nor did they comply with the requirements of actual economic conditions. Moreover, the prognoses for improvement of the economic state of the market had no grounds, and the 1998 crisis totally undermined the relevance of most of the regulations of the energy policy approved in 1995. As a result, the estimations turned out to be significantly lower, and the problems of the energy industry remained unresolved.

The latest edition of the document, the strategy of the year 2000, also revealed its lack of relevance to the actual state of affairs in the economy. Already in 2001 and 2002, its erroneous estimates of the rates of realization of the strategy became obvious.[32] The major flaw of this document, as well as those of its predecessors, is its rhetorical nature and the lack of detailed elaboration of premises for ensuring the announced qualitative and quantitative reform of the industry. This is especially noticeable in defining a concrete list of projects in the sphere of production, processing, and transportation of energy sources, energy saving, and others, as well as the analysis of sources for financing them.

These issues were only partially considered in the new energy strategy of Russia, thus significantly lowering the probability of realizing its plans and prognoses.

The major aspect of government activity in the sector is demonopolization and liberalization of the markets of energy sources. This issue is also one of the key points in discussions concerning Russia's entry into the World Trade Organization. We have discussed at length the dynamics of the reform process of natural monopolies - there are no visibly concrete results of this process, although its inevitability has been

[32] A new edition of the Energy Strategy of Russia is scheduled for approval at the government session in November 2002.

loudly proclaimed. The growth in energy prices was also declared as a long-term strategy; however, the regulation of energy tariffs is still more a matter of politics than of economic considerations. The great influence of regional authorities on the activity of regional energy commissions, which set the rates for natural monopolies, has resulted in the fact that the changes in tariffs are more firmly tied to regional government elections than to the stages of reforming regional markets or to the growth of expenditures of energy companies.

The dependency of the companies of the energy sector on regional authorities creates premises for widespread mismanagement. By manipulating tariffs, legislation on resources, tax control, and other matters, regional authorities often try to use energy companies to solve social problems of the region, or even worse, to promote their private interests. At the same time, the impotence of government and, most specifically, antimonopoly departments in solving problems that arise when energy companies use their positions for pressuring industrial enterprises, or even for transferring some of their expenditures over to them, should be kept in mind. This inevitably creates grounds for conflict, many of which have been continuing for years.

The flaws of the long-term government policy are especially acute in such spheres as the development of mineral raw material resources, the educational system, and the creation of the infrastructure.

Although the government has accumulated powerful levers for supervising and controlling the energy industry, they have either been virtually abandoned now, or are being misused by both federal and local authorities. Any kinds of reform in the industry are politically colored. The only unarguable achievement of the government energy policy is its support and lobbying for the interests of exporters on the international level. At the same time, there is virtually no long-term and coordinated industrial policy aimed at the formation of internal long-term factors of development and competitiveness. The majority of the market reforms have come about as a result of necessity or coercion, and not planning.

7 Conclusions

In summarizing the information set out and the conclusions drawn in the previous chapters, we must emphasize that the energy cluster at the present time is the most successful among the traditional industrial clusters, both in Russia as a whole, and in Northwest Russia in particular. Under the economic conditions of the period of transition, this may be explained by the high liquidity of the cluster's products on the domestic and foreign markets, and by their consequently large export potential. As in other economic sectors of Northwest Russia, the energy cluster exports primarily raw materials and low value added products, which significantly reduces the potential for long-term cluster development.

The energy cluster, however, is distinguished by a strong heterogeneity. It consists of sub-sectors that are characterized by both high and low viability.

Table 7.1 Evaluation of the Competitiveness of Energy Cluster Sub-sectors

Oil production industry	Competitive
Oil refining industry	Competitive
Gas industry	Potentially competitive
Electric Power industry	Potentially competitive
Coal industry	Low competitiveness
Shale industry	Not competitive
Peat industry	Not competitive

The authors would like to argument this evaluation of the competitiveness of the energy cluster industries with a commentary on the most relevant issues today, those which define the current situation and the potential for development of each industry.

The oil production industry. The oil deposits of the Timano-Pechora province, which have already been largely explored, are the basis of the competitiveness of the oil production industry. Even the relatively high production costs (in comparison to those of the countries in the Persian Gulf, Libya, Venezuela, etc.), due in large part to the harsh climatic conditions, have not prevented the companies from achieving high profit margins.

The bottlenecks of the industry are:

- Gradual depletion of resources at the deposits under exploitation and the need for significant investments into developing new ones;
- On-going government monopoly of main pipelines;
- Abrupt decrease in volume of the domestic market in the past decade.

Despite these bottlenecks, however, the oil production industry will most likely preserve its competitiveness during the next ten years, due to its high export potential.

To improve the competitiveness of the Northwest Russia oil industry it is crucial that the high cost of pipeline transportation is decreased by the order of magnitude. The present long distance pipelines and bottleneck ports on Baltic and Black Seas are a major negative cost parameter in export of the Russian oil and oil products. One of the ideas how to make these exports more competitive in the world markets in future is to use supertankers that could take oil from the new, ice-free ports in the Barents Sea. These ports as well as pipelines from the new fields to these ports shall be build but could prove to be a good investment.

The oil refining industry. The competitiveness of the oil refining industry is also ensured by the high liquidity of its products on the domestic and foreign trade markets. Additional advantages are:

- The possibility of using raw materials obtained in other regions of Russia (the largest oil processing plant in Northwest Russia, KINEF, utilizes oil from western Siberia);
- The modernization carried out in recent years in both oil processing plants has increased the thoroughness of the treatment of the oil and, consequently, results in the manufacture of products with high added value.

There seem to be no objective factors that would significantly lower the competitiveness of the oil processing industry in the future.

The gas industry. The potentially high competitiveness of the gas industry in Northwest Russia is a function of:

- A possible significant increase in gas production, as result of exploring new deposits in the Nenetsk Autonomous District and on the shelf of the Barents Sea;
- Expanding utilization of casing-head gas;
- Expanding gas distribution network in the region and the increased rate of pumping gas from the deposits in western Siberia;

- The de-monopolization of Gazprom and the development of competition in the sector.

At the present time, the competitiveness of the gas industry of Northwest Russia is limited by nearly depleted resources at the deposits under exploitation and excessive government control over the industry; most of the gas is put on the domestic market at fixed low prices. It is evident that the gas industry will be the last among the industries of the energy cluster to be free from government monopoly.

The new gas reserves on the shelf of Barents Sea and in the Yamal and Nenetsk areas are poorly competitive on the European markets due to expensive lnog-distance gas pipelines running through many unstable areas. It could be possible that a transport alternative such as LNG-transport or GTL (gas to liquids) could be considered viable alternatives for transporting gas directly from the Northern Seas to the markets in supertankers.

The electric power industry. The electric power industry is also characterized by a high competitive potential, which is hindered by a number of factors:

- Absence of genuine competition in the sector;
- Limited export options;
- Decrease of energy consumption of the domestic market as a result of the overall decline of the industry;
- Insufficient development of distribution networks and the "small-scale power industry."

It appears that the reforms that are being carried out today with the aim of de-monopolizing the industry, initially, in the production and distribution of electric energy, may in the future increase the competitiveness of the electric power industry, as well as the growth of industrial production in the country, and exports of electric power. The need for replacing most production and transmitting facilities, which have already outlived their capacities, poses a serious obstacle to its competitiveness. On the other hand, if a favorable investment climate is created, the renewal of energy facilities could result in growth of domestic demand for power technologies and the sustainable development of domestic power engineering. The necessary preconditions for such development, including traditions, and human and industrial capital, are existing in St. Petersburg.

Development of the bio-fuels, primarily wood-based, as a source of the electric power production will be another important feature of the future

electric energy production in Northwest Russia. Owing to extensive supplies of the wood waste accumulated in the previous periods this bio-fuel could even become another successful export article of the energy cluster.

The coal industry. In spite of the relatively high quality of bituminous coal extracted from the Pechorsky Field, the competitiveness of the coal industry of Northwest Russia is rightfully considered low. This is for the most part a result of the remote location, high transport and production costs, etc. The consumption of coking coal is at present almost completely dependent on the production volumes of Severstal, and the emergence of new, large-scale consumers, which might include metallurgy companies of the Urals, is not expected in the near future, due to the remoteness of the coal deposits and the general underdevelopment of the region's transportation infrastructure.

The shale oil and peat industries. The shale and peat industries are the least competitive industries of the energy cluster. This is a consequence of the extremely low demand for their products at present. The competitiveness of these industries may grow in the future, due to the development of the small-scale power industry and the growth in utilizing their products in other economic sectors: the chemical industry, building materials manufacture, agriculture, and others.

The main obstacle for the development of the energy cluster, as in other Russian industrial clusters, is an unfavorable investment climate. For this reason, even the very high profitability of the oil and gas industry is not sufficient to attract the volume of investments necessary for implementing large-scale projects.

The authors view the following as being among the most important influences in shaping the investment climate of the energy cluster of Northwest Russia:

1. Government control. The role of the government in the development of the energy cluster of Northwest Russia is equivocal. On the one hand, the government supports exporters by lowering the value of the ruble and fixing tariffs for transporting at fairly low levels. On the other hand, the role that the government plays has had many negative impacts on the industry. This is reflected in the absence of a clear and expedient industrial policy and stable legislative rules of the game, inconsistencies in the interaction between federal and regional authorities (a good example of this being the conflict between Lukoil and the administration of the Nenetsk Autonomous District), and other matters.

In the future, despite the gradual curtailment of the government monopoly in the cluster, the level of government involvement in business is likely to remain high. This has to do with the fact that the energy cluster

is the main contributor to the Russian treasury, and will probably continue to play this role for the next ten years.

2. The ongoing process of restructuring. The restructuring of the cluster, which began in the 1990s, is still far from completion at the present time. The government monopoly still prevails in the gas industry, and the reforms in the electric power industry have just begun. In the oil industry, the main pipelines are the property of the government. In the privatized sub-sectors (the oil production and oil processing industries, the coal, shale and peat industries), the new structure has not yet completely taken shape. Companies attempt to rid themselves of non-specialized and loss-sustaining manufacturing enterprises, and diversification is underway. A positive development is the completion of the process of property division in the cluster and the significant consolidation of assets, which corresponds to world-wide trends in this industry.

During the next ten years, the processes of restructuring in the cluster will probably come to an end. The reinforcement of vertical integration (for example, the oil production industry and the electric power industry) will take place, which will also have a positive impact on the overall efficiency of production.

3. The transport infrastructure. At the present time, the transport infrastructure of Northwest Russia, which serves the interests of the energy cluster, generally does not meet its demands. The system of pipelines is prone to a high risk of accidents, due to its level of deterioration. The electric power transmitting lines are also in a state of deterioration, and their length and density are insufficient, thus preventing the utilization of many power plants to their full capacity. Railroads are of primary importance for the coal industry and are a government monopoly. The system of railroads is insufficiently developed, and the efficiency of shipping via railroads is very low.

At the same time, the Northwest region has a great potential for the development of the transport infrastructure, due to its proximity to European markets and its role as Russia's "gateway to the sea." In recent years, the construction of new seaports and the laying of new oil pipelines have proceeded apace in the region. The future will reveal the competitiveness of the new Russian seaports in comparison with the sea terminals of neighboring countries.

4. The system of related and supporting industries. The level of interaction between the companies of the cluster and related and supporting industries is still significantly lower than in developed countries. The only exception is the interaction with equipment manufacturers, which continue to occupy a large portion of the market, despite the general decrease

in the competitiveness of their products during the last decade. The production capacity of equipment manufacturers, however, especially manufacturers of power engineering equipment, has been largely exhausted, and the reforms in the power industry may lead to a sharp increase of equipment imports, primarily for small-scale electric power plants.

The banking and finance sectors, industrial insurance, business consulting, and information technologies are still in their infancy. The large companies of the cluster still prefer to use services provided by international institutions (for example, obtaining loans from international banks, with profits from exports as collateral). This situation, however, is likely to change in the future, since the domestic companies providing such services view successful sub-sectors of the energy cluster as their main potential clients. In particular, the level of computerization in the oil and gas industry is substantially higher than in other Russian industries at present.

5. The development of the small-scale power industry. The primary aim of the power industry of the Soviet Union was to satisfy the needs of large industries. Due to structural changes in the economy, in the current situation the issue of expanding the network of small-scale power production facilities (small-scale power industry), which allows for the most rational utilization of the capacities of local sources of fuel and electric energy and lowers the dependence of companies on external supplies, is of paramount importance.

6. The preservation of the environment. The companies of the energy cluster, along with metallurgy companies, are the largest sources of various kinds of environmental pollution. The Soviet period left a legacy of highly polluting technologies and equipment. At present, the government in practice tolerates serious damage to the environment in the interests of immediate profit. The situation can change radically only after passing effective ecological legislation, with a system of penalties for polluting the environment in Russia. Until that time, companies will have no serious motives for actively implementing relatively costly measures for protecting the environment.

Development Trends

In the next ten to fifteen years, the general economic climate and the industrial investment climate is likely to improve, although this improvement might not be very significant. In the authors' view, the main factor that will determine the competitiveness of the energy cluster in the future is the demand for its products on the domestic and international market.

The domestic market will gradually grow, as prices approach the average international level. The volume of consumption of fuels and electric energy that was achieved in the last decade of the Soviet era, however, is unlikely to repeat itself. For this reason, the world market will be of great importance for the Russian energy cluster, since the domestic fuel and power industry has never encountered the problem of artificial limiting of supplies that is imposed by many countries, for example, on the Russian ferrous metals industry. In the industrial structure of Northwest Russia, the energy cluster will probably occupy a consistent leading position, due to the presence of significant resources and a large transit and export potential.

Uneven regional development of the energy infrastructure is considered to be the main problem for the energy sector of Northwest Russia in the future. This problem will also be connected with significant structural changes in energy networks as a result of the obsolescence and abandonment of deposits, generating and transmission networks that will necessarily result in a new structure of fuel balance, deposit and production setup. Northwest Russia is in the initial stages of a long period of dramatic changes. The formation of regional industrial production agglomerations will influence the concentration of energy production facilities, while the energy potential of certain regions in its turn will further define the development of whole industrial sectors.

Other characteristic features of the development of the cluster over a certain period are the following:

- The regularizing of prices on the domestic market in conformity with the average level of prices on the global market, which would limit the rates of domestic consumption and provide incentives for the process of energy conservation;
- Preservation of a high portion of gas in the fuel balance of the region;
- The growth of exports of oil, oil products, and gas, as well as electric energy (approximately up to 10% of the total volume of production of electric power in the region), the growth of oil and gas transit through the region to international markets;
- The deepening of regional discrepancies in the development of the cluster, the most active development in the Timano-Pechora oil and gas agglomeration, a gradual shift of primary production of oil and gas in Northwest Russia from the Republic of Komi to the Nenetsk Autonomous District, and the initiation of exploitation of oil and gas deposits in the shelf of the Barents Sea;

- The expansion of facilities for oil refining and gas processing;
- The preservation of existing volumes of coalmining and reduction of shale production, and reduction of profitability of these industries;
- Completion of fundamental reform in the electric power industry, and reforming of the gas industry;
- Continuation of weak competition in the cluster;
- Strengthening of vertical integration processes in the cluster, and the development of the outsourcing of services;
- Gradual development of all types of the transport infrastructure, of electric power grids, and networks of gas pipelines, seaports, etc.;
- Gradual development of the dispersed energy industry (thermal and hydropower plants) at industrial enterprises of other clusters, in order to lower expenditures;
- Increase of exports of power-plant equipment, while maintaining the prevailing position of Russian equipment manufacturers on the domestic market;
- Continuation of significant government influence in the cluster;
- Continuation of a high level of environmental pollution (several times higher than levels of pollution in developed countries).

Eventually, however, the energy cluster, not only in Northwest Russia, but throughout the world, might substantially convert itself due to introduction of new types of fuel. As expected the profitability of raw materials supply for energy production needs will tend to substantially decrease in long-term period. This is a serious challenge for the resource based Russian energy industries, which do not possess obvious cost advantages to compete successfully with e.g. oil producers of Persian Gulf. It evidences that the long-term strategic decisions in the Russian energy cluster should be oriented at the knowledge intensive projects, capable to provide more or less sustainable competitive advantages. We see the important role of government in encouraging foreign direct investments in the sector, which might be the first but crucial step to innovation driven development.

Appendixes

A1. The Largest Universities that Provide Personnel Training for Energy Sector in Northwest Russia

119 higher institutions with more than 535 thousand students enrolled are located in Northwest Russia, 2000-2001. The main part of educational base is focused in St. Petersburg. 78 universities, including 30 of them focusing on technical specialists training, are situated there. Still the total number of the students enrolled in St. Petersburg amounts to 350 thousand a year.

The main centers that provide personnel training for the energy sector in Northwest Russia are eighteen universities that are presented in the table below.

Table A1. Universities Providing Education for the Energy Sector

University	Major	Specialisation
St. Petersburg		
St. Petersburg State Mining Institute (Technical University)	Oil industry; Gas industry; Coal industry	Geology and prospecting; Oil and gas well-boring; Field development; Development and exploitation of oil and gas deposits; Engineering protection of environment; Mining machines and equipment; Mine survey; practical land-surveying; Mining and underground construction; Economics and management at the enterprise (in mining industry and prospecting).
St. Petersburg State Institute of Technology (Technical University) (Department of technology of organic synthesis and polymers)	Oil industry; Gas industry	Organic chemical technology; Chemical technology of natural energy carriers and carbonic materials; High molecular chemical technology; Polymer chemical technology
St. Petersburg State Technical University	Power industry	Electromechanics; Power supply of industrial enterprises and cities;

		Power stations; Electrotechnological utilities and systems; High voltage power engineering; Automated control of electric systems; Electric systems and power grids; Electric and electronic apparatus.
St. Petersburg State Electro-technical University	Power industry	Electric systems and power grids; Electrical engineering; Electromechanics and electric technolo-gies.
Northwest Correspondence Technical University (Energy department)	Power industry	Power supply; Thermoelectric power stations; Industrial heat and power engineering; Electromechanics; Electrical and electronic apparatus.
Republic of Karelia		
Petrozavodsk State University (Forest engineer-ing department, specialisation of industrial heating engineer-ing and energy saving)	Power industry	Industrial heat and power engineering. Power supply of enterprises.
Republic of Komi		
Ukhta State Tech-nical University	Oil industry; Gas industry	Economics and management at energy enterprises; Gas and oil machines and equipment; Geophysical methods of field develop-ment; Oil and gas geology; Development and exploitation of oil and gas deposits; Design, construction and exploitation of gas-main pipelines and oil storages; Oil and gas well-boring; Heat and gas supply and ventilation Water supply and water drain.
Subsidiary of St. Petersburg State Mining University	Coal industry	Underground field development; Mining machinery and equipment; Mining and underground construction; Electric drive and automatic machinery.
Department of St. Petersburg State Mining Institute (Technical University)	Coal industry	Underground field development; Mining machinery and equipment.

Arkhangelsk region		
Arkhangelsk State Technical University (Department of power industry).	Power industry	Industrial heat and power engineering; Power supply at industrial enterprises; Electrical technology and energy systems.
Oil and Gas Institute (on the base of Arkhangelsk State Technical Universit)	Oil industry; Gas industry	Development and exploitation of oil and gas deposits; Design, construction and exploitation of gas and oil pipelines and storages; Oil and gas well-boring; Oil and gas machinery and equipment.
Vologda region		
Vologda State Technical University (Department of Civil Engineering, specialisation of heat and gas supply and ventilation)	Power industry	Industrial heat and power engineering; Heat and gas supply and ventilation.
Kaliningrad region		
Kaliningrad State Technical University (Department of shipbuilding and power industry, specialisation of engineering, heat and gas supply and ventilation)	Power industry	Power stations; Thermoelectric power stations.
Leningrad region		
Institute of Nuclear Power Engineering (subsidiary of St. Petersburg Stat Technical University), Sosnovy Bor	Power industry	Heat and power engineering; Nuclear power stations and utilities.
Department of St Petersburg State Mining Institute (Technical University), Slantsy	Coal industry	Underground field development; Mining machinery and equipment.

Murmansk region		
Murmansk State Technical University (Department of natural and technical sciences)	Oil industry; Gas industry; Power industry	Geology and prospecting; Sea oil and gas extraction; Industrial heat and power engineering.
Novgorod region		
Novgorod State University (Engineering Technology Department, specialisation of power industry)	Power industry	Industrial heat and power engineering.
Pskov region		
Pskov Polytechnic Institute of St. Petersburg State Technical University (Department of civil engineering)	Power industry	Power supply at industrial enterprises.

Source: Ministry of Education of Russian Federation (2002)

A2. Energy Networks as a Marketplace

The Electric Energy Market in Northwest Russia

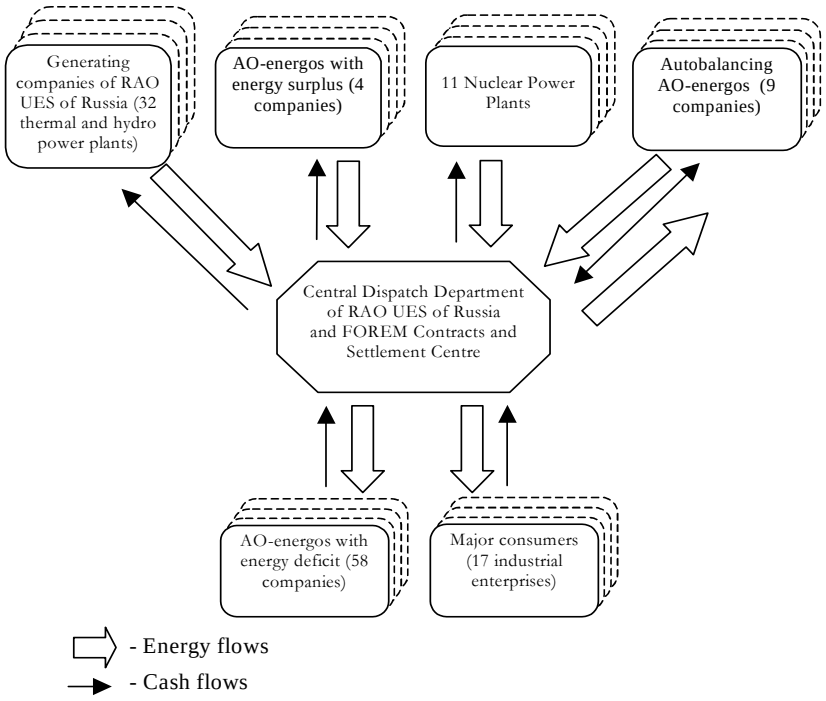
Today, total annual demand for electric energy in Northwest Russia exceeds 84 TWh. Out of this amount approximately 85% is supplied to local consumers by regional energy utilities (*AO-energos*). The rest is supplied by municipal energy enterprises and electric power stations owned by large industrial enterprises, i.e. 15% of the total consumption. The regional energy utilities, however, are not generating most of the electric energy sold. Their own production in the total sales volume in Northwest Russia varies from 2 to 70%, depending on the region. Energy balances of the regional energy companies are represented in chapter 5.5, Figure 5.18. This gap is filled by energy companies by purchasing substantial volumes of electric energy in the FOREM wholesale market.

Box A1. FOREM, The Wholesale Electricity Market in Russia

At the moment, a prototype of the wholesale energy market—the federal wholesale market of electricity (FOREM) - falls under the control of the major energy system agents (RAO UES of Russia and the RosEnergoAtom consortium). The federal wholesale electricity market (FOREM) offers services in electric energy trading within the Russian energy system. FOREM represents a system of contractual relationships among its numerous participants enabled via the united transmission grid of UES of Russia. The participants of the wholesale market include 131 companies that have the right to purchase and sell electric energy, and four companies that manage, coordinate and control the market. The list of FOREM participants is prepared annually by the Russian Federal Energy Committee and approved by the Government of the Russian Federation.

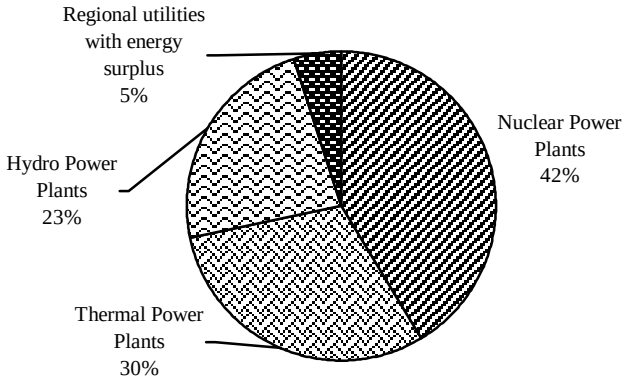
With the existing market structure all transactions are arranged under the supervision of the Center for Contracts and Accounts of FOREM and the Dispatching Central, both controlled by RAO UES of Russia. While controlling the flow of electric energy and cash, RAO UES of Russia often abused its position and dictated its own rules to the independent market participants.

Figure A1. The Existent Model of the Energy Market



In 2001, the total energy supply to FOREM was 299.6 TWh, while the used supply was only 288 TWh (96.1% of supply volume). Roughly 3.9% was a loss in the grid of RAO UES of Russia. In value terms the volume of electric energy purchased in the wholesale market was $3.24 billion. The major suppliers of electric energy to FOREM are nuclear and thermal power stations.

Figure A2. The Structure of Electric Energy Supply to FOREM in 2001

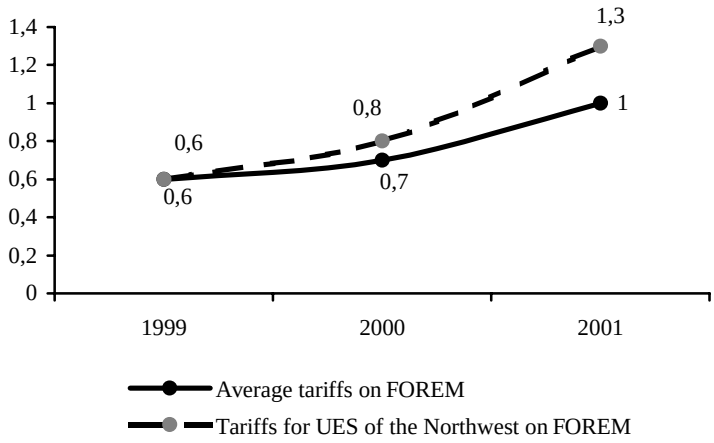


The participants of the wholesale market are divided geographically into seven energy systems:

- Unified Energy System of the Central District
- Unified Energy System of the North Caucasus
- Unified Energy System of the Northwest
- Unified Energy System of the East
- Unified Energy System of Siberia
- Unified Energy System of Middle Volga
- Unified Energy System of the Urals

The Russian Federal Energy Committee (FEC) fixes the electric energy tariffs in the wholesale market, as well as prices for services delivered in FOREM. The chart represents annual prices for electric energy in FOREM.

Figure A3. Annual Electric Energy Tariff in FOREM, US cent/kWh



A small portion of energy is sold by auction in FOREM. The volume of energy sold on a commercial basis is defined by FEC. In 2001, 11 TWh were sold by means of auction (about 4% of energy delivered to the market) for a total amount of $68.5 million.

There are fourteen companies allowed operating in FOREM in Northwest Russia. Among the electric energy suppliers these are the Leningrad and Kola Nuclear Power Plants, Pechora and Pskov Thermal Power Plants, and the Northwest Power Plant (combined heat and electricity gas-fired thermal power plant, the first such plant in Russia). On the consumers side all regional energy companies and the Kaliningrad Railroad are involved in trading there.

The heat and electric energy tariffs for various consumers are fixed by the regional energy committees on the cost plus amortization basis. Normally there is a diverse range of tariffs for various consumer groups. This is considered as one of the major tools for the regional governors

Table A2. The Electric Power and Heat Power Tariffs for the Major Consumers in Various Energy Systems of Northwest Russia as of September 2002

Energy company	*Electric Power, cent/kWh*		*Heat Power, $/Gcal*
	Industrial and equated consumers	*Households**	*Industrial and equated consumers*
Arkhenergo (Arkhangelsk region)	3.63	2.21	14.51
Arkhenergo (Nenetsk autonomous district)	3.79	3.79	individual tariffs
Karelenergo	2.65	1.26	4.25**
Kolenergo	1.61	1.89	16.91
Komienergo	4.10	2.52	7.10 – 10.47
Novgorodenergo	3.97	2.59	n/a
Pskovenergo	3.03	2.9	individual tariffs
Yantarenergo	3.63	2.71	10.79 – 12.62
Lenenergo (St. Petersburg)	3.0	2.37	10.37
Lenenergo (Leningrad region)	3.0	2.21	7.57
Vologdaenergo	3.0	2.37	7.54**

Notes: * city population, ** tariffs for regulated consumer groups
Source: Federal Energy Commission of the Russian Federation, 2002

and authorities that is used to carry out social and industrial policy. At the same time, the tariffs significantly vary within the Northwest region. The existing approach to fixing the tariffs determines the significant volume of cross-financing when surcharging industrial enterprises helps to restrain the growth of tariffs for households and agriculture.

The energy markets in Russia are in state of transition at the moment. The reforms that are widely debated in Russia are first to be implemented in the electricity markets and, on the later stages, also in gas and heat (in connection with housing system reform). The primary goal of these reforms is to get rid of subsidies and introduce competition. It is expected that competition in its turn will provide rewards to most competitive producers and motivate investments in upgrading and saving technology.

Key issues Related to Reforms of Electricity Markets in Russia

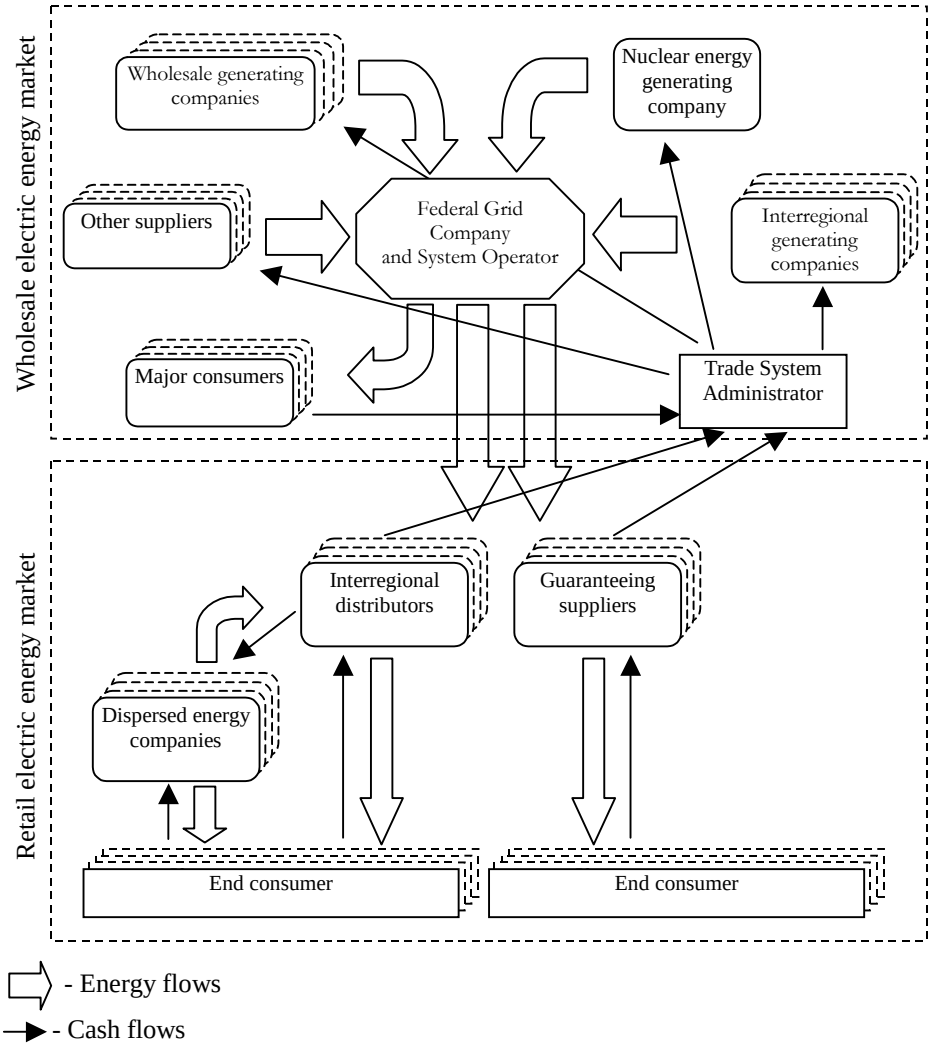
Reforms of electricity markets technically and practically implies changes and restructuring of RAO Unified Energy Systems of Russia (owner of transmission grid key generation facilities and services and R&D) and its subsidiaries – regional utilities as well as creation of market rules and infrastructure. The major directions of reforms carried out by RAO UES of Russia are defined by the Regulation of Government of RF #526 "Major Directions in Reforming the Power Industry." The document contains the basic goals, tasks and principles of reforms, as well as major steps and measures to be undertaken for the restructuring of the industry and liberalization of the energy market.

One of the major principles of the reforms is the division of monopoly and competing sectors of the industry. The reforms, therefore, result in separating production from distribution (competition is created in these sectors), and dispatching from power transfer (monopoly sectors). The target model of the energy market is represented in Figure A4.

Vertically, the energy market will be represented by the wholesale and retail markets. The process of establishing the wholesale market structure includes three key projects that we described below.

1. Federal-level Projects. Federal-level projects are those ones that are aimed at establishing the backbone infrastructure of the electric energy markets. As part of internal restructuring of the RAO UES of Russia, the Federal Grid Company, System Operator and the Trade System Administrator are being established.

Figure A4. The Target Model of the Energy Market



The Federal Grid Company (FGC). The Federal Grid Company (FGC) will combine all main networks that currently belong to RAO UES of Russia and regional energy companies into a unified national grid. The tariffs for grid services will be fixed by FEC because of the company monopoly. The establishment of the company was already begun on January 25, 2002. The RAO UES board of directors approved a plan to establish the company as a 100% subsidiary. In the first stage of the reforms, the FGC will acquire all the grid-related assets of the RAO UES. It is planned that after 2004, the FGC will also receive the main transmission grids (220kV and higher) currently belonging to the regional energy utilities. The mechanism for transferring the networks

from the regional companies to the FGC is still unclear (there is a large number of minority stockholders in regional utilities). Moreover, the way in which interests of minor stockholders of energy companies will be handled is also vague and widely disputed matters.

As relates to accounting for interests of minority stockholders in RAO UES of Russia in respect to transfer of assets to FGC a proportionate to current shares of owners in the stock of RAO UES of Russia distribution of stock in the newly created FGC is chosen to be implemented once the liquidation of current stock company RAO UES of Russia will happen after the end of restructuring program. At the same time, it is anticipated that the share of the government in the capital of the FGC will increase. It is still unclear, however, at what price the shares of minor stockholders of the FGC and regional energy companies will be purchased or the new stock issued. One possibility is that the FGC shares will be exchanged for shares of wholesale generating companies. In any event, serious property disputes in connection with the FGC may arise, because of the inevitable uncertainty about the degree to which exchange of grid and generating assets is equivalent.

The Trade System Administration (TSA). In order to organize trade in the wholesale electric energy market, to provide an accounting for the supplied energy, to create equal conditions for all market agents, to keep within the rules of trade, as well as to protect the consumer's interests, the Trade System Administrator (TSA) was established in the form of a non-profit partnership. Among the TSA founders, there are 28 organizations, including both energy producers and consumers. The concept of the TSA is based on the principle of equal representation of energy producers and consumers; this is why no participants are expected to be able to control more than 25% of the TSA.

The TSA has already worked out a model for the functioning of the wholesale energy market in the first stage of reforming the industry. Thus, according to this model the regulated market sector will be maintained up to 2004, while the free market will simultaneously take shape. The producer will be able to supply up to 15% of its energy to the non-regulated market, while the consumer will be able to purchase up to 30% of the required volume also there. According to this model, the regulated wholesale market (FOREM) will be preserved almost without changes. In this market, the FEC will continue to make balance tasks for the suppliers and consumers, as well as to fix the prices for energy. There will be two sectors in the non-regulated market: a spot market and direct contracting. It is expected that both markets will be functioning until 2004, subsequent to which the prices for energy will not be controlled and more.

System Operator (SO). It is planned to maintain and reinforce a unified system of dispatching by creating a System Operator (SO). The SO manages the operating modes of the power grid, making up and performing the balance between the supply and demand for energy, ensures the reliability of the energy system and the required level of energy quality. At the initial stage of the reforms, the SO will be established as a 100% subsidiary of RAO UES of Russia, formed around the Dispatching Central and the united dispatching boards from regional utilities. As in the case of the FGC, the share of the government in SO capital is expected to increase by 2004. After the controlling interest both in the FGC and in SO is acquired, the question of the expediency of their merger is likely to arise.

2. The creation of wholesale power-generating companies. There are plans to establish on the basis of 48 RAO UES of Russia electric power stations (32 thermal and 16 hydro power plants), which form the foundation for power generation in the Russian energy system, a number of large (wholesale) power-generating companies that would independently participate in the wholesale market. In order to avoid a monopoly in energy production and to provide maximum equality in initial conditions for the functioning of these companies in terms of energy production costs, it is proposed to establish six thermal-generating companies and four hydro-generating wholesale companies organized on the "same cascade – same company" principle. The procedures for forming the wholesale power-generating companies are determined by a special Regulation of the Government of the Russian Federation.

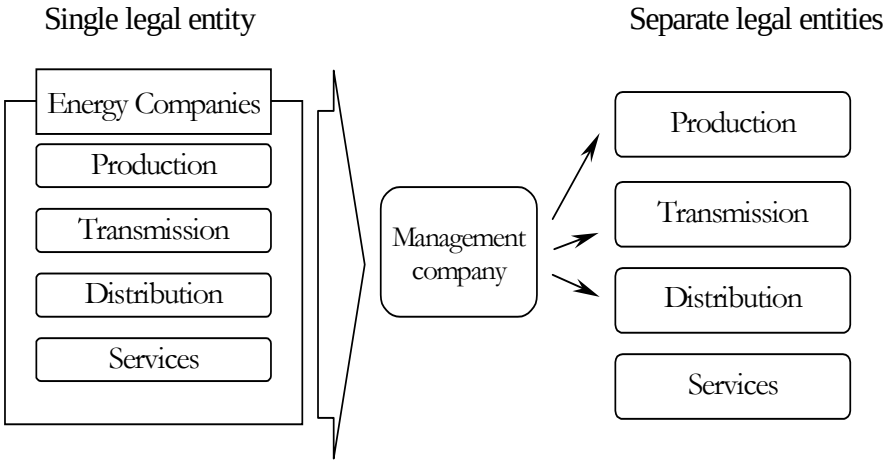
At the outset of the process of reforming the industry, the power-generating companies will be established as subsidiaries of RAO UES of Russia with 100% participation in their capital. The dismantling of the power production monopoly will be achieved through separating the wholesale generating companies from RAO UES of Russia with the proportional division of ownership in these power-generating companies corresponding to the shares owned by the present shareholders of RAO UES in its stock at the moment of separation.

3. The reform of regional energy utilities. The basic principle of reforming regional energy utilities is the same as for the whole energy system, the separation of production and networks, i.e. monopoly and potentially competitive sectors.

The reform of regional companies will be conducted in two stages. At the first stage will be corporate reorganization, by which the grid, generation, and distribution are divested from the mother company into independent legal entities. In order to keep the system manageable of the sys-

tem during the transition, the former executive body of the energy system will be converted into a separate management company that acts as an individual executive body, both in the grid and in generation and distribution, according to the Russian legislation on joint-stock companies.

Figure A5. The Proposed Scheme for Reforming Regional Energy Systems



At the second stage, the energy companies will be expanded through the interregional mergers of generating, transmitting and distributing companies. This will facilitate the creation by 2006 – 2008 of several fairly large-scale interregional generating companies, both in terms of production volume as well as in capitalization.

The process of industry restructuring is intended to be conducted in three stages and will take 8 – 10 years.

The first stage is expected to be accomplished in three years. During this stage the following tasks should be implemented:

- the internal restructuring of RAO UES of Russia, Ministry for Nuclear Power and regional energy utilities;
- the development of a legislative foundation for reform;
- the establishment of a market infrastructure;
- the liberalization of the wholesale market.

This is the stage at which the investment potential of the industry will be created according to the designers of the reforms. With that end in view, government shares of energy companies will be sold to strategic investors, low-efficiency energy production facilities will be disposed of,

and strategic investors will be attracted to manage wholesale power generating companies, with the right of subsequent purchase.

The second and third stages have not yet been elaborated. Their duration and substance, as well as the mechanisms , will largely depend on the outcome of the first stage.

Specific Regional Features of Reforms in the Energy Sector

The process of filing by the Northwest Russian energy companies for approval from RAO UES of Russia on reforms is close to completion. In the majority of the projects, reorganization corresponds to the basic model. However, the projects of some energy systems substantially differ from the proposed model due to their specific features. Decisions about reforming these energy systems are made individually. This argument is supported by many regional administrations, State Duma and many others. As a result decision-making on restructuring plans for particular utilities has stopped and alternative project proposals will be accepted.

Within the region, there are several isolated energy systems with models that differ substantially from the basic model. Among the partly and wholly isolated energy systems are the Arkhangelsk, Kaliningrad and Pskov energy systems, as well as the energy system of the Republic of Komi. The particularities of these systems are the following:

- Lack of integration in the power grid (total or partial);
- Lack of conditions for competition between power-generating companies;
- Long distances and overall remoteness of energy systems;
- Magnitude of volumes of cross financing.

It is evident from the specific features of the isolated energy systems described above that the basic model is not appropriate for reforming these energy systems. The reform will, therefore, be implemented according to a specially devised model. The division of regional energy companies according to their activity will not create additional benefits because it is impossible to create competition in generation at this stage. Such division in an isolated system may only cause an increase in costs in energy companies and will result in the growth of energy tariffs in the region. For this reason the principle of vertical integration will be maintained in the isolated systems. Due to the remoteness and long distances between major producers and consumers in the Arkhangelsk, Kaliningrad energy systems, as well as the system of the Republic of Komi their

integration into the interregional alliances of grids and production is not expected to take place in the near to medium term.

The monopoly of power-generating companies in the isolated energy systems will empower the regional energy committees to continue to determine energy tariffs in the future. To determine the validity of production and distribution costs in the vertically integrated energy company, the principle of separate cost accounting according to activity may be implemented according to reform plan.

At the same time, the project for reforming the major regional energy company, Lenenergo, which is expected to become the basis for the establishment of interregional generating grid and distributing companies, inspires the greatest controversy. At the present time, the managerial board of RAO EUS of Russia has fully approved the project of reform of Lenenergo proposed by the company's management. According to the plan, the reorganization of Lenenergo will begin in September-October, 2002.

Box A2. Reform of Lenenergo

The reform of Lenenergo is planned to take place in two stages. During the first stage, there will a division of generating, grid, and other companies, with a mirror-split of stock. The regional grid company will be established by Lenenergo with the latter's 100% participation in the capital. In addition, Lenenergo continues the production of energy and part of the task of distribution as its own functions. The establishment of a managing company is not expected to take place during the reforms; hence, the managing functions will be carried on by Lenenergo.

The second stage consists of an interregional merger, i.e. integration of these companies with similar ones divested from energy utilities of contiguous regions. At the same time, the takeover of energy utilities in the neighboring systems by Lenenergo is planned. In this case, the additional power capacity derived from its alliance to Lenenergo may exceed 4 MW.

The process of establishing the interregional energy companies and providing their effective functioning will face significant organizational, personal, political and economical problems, however.

The political problems in establishing an interregional company around Lenenergo arise from resistance from the governors and municipalities. Fearing to lose their influence over the energy sectors of their regions and the diversion of tax flows to St. Petersburg, the governors have already begun lobbying for the independence of the regional energy companies established by the reforms. Active resistance is also expected from the major industrial enterprises of the regions. Today they are in a position to control the growth of energy tariffs for industrial enterprises through their cooperation with regional energy companies and regional energy committees. The establishment of the interregional energy companies makes direct influence impossible.

Problems on the personal level include resistance from executives of energy companies that are being taken over. The main reason for their resistance to the proposed project and the Lenenergo growth, is their fear of becoming dependent on the management and shareholders of Lenenergo .

In order to overcome this resistance to the process of reform, it is necessary to use the administrative influence on the regional political and industrial elite, and to lobby specific decisions at the federal level. At the same time, taking into account the lobbying potential of RAO EUS of Russia and Lenenergo, as well as the attitude of the Russian government towards supporting the energy monopoly, the project is likely to be approved in its current form. Nevertheless, Lenenergo only intends to begin the actual integration of the regional companies in four years. Unfortunately some of the above fears and objections by opponents of Lenenergo reform in its present form are well grounded in facts and reflect a fact that Lenenergo was not able to provide sensible answers to questions related to increase in monopoly pricing and lack of instruments to attract sufficient investment into upgrading on reasonable terms.

An important element in reforming the Northwest Russian energy system is the sale to the strategic investor of shares in the Northwest Power Plant and Pskov Thermal Power Plant belonging to the RAO UES. The proceeds from sale of stock to strategic investors are expected to be used for the completion of the construction of unfinished power generating units. The electric power plants are export-oriented and located in the border regions with a developed infrastructure. For this reason they are considered to be fairy attractive for investments. The estimated volume of required investments in the Northwest Power Plant is $230 million, and in the Pskov Thermal Power Plant $32.5 million. At the moment, the investment plans are clear only for the Northwest Power Plant. It is anticipated that in the near future there will be a tender for the sale of the blocking stock of the station (25% plus 1 stock) and an option for buying an additional package (raising the investor's share in capital to up to 51%). However these projects will also face significant problems, primarily difficulties with fuel supplies and some major technical and location problems. Therefore, attractiveness of these projects in their present state is doubtful as is questionable that any of strategic investors will be interested to step in projects in such state.

Attracting strategic investors necessitates solid guarantees of fuel supplies for these power generation facilities. However, at present Gazprom does not provide any guarantees for supplying gas to the facilities that are being put into operation. This makes it necessary to revise the existing agreements between Gazprom's subsidiaries and energy companies. Even if Gazprom agrees to increase gas supply to these facilities, technical problems are likely to emerge. The maximum daily capacity of the gas pipeline systems that deliver fuel to the region amounts to 87 million m^3.

Allowing for seasonal fluctuations of gas consumption, this is not enough to provide a reliable gas supply to the facilities in question. Meanwhile, regional gas companies do not plan to modernize existing pipelines and to build new ones in the near future (they are not empowered to make investment decisions). Gazprom will, therefore, be able to guarantee gas supply only if it puts certain limitations on other consumers. This is highly unlikely to happen owing to major political problems associated with such decisions. A significant period of time will be needed to overcome the existing problems, and the implementation of the projects of selling shares of the Northwest Power Plant and the Pskov Thermal Power Plant may be a protracted process.

The Prospects for Reformation of the Energy Sector

Although the government regulation defining the major objectives of the reform of the energy sector was signed in the summer of 2001, and the beginning of the process of reform was officially announced, its prospects are still vague.

The time frame of the reform remains unclear. The Government has already changed the initial terms several times; however restructuring does not seem possible even within the new time frame. Thus, the Board of Directors of RAO UES of Russia has postponed consideration of the projects of the reform of the regional energy companies for several months. The delay was mandated by the President's Administration and supported by the government and the Ministry of Economic Development. They primary objection is that the RAO UES began restructuring regional energy companies without any valid legislative basis for it. The problems surrounding the approval of the proposed legislation by the State Duma and the Federation Council may result in a delay until Summer 2003 and even later. In that case, the start of the industry's reformation process might be postponed until the President elections in 2004 and RAO UES of Russia will only be able to resume its reforms not earlier than 2005. At the same time, it is still not clear to what extent the package of reformation documents will be modified by the State Duma, and would the Russian Government and RAO UES have enough political power for finishing the reforms.

One of the most serious problems of reform today concerns the legislation necessary for further restructuring of the sector that must be passed by the State Duma (The Lower Chamber of the Russian Parliament and the Federation Council (The Upper Chamber of the Russian Parliament). Consideration of the bills was postponed until the fall, while they were being elaborated by a specially formed conciliation commis-

sion. As a result of the commission's work, the government negotiated concessions to the legislators on a number of key issues. This process still goes on as the present paper goes to printing.

First, it was agreed that the decision on the restructuring of RAO UES of Russia would be made by a simple majority (50% plus one vote) instead of a qualified majority (75% plus one vote). This amendment significantly simplifies the activities of the government and the management of the RAO UES aimed at the company's reformation, since they no longer have to make concessions to minor shareholders, thus considerably decreasing their role in decision-making. On the other hand, neglect of minority shareholders interests leads to low valuation of RAO UES stock and is a very damaging factor in the future.

Second, it was decided that vertically integrated companies can be preserved for:

- Isolated energy systems, if the records of competitive and monopoly types of business are maintained separately;
- Energy production for internal needs or for a single consumer;
- Construction of new systems.

Regional energy companies are allowed to exist until July 1, 2004, while the competitive and monopoly business activities are required to be transformed into independent companies.

Another important amendment approved by the conciliation commission is that the regional authorities preserve the right to regulate tariffs on electric power transmission through electricity distribution networks and to regulate the level of surcharges for guaranteed suppliers by means of regional energy commissions.

At the same time, the committee was unable to come to an agreement on one of the key issues of reform. The idea of the division of proportional shares in the companies established by RAO UES of Russia (FGC and SO) that was put forth by RAO UES management and the Russian Government was rejected. The Federation Council and State Duma insist on the government keeping 100% of FGC and SO stocks, fearing that with the proportional capital structure of the established companies the government may lose its influence on these monopolistic sectors. However, the Russian government and RAO UES of Russia are unable to adopt it, since it may give rise to intense disputes with other RAO UES shareholders. For this reason, the clause on the division of proportional shares during the establishment of FGC and SO will cause the major difficulties when the package of bills on the reforms of the industry is

up for approval in the State Duma and the Federal Council. There is disagreement in the contents of reform also inside the Russian Parliament.

Despite the fact that the package of bills proposed by the Russian Government is considered to be fundamental, the Duma deputies have already proposed more than 500 amendments. This makes the fate and timing of these laws unclear. It is possible that their revision will result in various compromise settlements or half-measures that may dramatically influence the reforms.

The outcome of the reforms will be influenced not only by the uncertainties in legal regulations, but also by the processes of reform of the regional systems. The prerequisite for developing an effective competitive market in the industry is the concurrent reform of all regional energy systems, as well as the diminishing of influence of the regional authorities over the electric power plants. RAO UES of Russia, however, does not control all the regional energy companies. For this reason, the holding company will not be able to curtail the influence of the governors on all the electric power stations and to reform all regional energy companies simultaneously and on equal terms. The necessity of seeking new solutions while restructuring each energy company significantly impedes the process of reform of regional systems and delays the completion of the process.

Reforms of the gas industry are expected to follow in the near future. It is envisaged that many lessons from the electricity markets reform will create a useful basis for restructuring of the gas industry and Gazprom.

A3. Dispersed Energy Production

Current Situation

An effective retail market organization is essential for the functioning and development of the energy industry. However, the existing structure of the retail segment neither provide effective functioning and development of the industry, nor encourage consumers to save energy.

The policy of centralization of energy supply in the Northwest led to a situation in which 99% of energy was produced by several dozen large electric power plants (see Table 1). Almost everywhere in the region, energy is sold to consumers either by regional energy utilities (AO-energos) or by wholesalers, which are in turn customers of the regional energy utilities. At the same time, prices for energy are fixed in the form of tariffs by regional regulatory government bodies (regional energy committees).

Table A3. Russian Northwest Regional Power Systems Description

Region	*Area, thousand m²*	*Population, thousand people*		*Power production TWh*	*Heat energy production, million Gcal*	*% of centralized energy supply*
		total	*including urban*			
Total	1 678	15 104	10 743	83,05	141,4	99%
Arkhangelsk Region	5874	1 570	1 153	5,.55	19,2	95%
Vologda Region	145,7	1 332	900	6,19	22,4	n/a
Republic of Karelia	172,4	786	520	4,30	9,8	99%
Murmansk Region	144,9	1 195	1 100	16,53	13,2	99%
Republic of Komi	415,9	1 263	960	7,73	20,4	99%
Leningrad Region	83,9	1 659	1 094	31,37	15,1	99.8%
Saint-Petersburg	1,6	4 628	4 628	8,01	27,5	100%
Novgorod Region	55,3	800	560	0,91	6	99.7%
Pskov Region	55,3	847	534	2,30	3.4	99.8%
Kaliningrad Region	15,1	880	695	0,16	4.4	100%

About 1% of energy in the region is provided by production facilities not included in the power grid. These include:

- Small-scale electric power stations of the regional energy systems;
- Electric power plants of industrial enterprises producing low-capacity output for the energy system;
- Electric power plants of state-owned enterprises producing low-capacity output for the energy system;
- Small-scale electric power stations owned by private companies and authorities.

As a rule, these facilities generate energy for their own needs and do not sell it to out side consumers (or sell in very small quantities to captive customers nearby).

Unlike the power supply provided by the enterprises of RAO UES of Russia, which is almost completely centralized, about 70% of heat energy is generated at municipal boiler-houses included in the regional companies for residential and public utilities services. The residential and public utilities services are characterized by extremely low efficiency and user-friendliness. Nearly all enterprises of this sector are heavy loss-makers and primarily budget-financed. Despite the relatively large financing of the residential and public utilities by the local administrations, the reliability and quality of heat supply continually decrease. This is explained in the first place by the poor state of production facilities and networks. The wear and tear of the fixed assets of the residential and public utilities is over 60% of the service life on average, and up to 100% of the service life in some cases.

The current energy sector has a number of significant disadvantages:

- As a result of the heat and electric energy sellers' monopoly on the market, there are no incentives for producers to improve the efficiency and quality of the services delivered;
- The economic activity of market participants is totally untransparent that often results in excessive costs;
- Consumers are not encouraged to save energy by state supported low tariffs (They are much lower then they would have been if all costs are paid by consumers);
- Losses of heat and power in the energy systems continually increase. Thus, in Northwest Russia losses of power electric energy were over 13% of production volume, while in the heating systems losses were up to 40%;
- Low tariffs, state support of loss-makers makes retail trade a non-attractive business for strategic investors. As a result the fixed assets become outdated and are retired without due replacement;
- Due to the continuous deterioration of generating and transmitting equipment, the reliability and quality of the energy supply are decreasing, while the cost of operation and maintenance of networks is increasing.

Establishing new relations based on the principles of competition in the retail energy market will dramatically change both the existing structure of the energy cluster, and relations between the market participants in Northwest Russia. One way of creating an effective system of interrelations between heat and electric energy production and consumption, as well as establishing a competitive environment in the en-

ergy market, is to decentralize energy markets. A whole series of economic and legal prerequisites for establishing and developing small-scale production have already been created in Northwest Russia, but success in this direction will still require major break troughs on the law-making and regional government as well energy utilities side.

Small-scale Energy Producers as Retail Energy Market Participants

According to the already approved program of restructuring of RAO UES of Russia (subject to further major alterations as it is described in the preceding Appendix "Energy Networks as a Marketplace"), the energy market will be vertically divided into two parts, a wholesale and a retail market. Small-scale energy producers are of great importance in creating the competitive retail market.

According to the model of the retail market under discussion today, a small-scale electric energy producer is understood as a juridical person in any form of ownership, which possesses and/or controls power-generating facilities located at one or more electric power plants in order to produce and retail electric energy, and is not a part of the wholesale market. The purpose of the operation of small-scale producers of electric energy on the retail market is the generating profit by means of the production and retailing of electric energy to either distributing and/or energy-retailing companies, or to the end consumers, as well as by means of providing for additional systems services through a contract with a regional dispatching department.

The small-scale producers of electric energy that are connected to the grids of an energy distributing company that is part of mainframe energy system (it means utilities and networks operating within the main grid of UES of Russia) are required to comply with the technological rules of the electric energy market and other normative/legislative regulations determining technical and technological principles and rules for operating facilities producing electric energy.

In compliance with the Federal Law #128-FZ "On the licensing of certain kinds of activities," effective August 8, 2001, licensing of the activity of electric energy production is not implemented. The activity of distributing electric energy is governed by the rules of the retail market, technological regulations, as well as other corresponding normative acts. In other words the small-scale energy producers shall comply to rules and regulations imposed on the energy market. These are being changed at the moment, as it was previously discussed. Forthcoming

changes will determine greatly the future operational framework for these producers.

Small-scale producers of electric energy are not generally considered as the natural monopolies. In the event that their consumers have no access to other sources of electric energy a situation may occur in which a small-scale producer of electric energy will have a local monopoly. This will be regulated by antitrust laws (the Law of RSFSR #948-1 "On competition and the limitation of monopoly activities on goods markets," effective March 22, 1991). In practice this regulation is rather inefficient, leads to low tariffs and under investment. There is a hope that when new energy market laws will be introduced issues of small-scale power generation for limited range of captive customers will be duly addressed.

There are two ways of marketing electric power generated by small-scale producers. First approach is to sell to regional energy utility. In this case possible prices could not exceed the wholesale market price for the customers. It is also possible to sell directly to end consumers and distributors. The prices here are agreed-upon by the parties and subject to regulation in case no other connection are available.

Basic Principles for Integrating Dispersed Energy Production Facilities into the Retail Energy Market

Despite the fact that the small-scale generating facilities do not participate in the wholesale market, many operate within the energy network and de facto are potential competitors with respect to the generating companies participating in the wholesale market. At the same time, the small-scale generating facilities should not be discriminated by generating companies, either through regional dispatchers or through regional network companies. This vague principle could be difficult to implement in practice.

The small-scale energy production facilities are normally self-dispatching; they make decisions about the volumes and terms of delivery of electric power to the energy system on their own. As a result, the regional distributing functions do not go beyond the supervision of technical operating modes. However, in the case of pre-emergency and emergency situations, a regional dispatcher is authorized to interfere in the operations of a small-scale production facility. A small-scale production facility shall deliver additional system services under augmenting treaties.

Due to the absence of an organization that carries out the function of a clearance centre, the introduction of financial treaties between cus-

tomers connected to the grid or buying from the electricity trading company and small-scale electric power suppliers in the retail market is not envisioned. Therefore, on the retail market only contracts for direct energy supply between customers and the small-scale production facilities are possible (they must have a direct network connection simultaneously too.

In the event of a surplus in electric power at small-scale production facility, a mechanism is to be implemented by which the regional energy system would have at its disposal, and pay for electric energy. Consequently, the regional network company should make a compulsory purchase of electric power produced by small-scale production facilities connected to its network at prices equal to the wholesale market prices. Although fundamental in nature this principle will be difficult to implement in practice. We believe that resolution of this issue efficiently could pave the way for the development of small-scale power generation in Russia.

Prospects for the Development of Dispersed Energy Production

At the moment, conditions favourable for the development of dispersed energy production are taking shape in Northwest Russia.

This is, in the first place, highly dependent on the supply side condition of the energy balance in many regions. According to a prognosis, by 2010, 4,052 MW of production capacities will have been expended, while the annual growth of energy demand will have exceeded 2%. Under such conditions, a number of energy systems will not be able to provide consumers with a stable heat and electric energy supply that complies with existing standards. Moreover, the planned reduction of oil deliveries to electric power plants in remote regions and anticipated decrease in gas supplies for power generation purposes also determines the necessity for seeking the new ways of supplying energy. This favours development of dispersed energy production in Northwest Russia.

Another factor in favour of the development of the dispersed energy production in Northwest Russia is the uncertain future of the electricity networks. Despite the fact that the total length of electric networks in the region is over 225,000 km, considerable area of the region is not covered by the networks and, thus, is not included in the system of centralized energy supply. The connection of the majority of these areas in networks is not feasible and foreseeable in the near future[1].

[1] Study of planned developments in this area is presented in the Appendix "Energy Networks".

Therefore, the development of decentralized energy supply systems is very relevant.

An important condition for the development of dispersed energy production in Northwest Russia is the region's significant resource potential of alternative small-scale energy supplies (water resources, biomass, peat, wind power, etc)[2]. It is expedient to develop decentralized energy supply systems in the sparsely populated and remote regions on the basis of these very local energy resources.

Within the framework of the legislation for restructuring the Russian energy sector, a legal foundation for regulating the functioning of the retail electric power market represented by small-scale production facilities is being created. In April 2002, a package of bills on the restructuring of the electric power supply was introduced at the Federal Assembly of the Russian Federation:

- Law on Amendments to the Federal Law "On natural monopolies";
- Law on Amendments to the Federal Law "On the Power Industry";
- Law on Amendments to the Federal Law "On the Government Regulation of Tariffs";
- Law on Amendments to the Federal Law "On the Competition and Restriction of Monopolistic Activity on the Commodities Market";
- Law on Amendments to the Federal Law "On Saving Energy";
- Amendments to the Civil Code of the Russian Federation.

The major areas of reform of the energy sector and pricing methods relating to thermal and electric power have already been approved by the government of the Russian Federation.

At the same time, despite conditions favourable for the development of decentralized energy supply systems in the regions, the significant growth of investments in small-scale production facilities seems to be unlikely in the near future.

The development of dispersed energy production will be hindered by economic obstacles, first and foremost. Due to the low purchasing power in the regions that are most attractive for the construction of

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[2] Study of biofuel development is presented in the Appendix "The Future of Biofuels".

small-scale production facilities (sparsely populated and remote regions with an undeveloped infrastructure), the investment attractiveness of such projects is extremely low. The only investors in this case may be local authorities, which have only limited investment resources or strategic investors when they start developing their manufacturing facilities in such places.

The large industrial enterprises interested in reducing their dependence on the energy market, as well as energy equipment producers actively lobbying for their interests in the regions, will play the most significant role in the facilitating the effective legal basis and framework for the development of small-scale and dispersed production.

Among the large companies that are already developing dispersed energy production, it is important to point out the companies developing natural resources, as well as the enterprises in which energy is a part of production cycles. For example, some pulp and paper mills in the Northwest have some excess heat and electric power that is delivered to the network, in the nearby settlements. Besides pulp-and-paper mills, other enterprises of the forest industry may be considered promising from the point of view of the development of dispersed energy production.

Another obstacle hampering the development of small-scale production is the relatively rudimentary research base. This problem is evident in the absence of ready solutions for some types of fuel, the low level of standards of equipment, the underdeveloped infrastructure, and the absence of maintenance staff.

As a conclusion we would like to stress here that development of the dispersed and small-scale energy production will most probably be a bottom-up process where facilities will be created as a response to major changes in tariffs, reliability and availability of energy supplies from the national and regional utilities as well as solution to solving energy supply problems in the remote areas. We envisage that in the forthcoming decades Russia will see a major outburst of dispersed energy production if the regulations will be created in the process of energy sector reform.

A4. Energy Networks Development

Energy Networks of Northwest Russia

The accumulated length of the Region's overhead energy networks is around 255 000 km, of which 57 000 km are lines of ≥ 35 kV. Over 217 000 km of the energy transmission networks, accounting for 85% of the total, are distributing networks. The accumulated length of the existing cable networks is 2 420 km. The regional energy system includes 1783 substations of ≥ 35 kV with a total installed transformer capacity of over 52 000 MVa.

Management, operation and maintenance of the regional energy networks are the responsibilities of the regional energy utilities (AO-energos) and of the subdivision of RAO UES of Russia named Intersystem Electric Networks of the Northwest(IEN NW). All the electric mains and the 330-750 kV substations are on the balance sheets of the IEN NW .

Box A3. Intersystem Electric Networks of the Northwest (IEN NW)

Intersystem Electric Networks of the Northwest (IEN NW), is in charge of energy transmission, work mode control, monitoring of electric networks and related electric equipment, as well as installations, tuning and equipment maintenance. The company is operating 52 single/twin 330 kV, 400 kV, 500 kV and 750 kV high voltage lines (HVL) and twenty 330-750 kV substations. The accumulated length of the electric grids operated by the company is over 5000 km.

The construction of the IEN NW grid started in the late 1950s, reaching its peak in the mid-1980s (see Figure 1). At this time, 17% of the power grid have been in operation for over 30 years, which is causing major reliability and efficiency problems.

The IEN NW is carrying out maintenance of the grid equipment and substations with the help of five intersystem electric grid companies (IENC), i.e.:

Bryanskoye IENC

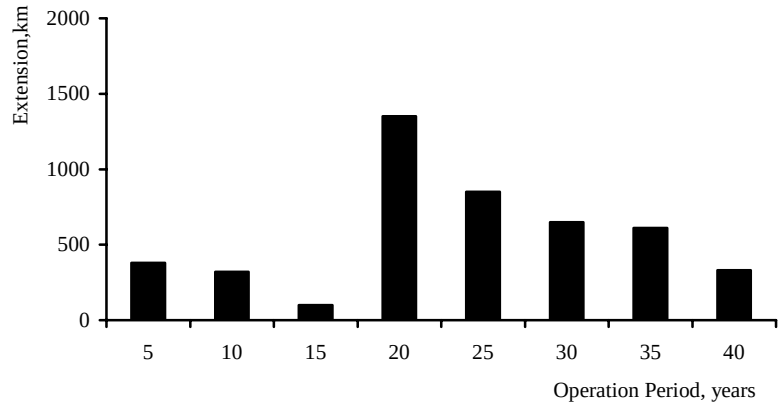
Vyborgskoye IENC

Karelskoye IENC

Leningradskoye IENC

Novgorodskoye IENC

Figure A6. Overhead Power Grid 330 – 750 kV: Operation Time Breakdown



Sources: Sevzapenergo (2002)

A special feature of the energy system of Northwest Russia is the lack of any high voltage lines linking the Western and Eastern energy systems[3]. The lacking energy transmission infrastructure is hindering the establishment of a technological unified energy system in Northwest Russia and triggering multiple control and reliability problems plaguing power supply within the Regions. The isolated Eastern and Western energy systems are an obstacle in the way of maintaining efficient energy balances in the Regions, resulting in energy shortages in some Regions (e.g. in Arkhangelsk Region, the Republic of Karelia, etc.) and energy surplus in other regions (e.g. in Leningrad Region and Murmansk Region).

In the territories bordering on Finland (i.e. in the Republic of Karelia and Murmansk Region), the energy networks are also rather disconnected. As a result of the inadequate transmission capacity of Kolenergo – Karelenergo – Lenenergo inter-grid energy transmission infrastructure, the above Regions have an unutilised capacity of over 800 MW. Republic of Komi is in a similar situation. At the moment, the spare capacities of Pechora Thermal Power Plant amount to almost 600 MW, which is also due to the low transmission capacity of the existing energy networks.

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[3] The Eastern energy system includes the networks of Komi Republic, Arkhangelsk Region, and Vologda Region; the Western energy system includes the networks of the Karelian Republic, Kaliningrad Region, Leningrad Region, Murmansk Region, Novgorod Region, Pskov Region, and St. Petersburg.

The energy systems of the utmost western regions of Northwest Russia, i.e. those of Kaliningrad Region and Pskov Region, are dependent on energy supply from Estonia and Lithuania. The Pskov energy system fails to be self-sufficient due to the lack of a direct link with RAO UES of Russia. Consequently, in the short term, ensuring the self-sufficiency of Pskov Region, which is currently relying on Estonian energy supply, is a priority energy networks development objective in Northwest Russia.

One of the major drawbacks of the energy system is the high-capacity (4000 MW, i.e. 41% of the region's installed capacity) Leningrad Nuclear Power Plant, which is not connected to the grid in line with the standards, causing emergency prevention problems in the grid and load adjustment problems in the electrical power plants.

Another problem plaguing the regional energy networks is the low energy transmission efficiency. The regional utilisation factor is max. 88% of the total energy consumption, the main reason behind the 12% energy loss being the worn-out energy transmission equipment.

Energy Networks Development in Northwest Russia

The key development factors of energy networks in the Northwest Russia are the increasing energy demand and anticipated changes in structure of power generation. The existing projections envisage the annual growth rates involving energy demand as follows:

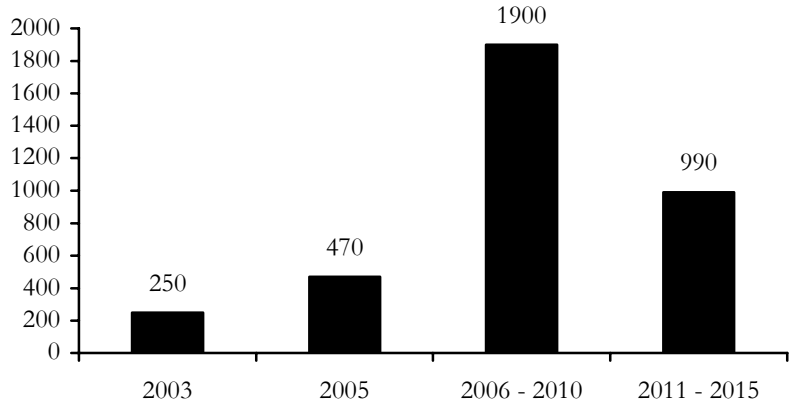
- 2001 – 2005, 1,9%;
- 2006 – 2010, 2,3%;
- 2011 – 2015, 2,2%.

In 2010, the energy demand could exceed 100 TWh, reaching 114 TWh in 2015. In view of the demand trend, to ensure an efficient and reliable energy supply, the region would need to build over 3000 km of ≥ 330 kV overhead lines by 2015.

However, the necessary investments in the energy networks cannot be ensured until the structural changes within the sector are completed and the Russian energy market becomes more liberal. Therefore, active development of the energy networks in Northwest Russia is not likely to begin until 2005, when the main market players will be identified, and the network operators will be in a position to provide the requisite financing of their projects. The leading power generation and trading companies will have a powerful say in the selection of energy network construction projects. Until then, the development of the regional energy grids will be

largely driven by the completion of the ongoing energy network construction projects. According to Sevzapenergosetproekt Research Institute, the projected construction rate of new networks of ≥ 220 kV is 720 km until 2005 and around 3000 km in 2006 – 2015.

Figure A7. Planned New Energy Networks in Northwest Russia, km



Sources: Sevzapenergo (2002)

The main planned development activities involving the energy networks of Northwest Russia are aimed to remove the bottlenecks currently existing in the regional energy system. The energy network development prospects are based primarily on the development of intersystem high-voltage transmission lines. Capacity increases in the high-voltage energy transmission infrastructure would serve to ensure the required energy transmission and to improve the overall reliability and operability.

The map showing the locations of the existing and planned new energy networks in Northwest Russia is presented in Figure A8.

Figure A8 . Locations of the Existing and Planned Power Networks in Northwest Russia

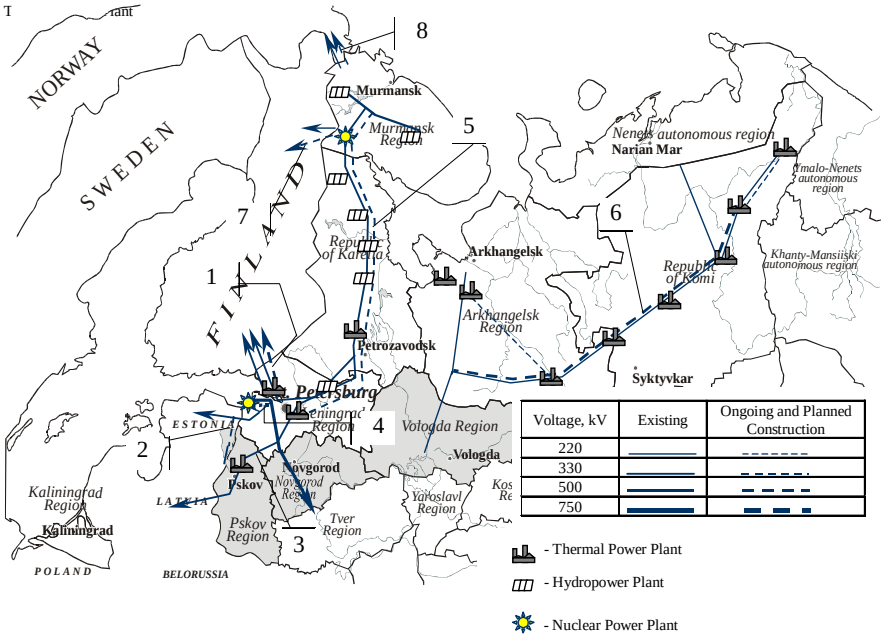


Table A4. Energy Networks of the Russian Northwest: Ongoing and Planned Projects

№	*Route*	*Voltage, kV*	*Length, km*	*Project Status*
1	Vyborgskaya Substation - State Border – Kymi Substation	400	50	Ongoing
2	Kingiseppskaya Substation – Perevolok	330	81	Ongoing
3	Pskovskaya Thermal Power Plant – Staraya Russa	330	75	Ongoing
4	Leningrad Nuclear Power Plant – Leningradskaya Substation	750	130	Ongoing
5	Kirishskaya Thermal Power Plant – Kolskaya Nuclear Power Plant	330	1100	Planned
6	Pechora Thermal Power Plant – Zaovrazhye Substation	500	774	Planned
7	Kola Nuclear Power Plant – State Border – Pirttikoski Substation	330	n/a	Planned
8	Pazskiye Hydropower Plant Cascade – State Border – Norway	n/a	n/a	Planned

Sources: Sevzapenergo (2002)

Until 2015, the Western and Eastern energy systems are expected to develop independently.

In the next ten years, the development priority of the Western energy system is the expansion of the energy networks ensuring energy transmission between the Kolenergo, Karelenergo and Lenenergo networks. The planned expansion will be achieved through the construction of a 330 kV high voltage line along the whole power transmission route. The accumulated length of the planned grid is around 1100 km. In line with the expected energy transmission volumes, the transmission grid project is envisaging three steps: Step I, Kirishskaya Thermal Power Plant – Petrozavodsk, by 2006; Step II, Petrozavodsk – Putkinskaya Hydro Power Plant, by 2010; Step III, Putkinskaya Hydro Power Plant – Kola Nuclear Power Plant, by 2015. In many ways, the construction schedule will be dependent on the progress of the rebuilding and upgrading project involving the power generating units of Kola Nuclear Power Plant.

In the short term, Northwest Russia will witness the development of Pskov Regional energy networks. Nearing completion are two high voltage line projects aimed to link the isolated Pskov energy system to the networks operated by RAO UES of Russia. The project involving the construction of a new 330 kV line is meant to provide a direct link between the Leningrad and Pskov regional energy systems. The start-up of this new line would make it possible to discontinue the ongoing energy transfers (involving the Estonian Grid networks) between the two above regions. Another project nearing completion is that of a new 330 kV line linking Pskovskaya Thermal Power Plant and Novgorod Region. Future development prospects involving the energy networks of Pskov Region are largely dependent on Pskov Thermal Power Plant's reaching its planned capacity. To complete the construction of this power plant, RAO UES of Russia is mounting its efforts to bring in a strategic investor.

In case of the Leningrad energy system, the key issue is to reinforce the linkage of Leningrad Nuclear Power Plant to the grid to ensure its meeting the regulations governing power generation reliability of nuclear power plants. A possible reliability improvement alternative is a second high voltage (750 kV) line. In Leningrad Region, the development prospects of the energy networks (including the exported energy networks) will be largely hinged on the start-ups and shut-downs of power generation capacities, specifically those in the largest plants, the Northwest Power Plant and Leningrad Nuclear Power Plant. The units of Leningrad Nuclear Power Plant, started up stepwise since the early 1970s, are nearing their design lifetime (approx. 30 years). E.g. the service life of Unit 1 will be exhausted in 2003, with Unit 2 following in 2005, Unit 3 in 2009 and Unit 4 in 2011. To compensate for the capacities to be taken out of operation, there are plans to build a new unit, Unit 5; however, due to

the lack of investment, the start of construction has been pushed back to 2015. Therefore, Minatom (the Russian Ministry for Nuclear Power) has decided to extend the respective operating terms of Units 1, 2 and 3 to 2008, 2010 and 2014.

The development of the energy networks comprising the Eastern energy system is driven by the need to eliminate the energy shortages plaguing all its Regional energy systems. This would involve a major capacity increase of the intersystems transmission infrastructure, which would serve to achieve a substantial power generation increase in Pechorskaya Thermal Power Plant with its current under-utilised capacity of 600 MW. For this purpose, in the course of the next decade, it is planned to build a new 500 kV high voltage line to improve the energy transfer between the grids of the Republic of Komi and Arkhangelsk Region. However, the start-up of the 200 MW Unit 6 in Pechorskaya Thermal Power Plant would involve a further increase of the transmission capacity in the Eastern energy system. The design of the energy network ensuring energy transfer between Komienergo, Arkhenergo and Vologdaenergo is to be updated by 2015.

The growing energy export volumes directed to the Scandinavian markets are expected to remain an important development trend of the energy system in Northwest Russia.

In line with the existing energy export contracts with Finland, in Leningrad Region there is the construction of the 45 km, 400 kV high voltage line and the rebuild/expansion of the Vyborg direct current link being completed at the moment. As a result of major investments in the energy transmission infrastructure, Lenenergo has improved its export opportunities, becoming the leading energy exporter in RAO UES of Russia.

Along with that of Leningrad Region, the Kola energy system has also been firming up. At the moment, the Kola system is getting ready to start energy transmission to Finland via the Imola Substation, which will result in a significant growth of energy export from Murmansk Region. At the same time, energy export to Norway has also been growing at a high rate.

Northern Finland offers the best energy export sales prospects for the energy industry of Northwest Russia. The favourable market prospects are based on the increasing power demand in Northern Finland and Norway and on the opportunities it offers as a transmission channel to supply Russian energy to Swedish consumers and participation in Nordic market. Another factor with an impact on the export potential of the Kola Grid is the availability of spare generation capacities, e.g. in Kola

Nuclear Power Plant. At this time, due to the modest energy demand in Murmansk Region and the low capacity of the southbound energy transmission networks of Kola Nuclear Power Plant, almost 25% of the Plant's capacities are under-utilised. A possible solution to ensure the utilisation of Unit 4 in Kola Nuclear Power Plant is the construction of a high voltage line to transmit energy to Finland. A project involving a 330 kV high voltage line linking Kola Nuclear Power Plant and Pirttikoski is currently under review. The new line could be used to transmit max. 4 TWha year. The investors considered for this are Rosenergoatom and a German energy company RWE (there are also rumours that group of investors could change as the time goes by). However, under the Russian law, all energy export networks are to be owned by the Federal Grid Company, which is being set up in the course of restructuring RAO UES of Russia. Therefore, the project's prospects are largely based on the outcome of the ongoing negotiations between RAO UES of Russia and Rosenergoatom concern and ability of the Federal Grid Company to come up with the necessary investments for the project.

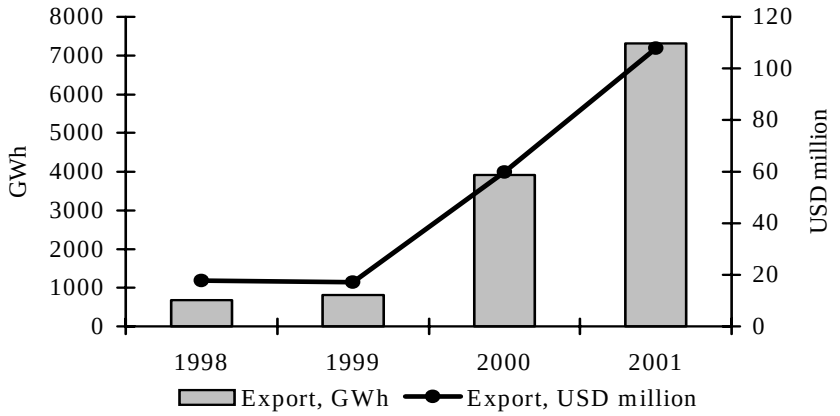
At the same time, implementation of the above project would involve continued operation of Units 1 and 2 in Kola Nuclear Power Plant, with their respective service lives expiring in 2003 and 2004. However, the activity aimed at upgrading and extending the life of the two units in question is being delayed due to financing problems. The most recent Unit 4 is due to be shut down in 2014. Along with the construction of the high voltage line linking Kola Nuclear Power Plant and Pirttikoski, the Kola Grid is to be complemented with a new line to transmit energy to Norway. It is planned to use the new line to transmit energy from the Pazskiye Hydropower Plant cascade. The planned capacity of the new power transmission facilities will serve to increase the energy export volumes by ~ 0,4 TWha year. Implementation of the above projects would bring up the Finland-oriented export volumes of Kola Grid to be on par with those of Lenenergo. Although very promising, as described above, both projects implementation is hindered by forthcoming changes in the RAO UES of Russia due to reform, major deterioration of generating assets and delays in building the networks (some power generating capacities may come out of use even before necessary grids are put into operation). In the longer term also the opposite way, i.e. energy imports to certain regions of Russia should taken as a possible alternatives.

Energy Exports

In the Western European market Finland is the key buyer of exported electricity for RAO UES of Russia. In 2001, energy export to Finland

was 7.32 billion KWh, accounting for 41% of the accumulated Russian exports (see Figure A9). Energy exports are handled by the two energy surplus systems, Lenenergo and Kolenergo. At the moment, energy supply to Finland is the most successful export project of RAO UES of Russia. In the future, Scandinavia, and especially Finland, will remain the largest export market for the Russian electric energy companies.

Figure A9. Energy Export to Finland



Source: RAO UES of Russia (1999, 2000, 2001)

However, in the short term the strategic prospects of Russian energy export to Finland will be curtailed, the main reason being the lack of synchronization between the two grids. The existing energy export technology based on direct current links (DCL) is quite expensive; in view of the currently low energy prices in Europe, this has been having a severe adverse impact on energy export profitability.

At this time, the operation of the existing energy networks is based on a wide range of process, environmental and sales standards and differing management principles. Europe is adopting decentralised grid management as its basic management principle, whereas Russia is planning to continue its centralised grid management also in the future. When the two grids are linked, the different management principles will become the key problem.

The only realistic solution to ensure the synergy of the power supply system of Northwest Russia and Scandinavia is a larger-scope project aimed to integrate the European and Russian Grids into a single energy system. Most of the operations within the grids are based on specific process modes and, technically, can be linked within the next few years; however, due to the need to bring up the efficiency and reliability of the

Russian grid to meet the European standards and to implement unified process standards and management principles, the full synergy effect can only be expected in the long term. To ensure efficiency and reliability improvement, the energy system of Northwest Russia would need major investments both in the power generating capacities and in the energy network.

Apart from the lack of synergy of the two existing cross-border grids, another factor with an impact on the prospects on their trade relationship is the forthcoming liberalisation of the Russian energy market. The growing attractiveness of the Russian energy market will be accompanied by the economic pre-conditions for energy import. Firstly, the inevitable substantial energy price increase, triggered by the restructuring of RAO UES of Russia, will result in a domestic sales profitability increase in the context of modest export sales revenues. In this case, the Russian energy companies will be able to amend their export strategy, expressly targeting an increased share of export volumes in their international trade transactions. Secondly, in spite of the extended service time of the existing generators in use in the nuclear power plants, after 2015 they will inevitably have to be shut down, with any new nuclear power generating capacities remaining vague prospects. This could result in an energy shortage, which might be partly compensated by importing energy from Finland and Scandinavia.

The strategic development prospects involving the Russian energy imports to the Finnish and Scandinavian markets are hinged on finding the solutions ensuring synergy of the two grids involved and establishing a single energy market, as well as on the need to elaborate and implement a new strategy, to be based on the improved competitiveness of the Russian energy export and aggressive capturing of new markets, rather than on the plans aimed to compensate the energy shortages expected in the West.

A5. The Future of Biofuels

Current Situation

The poor condition of residential and public facilities, as well as the anticipated shortages of the certain types fuel in the regions and the expected rise in prices for traditional energy resources, are important preconditions for the decentralization of the energy sector and the switch to local fuels. The development of power production facilities oriented towards small capacities in the near future might become one of the major lines of development of the energy sector in Northwest Russia. The

transfer from liquid fuel (fuel oil, diesel fuel, gasoline) and coal to natural, bio- and producer gases and biomass at small-scale power plants and most boiler units takes priority in the development of small-scale power-generation facilities in the region. Small-scale bioenergetics, which have a significant potential in Northwest Russia, can serve as one of the main solutions for problems in energy supply in remote, difficult to reach, and ecologically burdened territories. It will also help increase the energy effectiveness of the regional economy and companies that have access to biofuels as sub-products of their processes.

The development of bioenergetics in Northwest Russia is preconditioned by the availability of necessary resources in the region. Wood reserves in Northwest Russia make up more than 9,000 million m^3. Together with valuable softwood species and birch, which enjoy stable demand in the areas of traditional uses of marketable wood, there are many low-quality species (aspen, alder and others) that are less valuable. Such species make up from 0.5 to 37% of the forest stock. At wood-processing enterprises, wastes make up 300 m^3 and more of each 1,000 m^3 of raw wood processed and are virtually unutilised and represent a significant problem for companies. Potential reserves of wood wastes in the region exceed 20million m^3.

Northwest Russia occupies the second place in Russia after the Western Siberia in volume of peat resources. The total peat reserves of the categories $A+B+C_1+C_2$ in the region are equal to 8 billion metric tons.

Despite its significant resource potential, however, bioenergetics is not widespread in Northwest Russia, and the percentage of bioenergetics in the energy balance does not exceed 0.1%. This situation is a result of a policy carried out during the most recent decades, and aimed at centralizing energy and heat supply and the gasification of the region.

Since gas is still inexpensive on the domestic market and ecological standards are quite low, the regional authorities first and foremost support a policy of general gasification. In order to implement this policy, the regional administrations have already signed long-term agreements with Gazprom. In most regions of Northwest Russia, where significant biofuel resources are concentrated (the Republic of Karelia, the Arkhangelsk region, and the Leningrad region), the development of the energy sector will also be based primarily on small-scale combined-cycle plants and gas-turbine units, including the reorganization of regional boiler-houses into mini-thermal energy stations. The prospects for modernization of boiler houses by transferring them to biofuels (primarily wood wastes) exist only in areas remote from main gas pipelines. The implementation of the policy of total gasification of the re-

gions might encounter the problem of inadequate raw materials supplies, however. Gas resources are growing continually smaller, without being regenerated. Since most of the gas produced at new deposits will be exported, it is anticipated that development and growth of domestic gas supplies will be reduced in the near future.

Government Support

Purposeful government support will be important factor in determining the pace of development of bioenergetics in the Northwest, as well as in the whole country. Presently, federal and regional authorities fail to devote enough attention to this problem. The measures taken periodically are random and cover only certain aspects of the problem. There is no comprehensive approach to the development of bioenergetics, today.

Existing ecological standards and the present level of energy technologies do not encourage local administrations to reconstruct existing heat stations, or to build new ones, which would operate on biofuel. The development of bioenergetics is also complicated by a "hang-the-expense" approach to energy supply financing in the regions. Low prices for electrical and thermal energy, as well as constant budget subsidies of the energy sector in the sphere of residential and public facilities are another reason for the lack of interest of local administrations and other consumers in introducing energy-saving technologies.

Bioenergetics projects that receive support from local administrations in Northwest Russia are generally realized within the framework of international programs, and a part of the financing is provided by foreign participants (See Box A4. Reconstruction of Heat-Supply Systems in the Republic of Karelia). International programs supporting bioenergetics in Northwest Russia, are carried out in the Republic of Karelia, the Arkhangelsk, and Leningrad regions. However, the problem of introducing biofuels into the energy balance will not be solved even within the framework of international programs while the "hang-the-expense" approach still prevails.

Box A4. Reconstruction of Heat-Supply Systems in the Republic of Karelia

A program aimed at renewal of heat-supply systems was begun in 2001 in the Republic of Karelia within the framework of the Tacis project "The strategy of sustainable heat supply in near-the-border regions of the Republic of Karelia." The construction of two large-scale boiler-houses, which would use biomass (wood wastes) as a fuel, began in the village Kalevala and in the town of Lahdenpohja.

In Kalevala six currently operating boiler-houses will be substituted for a new one with a planned capacity of 9 MW, and in Lahdenpohja two boiler-houses will be replaced with a new generating facility.

The cost of the Kalevala project is €2,120 thousand; the Lahdenpohja project €1,380 thousand. The administration of the Republic of Karelia, the European Union and regional administrations are participating in financing the project. Thirty per cent of the project cost is paid from the budget of the republic, 20% has been granted by the European Union, and 50% is a credit given by the international corporation NEFCO to local administrations. According to preliminary estimates, the project will be completely paid back within 9-10 years.

The project of constructing the two boiler-houses operating on biofuel in Kalevala and Lahdenpohja is a pilot project, and there are presently plans underway for constructing new production facilities in the towns of Sortavala, Pitkäranta and Suojärvi. A new thermal power-station in Sortavala, which would use peat as a fuel, will generate both thermal and electrical energy.

According to the Tacis project, 10-12 thermal power-stations operating on biofuel will be built in the Republic of Karelia within the next five years, and by 2015 their number should reach 50.

The Federal target program ""The Energy-Saving Economy' 2002-2005 and looking towards 2010" was approved in 2001. This program defines the main aspects of government support for small-scale power-generation facilities. The program pays special attention to the problem of an effective energy supply based on the use of local fuels and the development of alternative energy sources.

The program mandates such measures as the production of 2.2 million metric tons (of fuel equivalent) of local fuels for local power stations, heating boiler-houses and the population until 2005. According to the program, the production of biofuel should be comprised of such biofuels as wood and peat.

Table A5. Projected Production of Biofuel in Russia

	Unit of measurement	*2000 actual*	*2005 planned*	*2010 planned*
Firewood	thousand m^3 million. t.f.e.	477 0.12	753 0.19	959 0.24
Peat	million metric tons million. t.f.e.	2 1.05	4.86 2.54	7.02 3.65
Total	million. t.f.e.	1.17	2.73	3.89

Source: Federal Target Program "Energy Saving Economy"

In addition, the program presupposes the installation of electrical and thermal energy facilities utilizing non-traditional renewable energy resources up to 100 MW and 15 Gcal/h by 2005 and 800 MW and 1,000 Gcal/h by 2010, respectively.

In order to solve the problem of the effective use of energy on the territories using local fuel resources, the program requires considerable investments. The sources of financing are not clearly defined, however. The federal and regional budgets provide not more than 10% of the required sum; it is planned that private investments will cover the rest of the amount.

Although procedures to raise such funds are not properly identified previous experience shows that the effectiveness of such programs is minimal. The lack of clearly defined sources of financing and purposes, as well as specific control mechanisms, prevent the program from becoming an efficient instrument of government support for small-scale power-generation facilities. For this reason, the influence of the government in this sphere in the near future will be very small and will be limited only to regional support of individual projects initiated by private investors.

This program will be most influential in the sphere of the scientific and technological development of bioenergetics. Presently, the weak scientific and technical basis (including the low level of certification and standardization of equipment, etc.) is one of the main hindrances in the development of bioenergetics. This is why the program devotes much attention to financing R&D activities, most of which are financed by the federal budget.

Development Prospects

The most promising sector of bioenergetics in Northwest Russia is the enterprises of the forest industry. There are 50 large forestry companies in the region that produce dozens of tons of wood wastes. These companies are inclined to transfer to biofuel because they possess large reserves of their own bio resources, and are interested in achieving a stable and cheap energy supply.

The pace of growth in prices for traditional energy resources in the region and the access of the forestry companies to these resources are the determining factors in the decision of the companies to transfer to operating on their own fuel. The companies that are located close to existing or planned facilities of the gas-transport infrastructure are, therefore, not likely to consider transferring to their own fuel as a priority. The price competitiveness and easy access to gas will encourage these companies to use gas rather than other kinds of fuel.

However, a number of companies are located in remote regions, which have no centralized power and heat supply. Presently, such enterprises are provided with fuel imported from other regions, usually fuel oil and coal. This results in a significant increase in cost of power and thermal energy production. As we see it, development of the energy sector in Northwest Russia do not envision gasification of these regions in the near future, which is why biotechnologies have considerable potential for development in such regions. The regions that have the greatest potential for development of bioenergetics are (figure 1): the southern areas of the Republic of Komi, the northern areas of the Vologda region, the Arkhangelsk region, and the western areas of the Republic of Karelia. Presently, large enterprises are concentrated on these territories, and the markets of biofuel and bio-boiler-houses will develop on the basis of these enterprises. The expected growth in prices for energy resources, and primarily for gas (according to our estimations, approximately by 50% a year) is likely to result in attempts of the forestry companies to find more effective means of energy and heat supply. The growing interest of these companies in alternative energy sources will further encourage the development of bioenergetics in Northwest Russia.

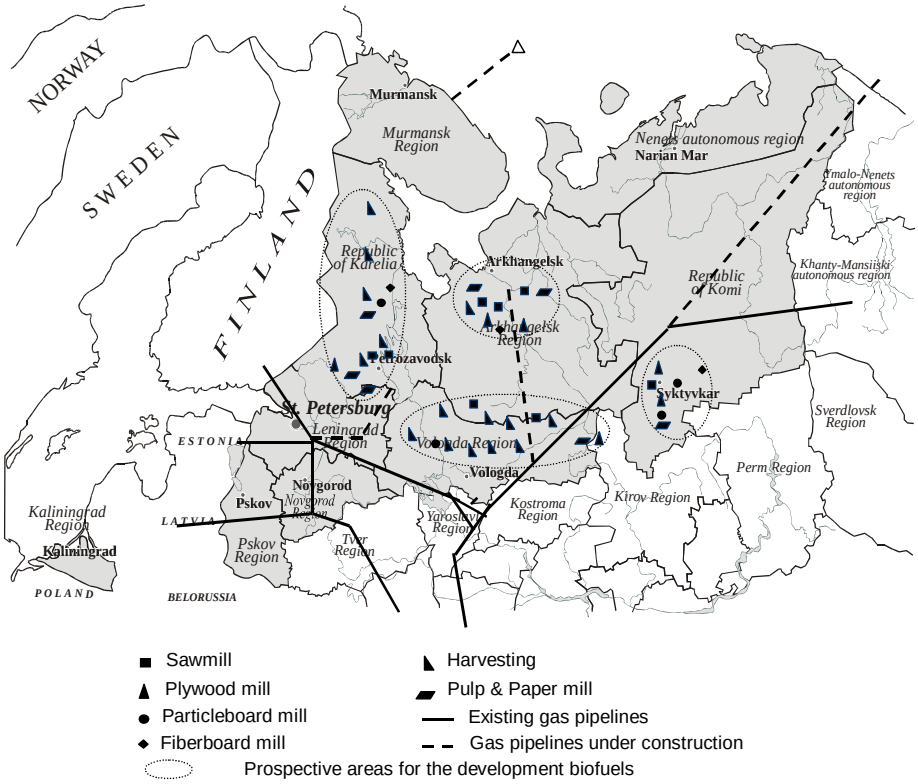
The most rapid growth of production facilities utilizing wood wastes as a fuel is expected in the Republic of Karelia. The following factors precondition active development of bioenergetics in the Republic of Karelia:

- Availability of large forest companies that are ready to invest into modernization of their energy systems;
- Motivation of the local administration to support the development of small power-generation facilities;
- Implementation of a number of international programs on the territory of the region.

In addition to the forestry companies in the abovementioned regions, certain enterprises in other regions will also be interested in using alternative energy sources. For example, the LEMO group already began implementing a project for the construction of a number of bio-boiler-houses in the Leningrad region (see Case box Modernization of a Bio-Boiler-House in Krasnoozero Village in the Leningrad Region) in 2001.

The forest companies have not only economic, but also technological reasons, for using biofuels. The systems of power and heat supply in the enterprises were built 30-40 years ago and have not been modernized, and are thus quite worn-out and inefficient. Already today, companies face the need to renew production and infrastructure facili-

Figure A10 . The Regions in Northwest Russia with the Largest Potential for Development of Bioenergetics



ties. The simultaneous modernization of energy systems in these enterprises and the transfer of their boiler-houses from coal and fuel oil to wood wastes would be expedient.

The peat industry will develop in Northwest Russia much more slowly. Despite its huge resource potential, peat will not achieve active market circulation in the near future. Presently, peat is used as a fuel for heat generation only in the area of residential and public facilities, primarily in regions far from a centralized infrastructure.

In conditions of increasing scarcity of energy in regional energy systems, local administrations are interested in developing the peat industry in regions that are not provided with a centralized power and heat supply, and are rich in local peat resources. It is relevant in the first place to the Republic of Karelia, and the Leningrad and Arkhangelsk regions. Regional programs that financially support the peat industry have been approved in order to promote the recovery and future development of these regions. During recent years, however, the industry has not received any money from the regional budgets.

Box A5. Modernization of a Bio-Boiler-House in Krasnoozerskoe Village in the Leningrad Region

In 2001, the LEMO Group, one of the largest forest harvesting companies in the Northwest, began the construction of bio-boiler-houses of various capacities in the Leningrad region. The construction of boiler-houses is planned for regions, where the production activities of the companies result in dozens of tons of wastes annually, which can then be recycled.

In 2001, the LEMO Group modernized a boiler-house in Krasnoozerskoe village, which originally operated on coal, and later on firewood. Presently, wood chips are being used as a fuel. The major consumers of the thermal energy produced by the new boiler-house are the residential and social sectors of the village.

The total capacity of the bio-boiler-house is 3 MW. During the reconstruction, two new automated boilers were installed, each one with a capacity of 1 MW. A firewood boiler, also with a capacity of 1 MW, was maintained as a reserve. All equipment and automatic machinery was produced in Russia or Byelorussia. The boilers were made at the Belkotlomash plant. The project cost was about $110,000.

In the near future, the company plans to build a new bio-boiler-house with a capacity of 4 MW in Shpankovo village (Gatchina area in the Leningrad region).

The lack of a modern production base for peat extraction in the region also negatively affects the development of the peat industry. In 2000 alone, three large regional peat production companies (Vologodskoe, Novgorodskoe, and Pskovskoe) were closed in Northwest Russia. Peat extraction equipment has not been modernized for more than ten years. This is why an increase of the share of peat in the fuel balance of Northwest Russia will require considerable investments, not only into production facilities, but also into peat extraction and processing.

If extraction volumes of peat increase, there may be a shortage of processing facilities. It will be necessary to develop local peat enterprises with smaller capacity. However, in the medium-term, the implementation of such plans is questionable, since neither companies nor regional authorities have adequate investment resources.

The main impetus for the development of the peat industry in Northwest Russia is expected in the longer term (after 2010), when the development of technologies will help decrease significantly the costs of bio-boiler-houses and production of energy peat, on the one hand, and energy markets will adequately adapt to prices for it, on the other. In this event, the share of peat industry in the total fuel and energy balance of the region might reach 1-1.5%.

A6. Energy Technology Development

The main areas of technological development in Northwest Russia are determined by both strategic priorities of energy producers, and the efforts of consumers to ensure reliable and inexpensive power supply. The following priorities for development in the energy sector of the region may thus be singled out:

- Refurbishing and reconstruction of power plants utilizing combined cycle units for gas-fired power plants;
- Introducing clean coal technologies for coal-fired power plants;
- Introducing new, more efficient biotechnologies and increase in introduction of renewable energy sources in the regional fuel mix;
- Improving the heat supply;
- Creating a gas-coal fuel strategy that promises to achieve a reliable fuel balance for thermal plants in the region;
- Maintaining the share of nuclear power in the power balance in the region;
- Developing small-scale and dispersed energy production

Demand has shifted to new generation technologies that are important in achieving environmental benefits at competitive. These are:

- advanced gas turbine/steam turbine combined cycles;
- clean coal systems;
- biotechnologies

Electric Energy Technologies

Development of Gas-fired Technologies: These technologies have advantages in terms of lower emissions, more flexible and less labor-intensive power plant operation, and operation at lower costs. The electric power that is obtained in this way can be provided more cheaply. It is expected that development of this technologies will be hindered by the increasing price for gas and lower availability of supplies in the future.

The following priority projects in gas-fired power generation are currently under development in Russia:

- the development of a range of gas-fired power generating units from 3 to 250 MWe, as well as standardized power plant designs utilizing

those units. These technologies are aimed to meet the needs for small-scale and dispersed power generation

- the development of a series of gas-fired power generating units utilizing jet turbine-engine technology. Here utilization of existing expertise in jet engine technologies is the basis for technology development
- increasing the effectiveness of combined gas-fired power generation by raising the limit of temperatures of the combustion cycle to 1,500-1,600°C.

A wide range of competing gas-fired power generation technologies are being developed in Russia today. These include the utilization of ship turbines and diesel engines, jet engines, and conventional gas turbine units for the purposes of power generation. Unstable market conditions, the lack of sufficient demand influence the survival of these technologies, which are in any case not yet fully developed.

Creation of Clean Coal Systems: Coal-fired power generation is anticipated to continue in the region, due to the difficult situation in the gas industry in Northwest Russia and the relatively low cost of electric power produced by these plants. It is unlikely, however, that many new conventional coal-fired plants will be built in the future. There are also plans to combust lignite, dirty coals, waste tip coals, other wastes, and even some biomass in the new clean coal systems, such as atmospheric and pressurized fluidized bed power and/or steam generation plant.

Despite the urgent need to reduce environmental pollution and increase efficiency of power generation, lower electric power production costs at coal-fired power plants will keep them in operation for several years to come. Further improvement of the economic situation in Russia will bring about the wider introduction of new technologies such as gas-fired combined-cycle plants, biofuels based generation, etc.

Coal-integrated gasification/combined-cycle power generating technology will have few chances on the market in the decades immediately ahead if investment decisions by the utilities companies are made strictly on the basis of cost considerations. This will subsequently strongly impact technological development and overall state of the manufacturing companies. It is hard to expect that in the situation when demand will not catch-up, the government will bear the full costs of investing in their survival. In other words increase in demand for energy technologies will most probably substantially outstrip the creation of clean coal systems, and domestic manufactures will lose a substantial share of its market in favour of successful joint ventures, new entries, or international competi-

tors. The prospects for development of bioenergetics are addressed in the Appendix "The Future of Biofuels".

Development of Renewable and Other Energy Technologies: The interests of consumers in reliable and low cost energy and heat power supply will facilitate the development of decentralized power production utilizing local renewable types of fuel. This will significantly increase the need for new alternative energy technologies.

The development of a framework for these energy technologies in Northwest Russia includes:

- The transfer of small power and heat generation plants from liquid oil and hard oil fuels to gas fuels, such as natural gas, gas from the gasification of biomass, and others, as well as to fossil fuels.
- The development of prototypes for full-scale equipment production utilizing renewable and other energy technologies for industrial and municipal use, such as:
    - wind power energy-based low-, medium- and high-capacity power generation units,
    - hydropower generation units for small hydropower plants that will be used for reconstructing dismantled and temporarily closed-down small hydropower plants with high-, medium- and small-head power generation units,
    - hydropower generation units (2 to 30 meters head) that does not require a dam construction, floating and submersible units for smaller water flows (>1.5 m/sec),
    - biomass gasification and power generation units using farm and agricultural waste, as well as municipal sewage waters,
    - gasification units utilizing the lumber and wood-processing industries wastes and fossil fuels, as well as wastes from the cellulose and paper industry.
- The development of modern automated control systems, providing automatic operation of power generation.
- The development of energy accumulation systems for self-contained power generation units, as well as for the excess supply in the regional energy systems.
- The creation of power generation units utilizing a range of renewable energy sources, as well as units that combine traditional and renewable sources, such as wind-diesel power generation units.
- Further advances in the elaboration of safety systems for self-contained power generation units and supply systems.

Improvements in District Heating Systems: Municipal heat distribution networks are also in need of immediate improvements that rely on technological development. Most of them are in very poor condition. More than 40% of the heat is lost during transport. These tremendous losses that occur in the supply networks not only put a heavy financial burden on municipal authorities, but also limit the possibilities for urban development and further residential construction.

The existing equipment in boiler houses, operated by solid fuels, must be replaced with fluidized bed and circulating fluidized bed furnaces, as well as with water-coal suspension furnaces to increase efficient. A range of emission gas-cleaning equipment should be designed and offered for the companies. The decentralization of the thermal power supply should be supported by developing small heat-generating units increasing small-scale and dispersed heat-energy production. Demand for above listed technologies is potential. It will materialize only in the case when the necessary economic motivation, i.e. the new tariff policy and regulations will be introduced by the responsible government bodies.

An unreliable system of supply and pricing problems in the municipal and energy utilities enterprises have created a vast potential market for low-capacity boiler houses, both automatic and those involving minimal manual operation. This demand is motivated by private and industrial consumption, which emerged after the beginning of privatization of industrial enterprises and housing in 1992. Thus, the best local and international technologies are expected to win this market in the medium-term perspective. In the short term, the financial abilities of potential consumers will limit the penetration of these technologies.

Factors Shaping the Future of Energy Technology Markets in Northwest Russia

Demand for Energy: The demand for energy is the driving force for energy equipment manufacturing and technological development. According to prognoses, the average rates of growth in energy consumption in the region will reach 1.9 to 2.3 per cent before 2010.

Over the years, the stabilization in production will be followed by an increase in energy consumption, reflected in the demand for energy and, correspondingly will translate into demand for technologies and equipment. Unfortunately, this connection is not be entirely straightforward. As a result of difference in pricing of technologies and equipments (growing faster then tariffs), and corresponding adjustments of energy tariffs.

The tariff regulation policy has cut down the investment resources of the energy utilities, which can now only afford to attend to their needs for urgent maintenance. The rehabilitation and maintenance of installed generating equipment will sustain day-to-day operations of the equipment manufacturers, but it will also channel their scarce resources away from the development of new technologies and maintaining feasible load at loading equipment manufactures.

At the same time, the foreign competitors of Russian energy equipment manufacturers will invest in more efficient and environmentally friendly technologies. As they have the global market at their disposal, the gap between these companies and their approaches will continually grow, and at some point will be impossible to overcome for many producers. These processes will lay the ground for major redistributions of market shares in Russia in the long-term perspective, leaving only a few of the most successful local manufacturers on the market. On the other hand an overall international trend of moving manufacturing to other, lower cost locations could provide a chance for many of the local manufacturers. These could be building alliances and partnerships or being taken over by the heading global manufacturers that will shift their production. But this opportunity is unlikely to realize unless the Russian investment and business climate substantially improves.

Changes in the Fuel Mix: It is widely accepted that the present geographical location of Russian power plants and the technologies utilized in them do not meet modern requirements for productivity, cost efficiency and reduction of environmental pollution. As a result, the anticipated changes in the fuel-energy balance, both in the region and in Russia as a whole, will have a great influence on the long-term development of energy technologies. In other words, more small-scale, dispersed production, introduction of biofuels, etc. will change locations and shape the future structure of the power generation in Northwest Russia.

Replacement of Worn-out and Outdated Equipment: According to statistics, during the past decade, the total installed capacity of electric power generation in Northwest Russia has increased. However, the total capacity in practice has steadily decreased, due to the rapid decay of the original equipment. In the near future, a crisis in the supply of electric power will take place if this trend does not reverse. This crisis has been delayed thus far by a long-lasting drop in demand, but any stabilization and even minor growth on the demand side will inevitably lead to shortages.

In addition, the volume of equipment that has almost outlived its service life greatly exceeds the rate at which new equipment is being introduced. The volume of operating production facilities that require renova-

tion in Northwest Russia is calculated at 200—600 MW annually. In order to eliminate, or at least to postpone, the shortage in electric energy, an intensive energy-saving program must be implemented, together with investments for the rehabilitation of installed capacities, as well as for the completion of ongoing and new construction projects. This represents a major challenge for companies developing energy technology and equipment manufacturers in a sense that first they must be able to cope with low demand and offer competitive new solution to the customers, then, presumably, to be flexible enough to accommodate anticipated growth for certain products.

Competition and International Cooperation: In the medium-term perspective, the competitiveness of Russian power equipment will be determined by the following factors:

- ✓ High entry barriers that exist on the domestic market, which are a result of the federal policy of protectionism. These barriers reduce international competitiveness of the Russian manufactures by allowing them to charge more owing to import duties on the western products.
- ✓ Long-established partnership relations between manufacturers and the largest consumers of power equipment. This allows companies to tailor-make their solutions and build long-term cooperation with consumers.
- ✓ Low production costs. It will be rather difficult to sustain this advantage due to anticipated shortages in skilled labor supply. The companies will be motivated to invest in upgrading efficiency of process technologies and management to sustain this advantage.
- ✓ Low after-sale service and repair costs (in comparison with imported technologies).

International companies try to use new opportunities on the market in order to increase their influence in the energy sector of Northwest Russia. In order to do this, foreign companies take part in international programs implemented in the region. This increases their influence in the modernization of the facilities of the power industry implementing energy-saving and ecologically safe technologies. The dynamism of the western companies will fuel the competition on the market and force domestic manufacturers of energy equipment to increase substantially their investments in developing new technologies and modernizing their facilities, or will lead to their demise or absorption by western companies.

Another means by which western companies expand their presence on the market of Northwest Russia is to participate in joint projects with local power engineering companies. The establishment of joint ventures has traditionally been one of the major aspects of international cooperation in the power engineering industry. Using the inexpensive, highly qualified workforce of Russian companies, as well as new technologies and the management expertise of western partners, joint ventures have occupied the leading positions in the sector. Presently, there are two large joint ventures in St. Petersburg – Interturbo (LMZ and Siemens KWU) and Ahlstom Power Nevsky (Ahlstom Power and Nevsky Zavod). The lack of unanimity in their operations on the market, as well as frequently recurring disagreements on financial and property questions between joint ventures and the Russian partners, cast doubt on the viability of this form of cooperation. It is most probable that take-over or completely new facilities, i.e. green or brown field projects will be the most probable if the international producers are to enter the Northwest Russian manufacturing.

Consolidation: The weakening of coordination between manufacturing, financial, investment and distribution policies of enterprises belonging to the same technological cycle has prevented power engineering companies in St. Petersburg from effectively attracting investments into fixed assets and current capital during the last decade (Case Box A6) as well as from offering competitive financial packages to domestic buyers.

The institutional changes (privatization and liberalization) that took place have improved organizational and financial conditions in the functioning of the power-plant industry of Northwest Russia. The process of consolidating assets has not yet been completed. A new wave of business deals involving power-engineering assets is expected after 2003. Interros has declared its intention to acquire power-engineering assets. It is also possible that new players will appear on the market in future. Primarily it could be international market leaders, which already have stock in Russian companies.

Development of R&D: During the Soviet period, a broadly based R&D complex was established in Northwest Russia. It included several large R&D institutes and design offices that were directly related to industries. In 1992–1996, most of the R&D organizations were privatized. In addition to the specialized R&D institutes, the power-plant engineering companies that have their own design offices are also active in research and development. These company research centers have traditionally been the primary developers of new technologies.

Box A6. Institutional Changes in the Power Engineering Complex of St. Petersburg in 1993-2001

The first attempt to establish a power engineering holding, the Energomash Corporation (EC), which was initiated by the largest enterprises in this sector (Electrosila, LMZ, ZTL) in 1993, was a failure. The EC, which did not own controlling interests in most of the enterprises, failed to form an effective holding structure and could not provide financing for a large number of export orders. In 1998, the EC filed for bankruptcy. In 1998, Interros joined in the process of redistributing property. In 2001, the consolidation of assets of the new power-engineering consortium Energomashexport – Silovye Mashiny (E-SM) was completed. In light of the mistakes of the EC, the new consortium was established only after Interros had acquired actual control over the enterprises. The completion of the process of switching to a single stock by the controlling company Energomashexport of Silovye Mashiny, Electrosila, and LMZ is planned for July 2003. The establishment of a unified company with a transparent ownership and clearly defined strategy has been successful in attracting medium-term and long-term credit resources. The financing of production of St. Petersburg power engineering enterprises is implemented by means of credits provided by several large financial institutions (Sberbank, Vneshtorgbank, Rosbank, Alfa-bank, and BALTONEXIM Bank).

The largest investors in industrial research and development are the government and the largest consumers of energy equipment: RAO UES of Russia and OAO Gazprom. For this reason, the significant reduction in budget financing and the low level of demand have led to the critical curtailment of research potential in scientific organizations.

The government influences the R&D sector by participating in numerous programs for research and development and some fundamental research. Generally, budget financing is carried out within the framework of federal industrial and regional target programs. These programs, together with the regulation of customs tariffs for imported energy equipment and technologies are the primary site of government participation in the development of technologies and the manufacture of energy equipment. Due to weak monitoring of expenditures and poor focusing (as a result of lack of knowledge and understanding of proper tools and methods as well as because of Soviet period heritage of general state-funding) on research on the part of the government, however, these programs do not achieve their goals and do not make effective use of government resources in the support of the R&D sector of the energy industry.

Human Capital: When privatization began, a large number of the most capable and skilled personnel left the sector. Beginning in the early

1990s, the number of employees engaged in production in the sector was reduced by more than two times, and in the area of research and development by three to four times. The influx of young specialists in the industry virtually came to a halt. The rapid aging of personnel involved both in production and research is an enormous problem. This leads to the disruption in the transfer of expertise from one generation to another and the loss of the legacy of scientific and production potential. The educational infrastructure that exists in the region in the form of specialized institutions of higher learning will only partially be able to redress this loss of human capital in the near future. At the same time, the main problem of power plant engineering companies is the lack of skilled workers. Coupled with this is the fact that system of technical training institutions has almost completely deteriorated, and in five to seven years the power plant engineering companies may find themselves in the catastrophic situation of having no new workforce at all.

Public Policy: The government of the Russian Federation is trying to support research and influence trends in technological development. Due to political lobbying and interest groups, this process lacks focus. It ends up providing funding in small amounts for numerous technological development projects, rather than concentrating on accomplishing a few projects of the highest priority. Market demand by the private companies for applied research has become the main force in shaping technological development in Russia.

The role of the government is limited to participation in the tariff policy, which can be viewed as an attempt to balance the investment requirements of the energy utilities with the diminishing purchasing power of consumers. This policy is not sustainable in the long run, as government intervention alone has proven unable to solve the problem of the pricing of electric power. By setting price limitations, the government takes on the burden of subsidizing the energy utilities to cover part of the price of energy, which consumers cannot afford to pay. The wiser approach would be to open electric power production markets to competition, thus facilitating the emergence of winners who will provide cheaper electric power.

Above we listed the major trends, of course, is not complete as the scale of changes is unique. More deeper investigation and studies will reveal more useful information and provide a necessary continuation of the discussion. We believe that information and views presented here will be useful for those involved in broad range of the energy sector related activities.

A7. Gazprom Restructuring

At present there are three alternatives Gazprom restructuring concepts worked out by the Ministry of Economic Development and Trade, Federal Energy Committee and Gazprom company.

Gazprom Offer

The first stage. To divide the gas market into the regulated and unregulated sectors before 2006. (In the regulated market the prices for gas and its transportation rates are fixed by the state.)

The second stage. The government will be regulating the prices for gas only in the wholesale market until 2011.

The third stage. After 2011 the state control over pricing in the whole market stops.

The issues concerning the division of Gazprom into separate gas companies and separation of the trunk transportation into the monopolistic structure belonging to state were not considered. Per se it is proposed to maintain the Gazprom control over gas pipelines.

Offer of the Ministry of Economic Development and Trade

The first stage. By 2005-2006 the independent gas producers (mainly oil companies) receive easy access to the gas-main pipelines and sell gas in the domestic market. The state continue to regulate the prices for gas which is supposed to increase up to 20 USD per 1,000 cubic meters by 2005. The state controlling the transportation rates as well as the easy access to gas pipelines.

The Gazprom affiliated companies will be transformed into the joint-stock companies but they will remain under the control of Gazprom. Gazprom itself will turn to the separate calculation of expenditures for gas production and transportation in order to fix the adequate prices for gas and its transportation rates.

The second stage. By 2010 independent companies should increase their share in the domestic market up to 25%. The Gazprom affiliated companies will be able to sell gas directly to final consumers while Gazprom will be controlling the export supply. The state will continue to regulate the gas prices that will rise up to 45 USD per 1000 cubic meters by the end of the stage. The sale of gas to the population at reduced prices will be stopped.

At the same time there will be changes in taxation. Firstly the gas excises will be transferred from the wholesale market to the production. Secondly, a special tax for the energy companies using gas is introduced in order to equalize profitability of companies using gas as fuel with the electric power stations working with fuel oil and coal.

At the second stage it is also planned to create a secondary market of purchase and sale of rights of access to gas pipelines. However all the gas producers should sell the gas of Mezhregiongas company (today it is the associated company of Gazprom) that in its turn resells raw materials to other suppliers.

The third stage. After 2010 the oligopoly market of gas wholesale will be formed. Companies producing gas may sell it not only to Mezhregiongas but also to the other large wholesale companies that must have been founded by that time. Moreover the independent companies also receive the opportunity to export gas under the control of Gazprom. The state in its turn stops regulating the prices for gas in the domestic market.

6-8 associated joint-stock companies will be founded on the basis of the existing associated companies of Gazprom. These companies will possess all the licenses for the fields while they will take a property on lease from Gazprom. The stocks of the established companies are exchanged for the stocks of Gazprom so that the controlling interests will be accumulated by new owners with Gazprom becoming more and more under the state control.

Offer of the Federal Energy Committee

The concept proposed by the Federal Energy Committee implies maintenance of the existing Gazprom structure. The wholesale market is the only one to be changed and it is supposed to be divided into regulated and unregulated sectors. The independent producers should get the opportunity to sell gas in the free market at the market prices while their share should rise up to 30%. Gazprom in its turn will be functioning both in the unregulated sector and in the regulated one. Gazprom controlling the whole gas-transport industry will also keep the dispatching functions.

The proposed project also points at the opportunity for establishing a gas-transport company leasing gas pipelines from Gazprom (or taking them on its balance) and representing its associated establishment.

As for the unregulated market it is suggested that there should be a non-profit organization founded – Trade System Administrator (by analogy with the concept of the energy market restructuring) accomplishing

the function of auctions arrangement. All gas suppliers represent the founders of this organization while the share of Gazprom as the largest supplier should constitute 50-75%.

The issue of pricing is emphasized in the concept. In the regulated market the state preserves its regulating functions and the wholesale prices are fixed by the Federal Energy Committee. In the unregulated market the trade is conducted at the market prices. Besides, it is expected to introduce the license fee the independent producers will have to pay to Gazprom. The license fee will be determined on the basis of gas transportation and infrastructure services costs as well as the required rate of return in order to accomplish the investment programs.

It is expected that by 2010-2012 the share of the competitive market will have become 70%.

Summary

By now none of the above gas industry restructuring concepts was confirmed by the government. Per se the restructuring of the gas monopoly is suspended and there is a number of reasons for that.

Firstly, there is a serious resistance to any plans of reforming from Gazprom. The company's top management has its own interest both in the Gazprom associated establishments and in the related businesses. The monopoly reforming may seriously hit at their interests.

Secondly, the government can't afford concurrent restructuring both gas and energy sectors owing to the necessity of maintaining the acceptable level of Russian industrial companies competitiveness. Under the conditions of energy saving in embryo the factor of cheap energy and resources allows Russian companies to be competitive in price. Besides, a significant price increase will affect the population expenses and this is fraught with the growth of social payments from the federal and regional budgets. The state can't afford it at the moment.

Thirdly, with the extremely low cost of gas raw materials the privatization of gas companies will entail a significant underestimate and as a result the state may receive less for their sale.

If we analyze the today's processes in the Russian gas industry, we will notice that some of the statements of the proposed concepts are gradually brought about:

- The government follows the policy of gas cost increase in the domestic market. Gazprom being short of investments needs to in-

crease its sales profitability in the domestic market. Besides, the independent gas producers expect the same growth. At the same time it is most likely that the gas cost in the domestic market will not achieve the level of the European market in the near 8-10 years. The rapid growth of prices may be expected within the next few years. Thus, in the beginning of 2003 the growth may be about 20-30%. The same rates of growth will remain in 2004 (after the presidential elections) and in 2005. Starting from 2006 the prices growth will most likely impair constituting 10-15% a year. As a result 1,000 cubic meters of gas may cost 45-50 USD in Russia in 2010.

- Oil companies starting to invest in the gas projects enter the market. The main barrier for the oil market players to enter the gas sector always consisted in the Gazprom's reluctance to provide non-discriminatory access to gas pipelines. However recently the changes may be seen. It seems that the oil companies have agreed on their positions with the gas monopolist. Gazprom remains the major supplier to the domestic market and the only exporter. The oil companies in their turn will be selling gas to the domestic market.

Reference List

1. Asanuma, B. (1989), *Manufacturer-supplier Relationships in Japan and the Concept of the Relation-specific Skill*. Journal of the Japanese and International Economies, 3: 1-30.
2. Asheim, B.T. and Isaksen, A. (1997), *Location, Agglomeration, and Innovation: Towards Regional Innovation Systems in Norway?*. European Planning Studies, Vol. 5, No. 3, pp. 299-330.
3. Barney, J. (1992), *Integrating Organizational Behavior and Strategy Formulation Research: a Resource Based Analysis*. Advances in Strategic Management, Vol.8, Shristava P., Huff, A., Dutton, J. (eds.). JAI Press: Greenwich, CT; 39-62.
4. Barney, J., Griffin, R., (1992), *The Management of Organizations: Strategy, Structure, and Behavior*. Houghton Mifflin: Boston, MA.
5. *BP Statistical Review of World Energy*. (June 2002). BP.
6. Brown, A.N., Brown, J.D., *Does Market Structure Matter? New Evidence from Russia*. Center for Economic Policy Research, Discussion Paper, No.1946, August 1998.
7. Centre for Strategic Research, (2000), *Analyse of Word Experience in Electric Power Reforming*. Moscow.
8. Cockburn, I. M., Henderson, R.M., Stern, S. (2000), *Untangling the Origins of Competitive Advantage*. Strategic Management Journal, 21: 1123-1145.
9. Dahmen, E. (1950), *Entrepreneurial Activity and the Development of Swedish Industry 1919-1939*. American Economic Association Translation Series, Homewood, 1970.
10. Dahmen, E. (1988), *Development Blocks in Industrial Economics*. Scandinavian Economic History Review, 36, pp. 3-14.
11. Dahmen, E. (1991), *Development Blocks and Industrial Transformation: The Dahmenian to Economic Development*. B.Carlsson and R.G.H. Hendriksson (eds.), Almqvist & Wiksell, Stockholm.
12. *Development of Nuclear Power Industry of Russia: Government Strategy and Key Factors*, (2000), www.rusoil.ru/reviewtext/review/id/707273.html
13. Dyer, J.H. (1996), *Specialized Supplier Networks as a Source of Competitive Advantage: Evidence from the Auto Industry*. Strategic Management Journal, 17: 271-292.
14. Energy Information Administration, (2002), *International Energy Outlook*
15. Feser, E.J. (1998a), *Enterprises, External Economies, and Economic Development*. Journal of Planning Literature, Vol. 12, No. 3, pp. 283-302.
16. Feser, E.J. (1998b), *Old and New Theories of Industrial Clusters* in M.Steiner (ed.), Clusters and Regional Specialization, pp. 18-40, Pion Limited, London.

17. *Forecasts of Russian Coal Industry Development*, (2002), www.rusoil.ru/ reviewtext/ review/id/707273.html
18. *Gas and Electricity in the Baltic Sea Region*, (October 2001), Integrated Gas and Electricity Study. Baltic Gas, BALTREL.
19. Goskomstat, (1999), *Statistical Yearbook of Russia.* Moscow
20. Goskomstat, (2000), *Statistical Yearbook of Russia.* Moscow
21. Goskomstat, (2001), *Statistical Yearbook of Russia.* Moscow
22. Grigori Dudarev, (1999), *The Role of Technology In Shaping the Energy Future In Russia.* Discussion paper. Helsinki: ETLA
23. Grigori Dudarev, Michael Zverev, (1999), *Energy Sector in Russia: Economic and Business Outlook*. Discussion paper, Helsinki: ETLA
24. Harrison, B. (1992), *Industrial Districts: Old Wine in New Bottles?* Regional Studies, Vol. 26, No. 5, pp. 469-483.
25. Heidenreich, M. (1996), *Beyond Flexible Specialization: The Rearrangement of Regional Production Orders* in Emilia-Romagna and Baden-Wurttemberg. European Planning Studies, Vol. 4, No. 4, pp. 401-419.
26. Holmes,John (1992), *The Organization and Location Structure of Production Subcontracting* in M. Scott and A.J. Storper, eds., Pathways to Industrialization and Regional Development. London, Rout-ledge, pp. 80-106.
27. International Energy Agency, (1999), *World Energy Outlook 1999 Insights (Looking at Energy Subsidies: Getting the Prices Right*). Paris
28. International Energy Agency, (2001), *Needs for Renewables, Developing a new Generation of Sustainable Energy Technologies*. Paris
29. International Energy Agency, (2001), *Technology Without Borders (Case Studies of Successful Technology Transfer)*, Paris
30. International Energy Agency, (2002), *Russian Energy Policy (outlook 2002).* Paris
31. Isaksen, A. (1997), *Regional Clusters and Competitiveness: The Norwegian Case*. European Planning Studies, Vol. 5, No. 1, pp. 65-76.
32. Jacobs, D. and de Man, A.-P. (1996), *Clusters, Industrial Policy and Firm Strategy: A Menu Approach*. Technology Analysis and Strategic Management, Vol. 8, No.4, pp. 425-437.
33. Kaufman, A., Gittel, R., Merenda, M., Naumes, W. and Wood, C. (1994), *Porter's Model for Geographic Competitive Advantage: The Case for New Hampshire.* Economic Development Quarterly, Vol. 8, No. 1, pp.43-66.
34. Larisa Slabinskay, Alexander Dolgopolski, (2002), *Liberalization of Gas Market.* Analytical Journal Oil-and-Gas Vertical, No 3, pp 51 - 54. Moscow
35. Lundvall, B. (1992), *Innovation, the Organized Market and Productivity Slowdown.* Technology and Productivity, OECD, Paris.

36. Lundvall, B.A. (1990), *User-Producer Interactions and Technological Change*. Paper presented to OECD_TEP Conference, Paris (La Vilette), June.
37. Mastepanov A.M. (2001), *Energy Complex of Russia on the Edge of Centuries – Current State, Problems and Perspectives of Development*. Analytical Rewire. Moscow.
38. *Mineral Wealth of Russia*, Volume 1. Moscow – St. Petersburg (2001).
39. Ministry for Antimonopoly Policy and Entrepreneurship Support, (2000), *The Machine-Building Industry Analysis*. www.maprf.ru/ru/cp_on_commodity_market/analysis/226/
40. Ministry of Energy, (2001), *Basic Concepts of Russian Energy Strategy up to the 2020*. Moscow.
41. Ministry of Energy, R&D Institute of Management and Economy in Oil and Gas Industries, (2000), *Oil Industry of Russian Federation in 1998 – 1999*. Moscow.
42. Ministry of Natural Resources of the Russian Federation, (2001), *On the State of the Environment of the Russian Federation*. Government Study. Moscow.
43. Nelson, R., and Winter,S.(1982), *An Evolutionary Theory of Economic Change*. Cambridge, MA, Harvard University Press.
44. Nelson, R.R. (1993), *National Innovation Systems: A Comparative Study*. Oxford University Press, New York.
45. OECD, International Trade by Commodities Statistics ITCS (1999).
46. Official www-site of Arhkenergo, www.arhen.ru
47. Official www-site of Centre for Strategic Research, www.csr.ru
48. Official www-site of Electrosila, www.electrosila.ru
49. Official www-site of Gazprom, www.gazprom.ru
50. Official www-site of Goskomstat of the Republic of Komi, www.komistat.ru
51. Official www-site of Izhorskiye Zavody www.izhora.ru
52. Official www-site of Karelenergo, www.karelen.elektra.ru
53. Official www-site of Kolenergo, www.kolenergo.ru
54. Official www-site of Komienergo, www.rao-ees.ru/komienergo
55. Official www-site of Lenenergo, www.lenenergo.ru
56. Official www-site of Leningrad Nuclear Power Plant, www.laes.ru
57. Official www-site of Lntransgaz, www.lentransgas.ru
58. Official www-site of Lukoil, www.lukoil.ru
59. Official www-site of Ministry for Energy of Russia, www.gov.ru/main/ministry/isp-vlast47.html
60. Official www-site of Novgorodenergo, www.novgorod.net

61. Official www-site of Pechora Power Plant, www.rao-ees.ru/pechgres
62. Official www-site of Pskov Power Plant, www.pskovgres.elektra.ru
63. Official www-site of Pskovenergo, www.rao-ees.ru/pskovenergo
64. Official www-site of RAO UES of Russia, www.rao-ees.ru
65. Official www-site of Russian state concern for generation of electric and thermal power at nuclear power plants (ROSENERGOATOM), www.rosatom.ru
66. Official www-site of Severgazprom, www.severgasprom.ru
67. Official www-site of Surgutneftegas, www.surgutneftegas.ru
68. Official www-site of Transneft (oil pipelines), www.transneft.ru
69. Official www-site of Turbine Blades Plant, www.ztl.ru
70. Official www-site of Yantarenergo, www.yantene.ru
71. Ohmae, K. (1995), *The End of Nation State: The Rise of Regional Economies*. Free Press, New York.
72. *Oil of Timano-Pechora*, (November 2000). Regional Supplement to a Journal "Oil and Capital". Moscow.
73. Park, S.O. and Markusen, A. (1995), *Generalizing New Industrial Districts: A Theoretical Agenda and an Application from a Non-Western Economy*. Environment and Planning, Vol. 27, No. 1, pp. 81-104.
74. Penttinen, R. (1994), *Summary of the Critique on Porter's Diamond Model – Porter's Diamond Model Modified to Suit the Finnish Paper and Board Machine Industry*. ETLA Discussion Papers, No. 462.
75. *Problems in Russian Oil Industry and Ways for Their Decisions*, (2000), Institute of Finance Researches,
76. RAO Unified Energy System of Russia, (2001), *Recommendations for development of AO-energos Restructuring Projects*, Moscow: RAO UES of Russia.
77. RAO Unified Energy System of Russia, (2001), *The Model of Competitive Retail Electricity Market of Russia*. Moscow: RAO UES of Russia.
78. RAO Unified Energy System of Russia, (2001), *The Model of Competitive Wholesale Electricity Market of Russia*. Moscow: RAO UES of Russia.
79. *Reforming of RAO UES of Russia*, (2002), World Energy Policy, Journal, No 6, pp. 28-40.
80. Rothwell, R. (1992), *Issues in User-Producer Relations: Role of Government*. Paper for Six Countries Programme Workshop on User-Producer Relations in the Innovation Process, Espoo, Finland, November 26-27, 1992.
81. *Russian Gas Market*, (2002), www.rusoil.ru/reviewtext/review/id/704472.html
82. *Russian Gas Zigzags*, (2002), Analytical Journal Russian Focus, No23, pp. 18 - 23. Moscow.

83. Russo, M. (1986), *Technical Change and the Industrial District: the Role of Inter-firm Relations in the Growth and Transformation of Ceramic Tile Production in Italy*. Research Policy 14, pp.329-343.
84. Specialized www-site for coal industry, Analytical and information materials of the coal industry, www.rosugol.ru/rosugol/lev_i.html
85. *St. Petersburg Wants to Become Ventspils or Tallinn*, (2002), Analytical Journal Russian Focus, No24, pp. 18 - 22. Moscow.
86. Steiner, M. (1998), *Clusters and Regional Specialization*. Pion Ltd., London.
87. Storper, M. (1997), *The Regional World. Territorial Developments in a Global Economy*. The Guilford Press, New York and London.
88. Storper, M. and Salais, R. (1992), *The Division of Labor and Industrial Diversity: Flexibility and Mass Production in the French Automobile Industry*. International review of Applied Economics 6 (1), pp. 1-37.
89. Storper, M. and Scott, A. (1989), *The Geographical Foundations and Social Regulation of Flexible Production Complexes* in J. Wolsch and M. Dear, eds., The Power of Geography; How Territory Shapes Social Life. London, Unwin Hyman, pp. 21-40.
90. *The Energy Complex of the North-West Federal District and Kirov Region* , (2000). Syktyvkar: Goskomstat of the Republic of Komi
91. The Federal Commission for the Securities Market of Russia, Information Disclosure (*Companies Reports*), disclosure.fcsm.ru
92. The Federal Law of Energy-Saving of Russia (1996). Moscow.
93. The Federal Reference Book, (2001), *The Energy Complex of Russia in 1999-2000*, www.rusoil.ru/fsprav
94. *The Growth of Influence of Russia on the World Energy Market*, (2002), www.rusoil.ru/reviewtext/review/id/707692.html
95. Timo Myllyntaus, (2001), *Electrifying Finland. The transfer of a new technology into a late industrializing economy*, Helsinki: ETLA.
96. *Turbines Daye*, (September, 1996), Analytical Journal Expert, No 35. Moscow.
97. Von Hippel (1987), *Cooperation Between Rivals: Informal Know-how Trading*. Research Policy 16, pp. 291-302.