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OECD WORKSHOP ON INDUSTRIAL RESTRUCTURING IN THE RUSSIAN REGION OF KRASNOYARSK 12-13 OCTOBER 1995

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Paris 1996

41480

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FOREWORD

The Workshop on "Industrial Restructuring in the Krasnoyarsk Krai" was organised in Krasnoyarsk in October 1995 as part of the programme of work of the Centre for Co-operation with the Countries in Transition (CCET). The workshop was attended by representatives of the Russian federal and regional administrations, OECD Member governments, other international organisations, and Russian and OECD area economic and business experts. The discussions focused on three main topics in relation to regional development: enterprise restructuring, job creation through entrepreneurship, and infrastructure.

The Krasnoyarsk region is at present an important producer of natural resources (i.e. non-ferrous metals, minerals, energy and forest products). With its highly-educated workforce, it is an area of great economic potential. At the same time, the region faces difficulties because of its remote location -- transportation costs and infrastructure quality are key factors for the region's economic development -- and the severe environmental damage which is a legacy of the Soviet period.

This report contains the papers prepared for the workshop, as well as the meeting's conclusions and recommendations. An introductory paper analyses the overall economic situation facing Krasnoyarsk's civilian industrial enterprises, describing some of the common transition issues facing them (including adjustments to input price changes, their relative capital and labour efficiencies, changes in ownership, and labour market issues) and addresses region-based approaches to effective industrial restructuring. Individual papers discuss the specific issues affecting the most important sectors of Krasnoyarsk's regional economy, namely: aluminum, forestry, telecommunications, energy and transportation.

Recommendations made by workshop participants include the devolution of traditional government advisory and business-related roles to the private sector, with a view to improving the climate for small business and fostering mutual trust for public-private partnerships; and the development of local financial markets, including financing mechanisms for small businesses. Priority should also be given to training and infrastructure development, particularly through investment in the energy, transport and telecommunications sectors. The central government should define a national policy for infrastructure development, the improvement of tariffs and the development of the communications complex, differentiating between implementation at the federal, regional and enterprise levels.

The workshop papers were written by consultants to the OECD. The views expressed are those of the individual authors and do not necessarily reflect the views of the OECD, or its Member countries. The report is published on the responsibility of the Secretary-General of the OECD.

Salvatore Zecchini
OECD Deputy Secretary-General
Director of the CCET

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1 - INTRODUCTION AND SUMMARY OF DISCUSSIONS

As part of the Programme of Work of the Centre for Co-operation with the Countries in Transition (CCET), a workshop on "Industrial Restructuring in the Krasnoyarsk Region" took place in Krasnoyarsk on the 12th and13th of October 1995. The CCET's work focuses on establishing a policy dialogue on industrial restructuring at local, regional and federal levels as a means of identifying problems and developing practical policy responses. The Krasnoyarsk workshop brought together representatives from the Russian federal and regional administrations, OECD Member governments, and Russian and OECD area economic and business experts (see participant list). These participants discussed a series of analytical background papers (see parts 2 to 6) prepared as a basis for deepening the understanding of the policy issues surrounding Krasnoyarsk's industrial restructuring efforts and the role that infrastructure improvements will play in furthering regional economic reform. The discussions were divided into three working groups (Enterprise Restructuring, Job Creation Through Entrepreneurship, and Infrastructure Development) and aimed at drawing conclusions that would be useful for regional officials in developing their economic reform policies.

The following summarises the discussions at the three working groups.

Working Group 1: Enterprise Restructuring

Presentations were made giving an overview of the current economic state of the Krasnoyarsk region's enterprises and of a case study involving intensive work on restructuring with one major enterprise.

Industry is the region's most important contributor to employment and GNP, with several very large enterprises accounting for the major share of civilian industrial employment and output. The ownership structure of the region's enterprises has changed greatly, with the forest products and food processing industries possessing a relatively large number of joint-stock companies. The state remains important in the mining, metal and machine building industries. Foreign investment remains minimal. Within the region, metropolitan Krasnoyarsk and the northern area (principally the Norilsk non-ferrous metals production) are the principal industrial centres.

Three major regional development issues facing Krasnoyarsk were stated to be:

- Choosing a regional strategy based on export development or import substitution. Should Krasnoyarsk rely on international competition to trigger growth, or should it attempt to create new industrial branches to substitute for imported materials?

- Determining the role of foreign capital. What role should foreign investment play? How large could this role be? What are the main impediments to foreign investment in the Krasnoyarsk territory?

- Determining the chances of bottom-up development. What amount of growth could come from new industrial enterprises, or should the region's leading enterprises be used as the incubators for future growth?

A Japanese team of specialists worked intensively with management from a major aluminium producer. The team concluded that the enterprise had a high level of technical expertise and product quality. At the same time, it noted several negative tendencies. The enterprise appeared to be losing its trained production workforce and the administrative overhead was growing. Moreover, vital enterprise information was not available to mid-level managers for their decision making. The lack of standard accounting procedures also reduced the quality of the information. In addition, the team suggested a reduction of the non-production departments, including headquarters staff, and increasing the flow of resources to the sales and marketing departments.

The following recommendations emerged:

1. There should be a strengthening of the role of voluntary, private sector associations (e.g. Chambers of Commerce and producer associations) as providers of information and advice, and a transfer to them of many of the functions now being carried out by government.

2. The development of local financial markets, especially securities markets, should be a priority, especially the seeking of technical assistance from the foreign donor community.

3. Enterprises should adopt international accounting standards and legal protocol. They need to develop transparent corporate governance structures.

4. Enterprises should work with regional and local administrators on the restructuring of their social assets. The devolution of these social assets should be an enterprise objective.

5. Regional service industries need further development, in part through government divestiture of its business-related service activities.

6. Government should not seek to "pick winners" among regional industries. It should facilitate the growth of the regional economy in the context of the regional, national, and international division of labour.

Working Group 2: Job Creation Through Entrepreneurship

The first day's discussions assessed the obstacles to small firm development and considered how the Regional Administration might help overcome them. The second day's discussions examined specific training programmes for small and medium-sized enterprises (SMEs). The discussions drew on an earlier OECD conference, "The development of SMEs in the Krasnoyarsk Region", which took place in Krasnoyarsk in 1994. The working group consisted of participants from various levels of Russian regional and local governmental administrations, businesses, chambers of commerce, educational institutions, and the OECD Secretariat. In addition, several experts connected with other international organisations and OECD area foundations also actively participated.

Most participants stressed the importance of improving the business environment for SMEs. It was pointed out that despite the establishment of a general legal framework by the federal law "On Support of Entrepreneurship in the Russian Federation (June 1995)", the legislative framework for small businesses remained incomplete. Regional laws, which need to conform to the federal Civil Code, were currently in preparation to deal with issues such as: registration, state orders, international trade, training

and financial support. One representative from a Russian small business also emphasised the need to increase an SME's opportunities for improved co-operation with large enterprises.

According to regional authorities about 24 000 small businesses, each of which employ from 8 to 15 people, operate in the region. They estimate that small businesses employ around 240 000 people, or about one-sixth of the region's total employment. Official statistics show only 5000 SMEs, while tax authorities record 13 000.

All agreed that successful SME development required a network of intermediaries, including information dissemination, consulting, training and financial services. The local chamber of commerce represented one of the elements of this infrastructure, although it tended to target larger enterprises, not SMEs. Moreover, some participants emphasised the use of independent or non-governmental organisations in providing SMEs with financial help.

During the discussions on special training projects for SMEs, most attention was focused on the Adenauer Project's "Siberia Europe" programme and the Morozov Project, which is run by the Aero-Space Academy and supported by the European Bank for Reconstruction and Development. The Russian-American Centre at Krasnoyarsk State University and the Russian-British Training Centre at the Timber Industry Institute were also mentioned.

As large enterprises cut staff or lose staff by not being able to pay them, Russia's human capital is becoming increasingly underemployed. This trend is especially severe in small company towns and among women, professionals, technicians and young people. All participants agreed that the dynamic development of small business would be one key to creating new jobs and reversing the trend to underemployment. At the same time, the working group compiled the following list of obstacles impeding the development of small business entrepreneurship:

- the tax system is unclear and unfavourable to entrepreneurship;
- the federal and regional laws and regulations governing economic activity are unstable and there is a lack of legal information;
- the macroeconomic situation and political environment are unpredictable;
- crime and insecurity are growing;
- market information is lacking;
- public attitudes toward entrepreneurs are often intolerant and unfavourable; and
- people lack knowledge and practical skills to start their own small businesses.

The working group also aired several areas of disagreement, especially on the role of regional administrations. If a regional administration views SMEs largely as an instrument for overcoming some bottlenecks or shortages, it leads to the selective support for some SMEs and the creation of artificial barriers to others. As a result, such an outlook can stimulate corruption and impede SME development. Some participants believed that regional administrations tended to be heavy-handed in treating SMEs instead of treating them as equal partners. Such an atmosphere encouraged SMEs to remain in the shadow economy.

Group 2 made the following policy recommendations:

1. The group recognised that progress was made in that a specific law on promoting regional SMEs was drafted and various investment programs implemented. However, the general climate for small business needs improvement. To this end, local and regional administrations should give an overall political message that small business is a policy goal and that they will be assisted in a climate of co-operation.

2. The legal and regulatory framework for regional SMEs should be made transparent and improved within the specific competencies of the local and regional authorities. Such actions would include a law on SME finance and establishing non-prohibitory taxation measures.

3. The region should develop all forms of infrastructure directly affecting SME development. One especially important dimension concerns the free flow of information, main economic indicators, and data on all local/regional SME programs: funds, loan guarantees, fiscal incentives.

4. Intermediary institutions for SME support need to be developed. For example, the existing network of Chambers of Commerce could be enhanced and new institutions that specifically target SMEs' needs could be created. Particularly useful would be an independent expert body for evaluating business plans and allocating budget-funded resources.

5. A credit policy should be developed for start-ups, including help with business advisory services, technical assistance and tutoring.

6. Mechanisms and conditions for building public-private partnerships are needed. Above all, an atmosphere of mutual trust between public and private actors needs to be fostered.

7. Statistics on small businesses in Russia need improvement. Such an effort would include the design of an effective statistical monitoring system for output, employment and wages and the systematic, broad dissemination of statistics.

In the area of training for small business, the Working Group generally concluded that there was a need to:

1. Highlight the importance of education and training in creating a favourable environment for a market economy. There is a need to create a general understanding of entrepreneurship and an entrepreneurial culture.

2. Promote and develop a variety of training approaches for SME development. An evaluation of all existing national and international programs in the region was considered to be an important first step.

3. Promote co-ordination between various training providers and sponsors.

4. Create an independent, joint expert body for evaluation of the training programs in the region.

5. Emphasise those programs targeting the training of trainers and disseminating entrepreneurial "know-how" on the local level throughout the region.

6. Create a small business development forum that would meet semi-annually and involve all public and private actors that promote SMEs.

7. Enhance co-operation with international programs capable of providing technical "know-how" and assistance in the transition process.

Working Group 3: Infrastructure Development

Thirty-two specialists took part in Working Group 3. Among the participants were representatives from the OECD, the Krasnoyarsk regional administration, the Elektrosvyaz Joint-Stock Company, the Krasnoyarsk Railroad, the Yenisey River Company, Passazhiravtotrans Joint-Stock Company, Krasnoyarskavtotrans Joint-Stock Company, State Technical University, private companies, other Russian regional administrations and the Institute of Communications from Moscow.

Working Group 3 recognised infrastructure improvement as a key to creating a competitive environment in the Krasnoyarsk Region, thereby ameliorating the lives of its population and the business environment. Improving conditions in the transport, telecommunications and energy sectors in line with the principles of a market economy will take the government out of the business of managing and operating these sectors and allow it to devote its resources to providing the strategic, policy, regulatory, standard setting, and enforcement framework.

The working group underscored the particular features of the Krasnoyarsk Region's economy, namely the vast, sparsely populated territory dependent on a rich endowment of natural resources and heavy industry. Krasnoyarsk Region ranks third or fourth among Russian regions in federal investment allocations, although these are steadily declining, and second only in foreign direct investment.

The most serious issues confronting the group in the area of infrastructure development were:

- How to provide adequate services at reasonable, competitive costs to the general population and the business community.
- How regional authorities can influence policies still largely developed at the centre and what should be the roles of each level of government.
- The degree to which cross-subsidisation distorts economic development.
- Appropriate levels and usage of tariffication.
- How to ensure adequate levels of infrastructure financing.
- How to define ownership in the infrastructure sectors.
- How to increase efficiency through competition and ownership rights.

Main conclusions

In the course of their work, the Group participants recognised that the current state of the regional infrastructure leaves much to be desired and that, according to many development indicators, the region lags behind the country's leaders.

At the same time, the Krasnoyarsk region, despite its remoteness, possesses substantial economic and scientific potential. Its geographic location is advantageous for developing competitive transportation, communications and energy, all of which would be beneficial for the region's commercial potential.

Options for changing the policy on infrastructure rates were suggested as a way to ensure the competitiveness of industrial exports and to obtain investment funds (especially important for developing the service sector). Suggestions on the development of regional investment funds were discussed. The participants learned about the World Bank's main conclusions on infrastructure development problems.

The Working Group's participants concluded that it was expedient to: foster a competitive environment by dividing the services market into sectors; accelerate development of private businesses; transfer an increasing number of functions from the centre to the regions and to enterprises; and improve the management system.

Recommendations of Working Group 3

On dividing management functions and the policy for tariff setting, the Working Group suggested to:

1. Recommend a market strategy for infrastructure development to the central public administration bodies.

2. Recommend to the Russian Federation government that it define a national policy that would elaborate programmes for overall infrastructure development, for the improvement of tariffs, and for the development of the communications complex with a clear division of the levels of its implementation (federal level; regional level; and enterprise level).

3. Study the possibilities of unbundling infrastructure services so as to transfer ownership to the private sector and to attract private capital, thus reducing the burden on the budget and reducing the basket of rates. The conclusions and recommendations obtained through such a study could increase the efficiency of all sectors of infrastructure.

4. Use leverage in the communications environment when distributing all resources, both in the sphere of consumption of services and in the sphere of natural resources (broadcast band, etc.). The principle for distributing resources should be a "fragmentation", or division, of resources among individual investors that does not contradict natural monopoly. The criteria for investment preference should be development, economic efficiency, and expansion of the range of information services.

5. Regulate infrastructure tariffs by linking future increases to a balance between price and demand that is based on market research.

6. Move gradually from administrative regulatory principles with unified rates to market principles based on competition in cost, quantity, and quality of services offered by commercial organisations.

7. Reconsider the existing approach to cross-subsidies by developing mechanisms to minimise unprofitable areas in the different infrastructure branches.

8. Separate unrelated auxiliary services from main services, transferring those auxiliary services to the private sector.

9. Re-evaluate the existing transportation mix in favour of water transport, thereby relieving the heavy burden that railroad transportation costs impose on the competitiveness of many

regional products. This problem is closely related to the need to increase local processing output.

10. Increase the efficiency of general use carriers so that transportation services cost less than a client's own transportation fleet.

11. Expand the range of services to enable a horizontal intensification of co-operation among carriers through transportation scheduling information exchanges, etc..

12. Improve the use of double rates, with a view to maximal switching of single rate users to double rates. This shift would improve the energy sector's efficiency. Further differentiation of rates by time of day would level energy consumption peaks and decrease costs.

13. Separate the management of power generating and transmitting systems.

14. Accelerate the transfer of commodity services from a monopolised central management to development by market principles.

15. Renounce monopoly development in favour of a multi-component competitive system.

16. Have the regional executive authorities implement the restructuring of the region's infrastructure system.

In the area of investment the Working Group suggested that:

1. Investment activities should be competitive. The main principle for tenders should be the quality of investments, the quantity and quality of services rendered, and the accessibility of infrastructure networks.

2. When underwriting infrastructure investments, priority should be given to modernising the existing material base.

3. Banks, banking associations and associations of joint-stock companies should be used to capitalise the investment funds.

4. Infrastructure development should be implemented through project development and use working groups.

5. The creation of a favourable environment for innovative infrastructure businesses should be defined as a priority policy.

6. The introduction of local taxes on fuel, rental of land for development of parking lots, paid transportation on certain routes, and others be reconsidered; and that there be a switch from the pooled use of budgetary revenues to their specific use for transportation and communication services.

In the area of human resources the Working Group suggested that the Krasnoyarsk Technical University develop programmes for management training and project implementation for infrastructure restructuring.

In the area of co-operation between OECD and the Krasnoyarsk regional administration it was suggested to:

1. continue joint tariff policy studies for energy, communications, and railroad transportation;

2. recommend a follow-up conference in Krasnoyarsk in 1996.

3. study possibilities for internships in foreign research centres for the region's specialists.

2 - KRASNOYARSK: A REGION BASED APPROACH TO INDUSTRIAL RESTRUCTURING

by Peter Huber, Serguei Nagaev and Andreas Wörgötter

Resource endowment

Krasnoyarsk, one of the largest Russian administrative territories, is located in eastern Siberia. It is a geographically diverse region, with an ice zone and arctic deserts in the north, broad stretches of tundra and taiga, mountains cutting through the middle, and steppe and forest-steppe in the south. Major rivers also cut through the region, including the Yenisei, one of the world's largest.

The climate is distinctly continental and varies within the region. January temperatures average around -30°C in the north and middle and about -20°C in the south; while in July they range from 13°C to 20°C. The northern regions are covered with snow for 208 to 320 days a year and the southern regions for 100 to 130 days. Seas in the north are covered with ice for nine months; the main part of Yenisei and its tributaries for 5-6 months.

While north of the polar circle the soil is permafrost and immature tundra, soil covers vast other areas of the region, the soil in the forest and forest-steppe is a highly productive black humus earth (chernozem). The region's vegetation is rich and varied. To the south, in the very centre of the region, the greatest part of the territory is covered by coniferous woods with cedar, pine-trees, larches, fir-trees and giant firs. Krasnoyarsk's state forest domain covers about 168 million hectares. Total regional plantation reserves are estimated at 14.4 billion cubic meters. Mature and over-mature plantations make up about 11.3 billion cubic meters (78 per cent of total reserves). Coniferous wood accounts for 10.2 billion cubic meters (70.8 per cent). The main forest species are Siberian fir, cedar, aspen and birch. Wildlife abounds, including a number of important game and fur-bearing animals.

Krasnoyarsk is one of the Russian Federation's most richly endowed areas. Mineral resources include coal, oil and lignite, gas, iron ore, non-ferrous and rare metals, manganese, table salt, and various other chemicals such as, phosphorite and apatite, graphite, rock salt and magnesites. Moreover, these natural resource deposits lie very close to each other, permitting relatively easy development.

Oil reserves for industry are estimated at 618 million tons. Gas is produced at two gas fields: South-Soleninsky gas deposit and North-Soleninsky gas deposits. The latter deposits predominantly serve the Norilsk mining and smelting plant. Gas reserves are estimated at 1.1 billion cubic meters, and condensed gas at over 58 billion tons.

Lignite is mined in the Kansko-Achinsky region, which possesses about 60 per cent of all estimated coal deposits in the Commonwealth of Independent States (CIS). Almost the entire deposit can

be open-cut mined. The Minusinsky basin is located at the border with Khakass Republic and is estimated at 89 billion tons. The Tunguss basin is considered to be the world's largest coal basin, with coal deposit reserves of about 2.3 trillion tons, most of which is located in the remote northern regions with adverse climatic conditions. Some coal deposits are located on the Taimyr peninsula.

Krasnoyarsk's metal ore deposits are enormously rich, both in variety and size. Estimated reserves of iron ores are around 2.3 billion tons, of which 56 per cent are easily enriched ores. The region has large reserves of bauxite (estimated at more than 100 million tons) and nepheline (reserves of about 638 million tons) to support an important aluminium industry. Major copper and nickel ore deposits are located in the so-called "Norilsk" ore deposit in the north of the territory. Those deposits also contain the ores and compounds of titanium, chromium, molybdenum, wolfram (tungsten), manganese, cobalt, zinc, cadmium, mercury, tin, antimony and bismuth. Krasnoyarsk has one of the largest lead deposits in the world.

Krasnoyarsk also boasts significant deposits of alkali metals (sodium and potassium); alkaline earth metals (magnesite -- Russia's largest deposit, with reserves for derived magnesium estimated at 500 million tons -- and beryllium compounds); rare earth metals (gadolinite, samarskite containing yttrium, compounds of scandium, elements of the lanthanides and actinides); rare metals (compounds containing zirconium, hafnium, vanadium, niobium [columbium], tantalum, rhenium, gallium, indium, thallium, germanium, tellurium); noble metals and platinoids (gold, silver, platinum and platinoids -- palladium, rhodium, iridium, osmium, and ruthenium); phosphates; apatite (about 21 per cent of all Russian reserves) and raw materials for cement (limestone, clay, and gypsum).

Population trends

On 1 January 1994, the population in the Krasnoyarsk territory was 3.1 million, a population density (about 4.3 inhabitants/km^2) four times lower than the Russian Federation average. The territory's population is concentrated in several sub-regions, a reflection of severe climatic conditions. Around 99 per cent of all cities and towns are located along rivers, which are traditionally the main transport arteries.

Post-Second World War industrial development largely determined Krasnoyarsk's population growth. Rapidly growing industry, particularly mining, required an influx of labour. This problem was partially solved by attracting migrants from other regions of the former Soviet Union. Migration was largely to urban areas and, by 1987, three-quarters of the territory's population was urban, with almost one-third of the population residing in metropolitan Krasnoyarsk. The growth of urban areas has stopped.

Table 2.1. Population 1926-1994 (thousands)

Data	**1926**	**1939**	**1959**	**1970**	**1979**	**1989**	**1993**	**1994**
Total ('000)	1317	1708	2248	2567	2757	3106	3123	3100
Urban (%)	12.22	27.87	48.75	62.02	69.39	72.47	71.95	71.90

Source: The Demographic Year book of the Russian Federation 1993.

Table 2.2. Population of the cities of Krasnoyarski Krai (thousands)

Data	197 0	1976	1979	1986	1989	1991	1992	1993	1994
1. Krasnoyarsk	648	758	796	877	913	924	925	919	914
2. Norilsk	135	167	180	179	175	169	165	167	163
3. Achinsk	97	113	117	120	122	122	122	122	122
4. Kansk	95	98	101	106	110	110	110	110	110
Total	975	1136	1194	1282	1320	1325	1322	1318	1309
Share in urban (%)	61.24	64.82	62.42	56.95	58.64	58.86	58.73	58.66	58.73
Share in total (%)	37.98	42.67	43.31	41.27	42.50	42.66	42.56	42.20	42.23

The region is populated by many national and ethnic groups (see table 2.3). In general, minorities remain a small share of the territory's total population, with no minority group accounting for more than 5 per cent. Russian is the common language of all groups. Ethnic groups in the North still speak their national languages.

Table 2.3. Ethnic structure of the population (%)

	%
Russians	86.0
Ukrainians	3.3
Germans	1.5
Byelorussians	0.9
Chuvash	0.8
Mordva	0.4
Ethnic groups of North	0.4
Others	4.9

Over 80 religious communities of various denominations are registered in the territory, principally from the Russian Orthodox church (Russians, Ukrainians, Byelorussian) and Protestant church (Germans) . No conflicts on ethnic or religious grounds have occurred, and the general life-style of the non-native nationalities is similar.

The number of economically-active persons has declined somewhat (by over 4 per cent) over the last few years, increasing slightly the dependency ratio (the number of non-active, children, invalids and old people, to the number of economically-active) from about 0.88 to 0.92.

Table 2.4. Age group distribution (1994) [1]

Krasnoyarsk territory	Population	(%)
Total	3,122,412	100.0
Children [2]	791,018	25.4
Working age [3]	1,836,025	59.0
Pensioners [4]	485,369	15.6

Notes: (1) beginning of the year
(2) 0-15 years (males and females)
(3) males 16-59 and females 16-55
(4) males 60+ and females 56+

Migration

The region has always had a shortage of labour, and attracting workers away from other regions was a common state policy. People traditionally moved to the north for extra pay, called the "long rouble", and they usually did not plan to settle permanently. A significant local decline in purchasing power has undone the region's earlier relative wage advantage.

Table 2.5. Migration of population in the Krasnoyarsk territory in 1993

Region		1993
Departures to	other Russian areas	41500
	CIS countries	14044
	Outside CIS	1910
Arrivals from	other Russian areas	32860
	CIS countries	19340
	Outside CIS	0

At retirement age immigrants who had saved enough money usually returned home or settled in warmer, southern regions of the Soviet Union. This traditional outward migration was compensated by a growing inflow. However, the continuing economic crisis, under-developed social infrastructure and higher prices now make the region less attractive for migrants. The current outflow to other parts of the Russian Federation remains greater than the net inflow from other CIS countries (mainly ethnic Russians from Kazakstan, Ukraine, Kirghisia and Uzbekistan), where economic or ethnic problems are more severe. Immigration may fall, as most people in the region continue to live in abject poverty.

Birth, deaths and natural changes

The territory's population is decreasing, an important signal that living standards are deteriorating. The negative migration balance (8 452) cannot explain the drop (37 700) in the number of economically-active people between 1992 and 1993; only death rates can explain these losses.

The birth rate has fallen significantly (on average 1.4 times since 1990) accompanied by a rapidly growing mortality rate (1.5 for the same period). The death rate for men is 2.5-4 times higher than for women. Alcohol abuse is probably a significant factor in the growing mortality rate. The situation in the rural zones of the Krasnoyarsk region, particularly in small towns and villages on the banks of the north rivers, is much worse than in urban zones. The rural zones lack medical supplies and services, particularly the capability to make an early diagnosis. The latter has had a significant impact upon the rural death rates, which are higher than in cities. This recently growing rate of mortality and declining birth rates is negatively affecting today's population and will lead to additional labour problems in 10-15 years.

Environment

Industries are the biggest contributors to environmental pollution in the region; many of them were built and designed without regard for protecting the environment.

Air pollution

In the region's industrial cities, air pollution is extremely high, even by Russian standards. Atmospheric conditions in the territory are unfavourable for dissemination of pollutants during the winter and the rest of the heating season. Norilsk, the largest city in the world north of the polar circle, is the largest air polluter in the Russian Federation and alone accounts for twice as much pollutants as the three Baltic states. In 1992, the Norilsk steel plant emitted 2.34 million tons of pollutants (6.2 per cent of Russia's total), 97.7 per cent (2.24 million tons) of which was SO_2 (21.4 per cent of Russia's total). Only 20 per cent of SO_2 emissions were retained in 1992 by the installations. Norilsk also emitted 30.7 thousands tons of H_2SO_4 and 300 tons of *Cl*. It is probably the largest source of sulphur dioxide in the world. Its emissions affect the taiga and tundra ecosystems.

Table 2.6. Emission of pollutants by sectors of the economy (%)[(1)]

	Russia	Krasnoyarsk	Region's share of Russian sectoral pollution
Metallurgy	50.8	90.0	22.8
Other	6.5	2.4	5.0
Power and Mining	12.8	2.0	2.0
Fuel	3.5	1.5	0.8
Road vehicle transport	6.9	1.5	2.5
Agriculture	10.8	0.9	1.1
Chemical Industry	3.4	0.7	2.8
Forest	1.9	0.4	3.2
Construction Materials	2.5	0.4	1.8
Machine Building	0.7	0.2	3.6
Light	0.2	0.1	3.9

Note: (1) Share of tons of total hazardous wastes emitted (in %).

Poor winter wind conditions and the use of many small boilers cause high concentrations of various air pollutants in other regional cities. Especially serious is the highly carcinogenic agent benzapyrene (daily precipitation in Krasnoyarsk is around 126g). Aside from Norilsk, the following cities of Krasnoyarsk region are among the most polluted areas in Russia: Krasnoyarsk, Achinsk and Nazarovo. The Kansko-Achinski area is also an important source of sulphur emission.

Data on air treatment (see table 2.7) give an over-optimistic picture of the environmental situation in Krasnoyarsk. They are distorted upwards, because most air treatment facilities are made to capture dust emissions, which account for much of the weight of captured emissions, but which are also relatively harmless when compared to other pollutants.

Table 2.7. Air treatment of stationary sources of emission in selected cities

City	% of pollutants intercepted	% of inadequate installations
Achinsk	86.0	n.a.
Krasnoyarsk	77.2	17.0
Norilsk	46.6	13.8

Note: n.a. - data not available.

Water pollution

In the 1960s, all major rivers in the European part of Russia were blocked by a series of dams. The dam construction program in Siberia diverted the upstream Yenisei and Angara into chains of reservoirs, submerging thousands of square kilometers of productive land in the valleys. Hundreds of

thousands of trees were covered, and their rotting is now a major source of pollution in reservoirs. According to some estimates, 3.6 million cubic meters of timber are afloat on the Angara river, in the huge reservoirs of Bratskoe and Ust'-Ilimsk, and the average concentration of phenols in the river amounts to 5-10 times the internationally-accepted, maximum permissible concentrations (MPCs). A similar situation exists on the Yenisei river, where the dams are so vast that they influence the climate. The total length of the Yenisei (4 090 kilometres) is polluted -- the average concentration of oil in some parts exceeds 10 MPCs (0.5 mg/l) -- and it is also polluted with lignosulphonates, methanol, and volatile acids.

In the Norilsk region, water pollution is as catastrophic as air pollution. The lake near the plant receives about 53 million cubic meters of polluted water a year, and only 9 million cubic meters (17 per cent) is treated.[1] This water pollution feeds down to the Kara sea, which is highly polluted, particularly in the Yenisei bay, with oil (up to 6 MPCs - 0.3 mg/l) and phenols (up to 10 MPCs -- 0.01 mg/l).

Forest destruction

Logging continues on an enormous scale in the territory, especially in the southern mountains, along the Yenisei and in the Angara region. Forest degradation, caused by extreme industrial pollution, is especially severe around Norilsk. In 1988, 169 thousand hectares of forest area were severely damaged, and 545 thousand hectares were seriously affected. In 1976, the area of affected forests around Norilsk was 339 thousand hectares, or 40 per cent less. In 1989, the border of completely dead forest was 90 kilometres south of Norilsk, 120 kilometres to the south-east and 60 kilometres to the east.

Soil and land use

Soils in and around major industrial centres are polluted with heavy metals. In Krasnoyarsk, the maximum content of lead in soils was 4 MPCs (120mg/kg), vanadium around 1 MPC (150 mg/kg), and concentrations of copper, zinc and nickel were three times higher than the average.

Radioactive pollution

The formerly closed city of Krasnoyarsk-26 has long produced plutonium for nuclear charges. For about 30 years, liquid radioactive waste from military plants was pumped underground - to the water-bearing clay and sandy soil of the testing site "Severni". The pumping continues today. A study on radioactive pollution in Krasnoyarsk-26 area, along the Yenisei stream, shows spots where liquid radioactive wastes were spilled. The concentration of plutonium in the soil of the region is 12 times higher than the MPCs. A leak at this storage could provoke a world-wide catastrophe.

The most polluted zones in the cities of Norilsk, Krasnoyarsk, Achinsk, and Nazarovo are also areas with the highest growth rates for diseases.

Political administration

Krasnoyarsk territory includes two national okrugs: the Taimyr (Dolgano-Nenetskii) autonomous district (862.1 thousand sq km) and the Evenky autonomous district (767.1 thousand sq km). Krasnoyarsk city is the region's capital. The territory, which forms part of the East Siberian Economic Region, is divided into 48 districts and has four cities, 23 towns, 43 urban-type settlements and 510 villages.

The economy

The Krasnoyarsk region's GDP for 1993 amounted to 472 billion rubles, or 3 per cent of Russia's total GDP (14 trillion rubles). Per capita GDP amounted to 152 thousand rubles, placing the region in third place among the other Russian regions.

Table 2.8. Sectoral share of GNP in the region (%)

	1985	**1990**	**1993**
Total	100	100	100
Industry	66.0	66.3	66.3
Agriculture	11.5	11.4	11.3
Construction	13.9	14.0	14.1
Transport and communication	5.5	5.6	5.5
Other sectors	3.1	2.7	2.8

Industry is the leading contributor to the region's GNP, followed by construction and agriculture (see table 2.8). Considering the substantial changes that have occurred in Russia since 1990, there is a remarkable stability in the structure of Krasnoyarsk's GNP. This stability suggests that all sectors have been hit more or less evenly by the transitionary recession in Krasnoyarsk. There is some evidence that the transition shock was not a structural, but an aggregate shock to the economy.

The economically-active population amounted to 1 581 thousand in 1993, of which 70 per cent worked in production and 29 per cent in non-production sectors. Of those engaged in production, most (45 per cent) work in industry, while others work in construction (19 per cent), agriculture (13 per cent) and transport and communication (23 per cent). Education (42 per cent) and health care (17 per cent) account for the largest share of workers in the non-production sector.

Territorial and industrial complexes (TICs) in the Krasnoyarsk Region

In the Krasnoyarsk region, enterprises were constructed by central planners with the goal of creating territorial and industrial complexes (TIC). These complexes linked enterprises, facilities and structures of a single industrial branch so as to produce many of the necessary inputs (particularly energy) and the social infrastructure necessary for a large territory with highly concentrated natural resources. There are three such TICs in the Krasnoyarsk region: Kansko-Achinski, Sayansky, and Lower Angara. The Norilsk Region forms an industrial complex.

Finance & banking

Finance

Krasnoyarsk Krai is a main contributor to Russia's budget revenues, sending about one-third of its 1995 revenues to Moscow. The regional budget had a positive balance of 29 billion rubles.

Table 2.9. Budget of Krasnoyarski Krai in 1993 (billion rubles)

	Revenues	Share in total (%)	Expenditures	Share in total (%)
Russia[1]	21,059.800		21,079.40	
Krasnoyarski Krai[2]	559,000	2.65	530,00	2.51
Taimyr a.d.[2]	8.9	0.04	18.4	0.09
Evenky a.d.[2]	4	0.02	11.5	0.05

Notes: (1) Figures refer to the budget of the central government in Russia
(2) Figures refer to the budgets of the local authorities.

Table 2.10. Structure of budget revenues and expenditures 1993 (%)

Revenues	**Profit tax**	**Value added tax**	**Physical bodies tax**	**Other taxes**
Krasnoyarski Krai	47.4	8.7	23.6	20.3
Evenky a.d.	6.8	11.4	22.7	59.1
Expenditures	**Economy[1]**	**Social services and culture[2]**		**Other**
Krasnoyarski Krai	33.2	51.3		15.5
Evenky a.d.	27.0	37.6		35.4

Notes: (1) Expenditures include subsidies paid to firms.
(2) Social services and culture include health, housing, law and other.

Total taxes on enterprises raised about 464 billion rubles and represented about 31 per cent of total profits. The direct profit tax on enterprises accounted for about half of the enterprises' tax burden (265 billion rubles). Regional enterprises have an enormous profit rate in current prices, nearly 100 per cent; real profit is more modest, as inflation was high. Average profitability is increasing, but this average hides the fact that some enterprises are running high profits, while a growing number of others are falling into the red. As enterprises are "marketised" some are becoming highly profitable while others are making losses.

Table 2.11. Profitability of Krasnoyarsk enterprises

	1985	1990	1993	1994
Profitability of industrial enterprises (in % of total costs)				
Kranoyarski Krai	11.1	10.1	98.6	n.a.
Evenky a.d.	n.a.	n.a.	20.2	n.a.
Share of total number of unprofitable enterprises in the Krasnoyarsk territory				
Total	n.a.	n.a.	22.5	35.3
Industry	24.0	10.4	13.6	32.9

n.a. - data not available.

Total 1994 losses in the Russian economy equalled 10 361 billion rubles. Unprofitable enterprises accounted for 28 per cent of this amount, and industry, for 42 per cent (4 383 billion rubles). About three-fourths of the unprofitable enterprises were in the mono-industrial branches. In Krasnoyarsk, losses in the whole economy amounted to 255.5 billion rubles; industry accounted for 79 billion rubles.

In 1993, 17 per cent of Russian enterprises were unprofitable, and they recorded total losses of 1 288 million rubles. (Losses in the industrial sector were 18 per cent of this amount or 288 million rubles). In Krasnoyarsk, 22.5 per cent of all loss-making enterprises were in the red by some 37.5 million rubles (13.6 per cent of the industrial enterprises made up a loss of 2 million rubles). Krasnoyarski Krai's share of Russia's total loss fell slightly from 2.9 per cent to 2.7 per cent in 1993.

Table 2.12. Share of total number of unprofitable enterprises in the region (%)

	Industry		Agriculture		Construction	
	1990	**1993**	**1990**	**1993**	**1990**	**1993**
Krasnoyarsk	10.4	11.3	0.2	9.2	5.2	9.3

Table 2.13. Loss of time in industry (man days per worker per year)

	1985	1990	1993
Krasnoyarski Krai	1.57	1.86	8.14

Of all Russian regions, Krasnoyarsk suffers the most from overdue wage payments in industry, construction and agriculture. This situation reflects the large share of enterprises receiving money from the state budget. As of 1 January, 1994 some 39 billion rubles were owed. Overdue wages have soured the motivation of the workforce: loss of time in industry due to machine breakage has more than quadrupled in the Krasnoyarski Krai (see table 2.13). Such dramatic increases cannot be due to ageing capital and disruptions in delivery alone, since these were also frequent during the Soviet era.

Banking

Krasnoyarsk's financial institutions are predominantly medium and small enterprises with relatively few regional branch offices. Most banks are highly specialised. As was the case for the majority of banks in Russia, the region's banks were established by industrial giants, particularly by the so-called, "special exporters of strategically important goods", to service their operations. Banks in the region had outstanding loans of 737 billion rubles as of January 1994, over 95 per cent of which were for terms of less than three months. They reported loan defaults of 74 billion rubles.

The region's single large bank, the Yenisei bank, ranks among the 30 largest Russian banks according to the size of assets (1 014 billion rubles on 1 July 1994). Its equity capital equals 146 billion rubles, net deposits amount to 55 billion rubles and loans are 365 billion rubles. Profits from operations were 21 billion rubles in 1994. The Yenisei bank has 34 branch offices and a staff of 1 368.

Agriculture

Climatic conditions determine the agricultural specialisation within the region. Crop production is developed in the south where highly productive black earth sections occur, and livestock farming in the north.

Between 1992 and 1993, Krasnoyarsk's agricultural sector grew in relative importance (accounting for 7 per cent of the region's GDP in 1992, and 9 per cent in 1993), bucking the general decline for agriculture in Russia. Production grew in nominal and real terms. Livestock farming accounts for a greater share of output than does crop growing. The number of agricultural workers in the region remained relatively stable.

Table 2.14. Indicators of agricultural production

	1992		1993	
	Output	**%**	**Output**	**%**
Russia				
Total (current prices, bn rubles)	2 655 747	-	22 388 399	-
Total (per capita, thousand rubles)	17.90	-	149.25	-
Krasnoyarsk				
Crop-growing	689.1	36.83	793	41.02
Live-stock	1 182	63.17	1 140	58.98
Total (prices 1993)	1 871	100	1 933	100
Total (current prices)	59 740.80	-	526 694.40	-
Total (per capita)	19.60	-	172.80	-

The recent decreasing importance of livestock to crop production results from changes in the price structure, which is moving away from the Soviet rule's bias towards cattle breeding. The removal of this bias had a severe impact on the northern regions, where climatic conditions are relatively unfavourable to crop production.

Krasnoyarsk's agricultural enterprises have historically been more profitable than others in Russia. Krasnoyarsk's ratio of total profits to total costs exceeded Russia's by about 1.2 times in 1990 and, with the extremely good 1993 harvest, by about 1.5. Higher transportation costs have made production in the more isolated areas less profitable (see tables 2.15 and 2.16)

Table 2.15. Agricultural enterprises in 1992

		Russia	Krasnoyarski Krai	Share of Krasnoyarsk
Agricultural enterprises				
Land under crops (million hectares)	1992	160.59	2.21	1.38%
	1993	156.46	2.15	1.37%
	Difference	-2.2%	-0.9%	
Output (trillion rubles)	1992	1,750.14	41.82	2.39%
	1993	14,104.69	3,576.26	2.54%
	Difference	806%	855%	
Productivity	1992	10.90	18.91	1.74
('1000 rubles per hectare)	1993	90.15	166.64	1.85
Private farms				
Land under crops (million hectares)	1992	5.82	0.61	1.05
	1993	8.64	0.79	0.92
	Difference	1.5%	0.7%	
Output (trillion rubles)	1992	29.21	0.30	1.02%
	1993	425.38	5.79	1.36%
	Difference	1456%	1940%	
Productivity	1992	5.02	4.88	0.97
(1000 rubles per hectare)	1993	49.23	73.08	1.48
Private subsidiary plots				
Land under crops (million hectares)	1992	7.14	0.12	1.64%
	1993	6.39	0.20	3.08%
	Difference	-0.4%	3.0%	
Output (trillion rubles)	1992	876.40	17.62	2.01%
	1993	7,858.33	163.28	2.08%
	Difference			
Productivity	1992	122.79	1230.52	1.23
(1000 rubles per hectare)	1993	150.68	829.48	0.67

Table 2.16. The situation of agricultural enterprises in Krasnoyarsk 1980-1993

	1980	1985	1990	1993
Profitability[(1)]		**percentage**		
Russia	-9.3	16.2	39.9	48.8
Krasnoyarski Krai	4.8	19.9	48.7	77.1
Share of Unprofitable Enterprises		**percentage**		
Russia	71	22	3	10
Krasnoyarski Krai	58	38	0.2	11
	1981-85	**1986-90**	**1991-93**	**1993**
Labor Productivity[(2)] (1975=100)		**percentage**		
Russia	110	128	87	96
Krasnoyarski Krai	115	119	96	104

Notes: (1) Profitability is defined as profits/total costs. The 'profitability' and 'loss' still used in farm accounting are quite different from the Western ones -- effectively ignoring capital costs and designed to measure results in a situation where prices and quantities are determined by planners, not markets. (2) Value added per worker.

Source: Economic Situation in the Regions of the Russian Federation in 1994.

Crop production

Crop production accounts for nearly 40 per cent of the total value of Krasnoyarsk's agricultural output. In 1993 the crop area covered 2.7 million hectares, down almost 2 per cent from 1992. The gross harvest was 3.150 thousand tons of cereal, 1.056 thousand tons of potatoes and 198 thousand tons of vegetables. This result reflects the region's strong agricultural specialisation in cereals (over 55 per cent) and forage (over 40 per cent). The rest is made up of potatoes, vegetables and industrial crops.

Table 2.17. Structure of the arable land under crops (% of total arable land)

	Cereal		Industrial crops		Potatoes, vegetables, etc.		Forage crops	
	1992	1993	1992	1993	1992	1993	1992	1993
Russia	54.0	54.5	5.2	4.9	3.7	3.9	37.1	36.7
Krasnoyarsk	56.0	55.7	0.5	0.4	3.0	3.4	40.5	40.5

The dominance of cereal and forage crops makes Krasnoyarsk's agricultural sector vulnerable to changes that might negatively affect production in these areas. In 1994, cereal production declined by 30 per cent to a 25-year low. Potato and vegetable production have remained relatively stable. The latter are staple food products and are predominantly produced on private subsidiary plots, where land owners have direct incentives to increase production.

Table 2.18. Importance of the agro-industrial complex relative to total industry (%)

	Volume of output		Number of enterprises		Staff		Annual Cost of Real Assets	
	1992	1993	1992	1993	1992	1993	1992	1993
Russia	15.8	18.0	45.0	33.3	15.3	14.9	12.1	13.1
Krasnoyarsk	7.4	8.7	30.7	24.9	10.9	10.5	4.2	4.3

Source: Economic situation in the Regions of the Russian Federation in 1994.

Organisational changes

State-owned enterprises, private farms, and family-owned private subsidiary plots account for most of Russia's agricultural output. Since 1990 the share of output from private subsidiary plots has risen continuously, while the shares of state agricultural enterprises and (to a lesser extent) of farms, have fallen. Subsidiary plots are both a rural and an urban phenomena. They are rudimentary farms on small areas of arable land (often less than 0.5 hectares) and use little specialised machinery or modern technology.

Table 2.19. Structure of agricultural output (% of total agricultural output).

	Year	Russia	Krasnoyarski Krai
State Agricultural Enterprises	1975	72.0	72.0
	1980	75.0	74.0
	1990	76.0	75.0
	1992	66.0	70.0
	1993	63.0	68.0
Private subsidiary plots	1975	28.0	28.0
	1980	25.0	26.0
	1990	24.0	25.0
	1992	33.0	29.0
	1993	35.0	31.0
Farms	1992	1.1	0.5
	1993	1.9	1.1

There are 437 agricultural enterprises in the region, of which 414 were previously collective and state farms (kolkhoz and sovkhoz). Agriculture throughout Russia, including the Krasnoyarsk region, was intensively reorganised in 1993. Only one-third (147) of Krasnoyarsk's collective farms remain. No bankruptcies have been recorded for any Krasnoyarsk agricultural enterprise. Since 1992 the number of new private farms has shown steady growth (see table 2.20), outpacing the growth achieved elsewhere in Russia.

Table 2.20. Number of farms on January 1 of each year

		Russia	Krasnoyarski Krai
1992	Number	49,01	922
	Area, ha.	2,05	40568
	Average plot, ha.	42	44
1993	Number	182,78	3705
	Area, ha.	7,85	155,610
	Average plot, ha.	43	42
1994	Number	269972	4849
	Area, ha.	11,33	179,413
	Average plot, ha.	42	37

Table 2.21. Number of agrarian enterprises on 1 January 1994

	Total	*Kolkhozes and sovkhozes*		*New organisation forms*	
		Number	% of total	Number	% of total
Russia	26,878	10,500	39.07	16,378	60.93
Krasnoyarski Krai	437	147	33.64	290	66.36

Source: Economic Situation in the Regions of the Russian Federation in 1994.

Over two thirds of Krasnoyarsk's agro-industrial output is produced by state-owned agricultural enterprises. Past patterns continue, for these enterprises use nearly four-fifths of the arable land. In Krasnoyarsk, private subsidiary plots use land the most efficiently. Their efficiency is 4-10 times greater than that for other types of agricultural producers. (All agricultural data must be viewed with caution, for farmers tend to underreport the real volume of their outputs in order to avoid taxation.)

Transportation and communication

Transportation

The Krasnoyarsk region's vast expanse makes developing transport and communication networks highly important. The transport and communication sectors account for 12 per cent of Krasnoyarsk's real assets, but its share of output is low, only 5.5 per cent of GNP (268 billion rubles), and declining. They have about 16 per cent (around 260 000 workers) of the region's employed.

Structure of transportation turnover

According to the region's Statistical Committee, transportation turnover amounted to 111 million tons of freight in 1993, a drop of 27.2 per cent over 1992. All types of transport recorded drops -- rail (-20 per cent), river (-31 per cent), road vehicle (-40 per cent) and air (-47 per cent).

Railways remain the region's most important freight movers, often representing the sole available means of transport. The relatively high cost of other forms of transportation has made rail

transport the only affordable transportation provider for most people. River transport remains an important means of transportation, though it is rapidly losing market share.[2] Road vehicle transportation has always played a relatively smaller role in this region than in Russia. Air and pipeline transport are even less significant. Their shares account for 0.9 per cent and 0.2 per cent respectively of overall transportation in the region in 1993. Data for 1993 shows significant one-year declines for road vehicle and air transportation.

Table 2.22. Share of transport means in total transport (%)

	Rail		Road		Water	
	1990	**1993**	**1990**	**1993**	**1990**	**1993**
Russia	37.2	49.3	51.1	40.7	9.7	7.9
Krasnoyarski Krai	46.7	61.3	40.5	28.4	11.6	9.2

Local transport accounts for 43.4 per cent of the region's total transport. Krasnoyarsk's position as the major transport route from East Siberia to the European part of Russia makes transit transport also important. It accounted for 33.1 per cent of total transport in 1992, while interregional transport out of Krasnoyarsk accounted for 23.6 per cent .

Some territorial industrial complexes within the region are like transportation "islands". Transporting heavy freight to the Norilsk zone can only be done via the Yenisei river or by the Kara sea. No railway lines nor roads connect this zone with the "Mother Land". Roads and railway networks are even less developed in the zone of the Low Angara TIC.

River transport

The regional network of rivers and lakes was the only means of transport during past centuries. Practically 99 per cent of all cities, towns and villages are located on the banks of large rivers. The river transportation system of the region is based on the Yenisei river. Another independent system is the Khatanga river and its tributaries, and the Culim river, which is a tributary of the other great river, the Siberian Ob'.

The total length of waterways exceeds 10 000 kilometers. The navigation period north of the Yenisei is between May 15 and October. Downstream on the Yenisei there are two ports suitable for docking ocean vessels, Igarka and Dudinka, and two river ports, at Krasnoyarsk and Lesosibirsk. The region's river transport infrastructure depends on one river ship company. It owns a large passenger and transport fleet, docks at 19 river ports, the Krasnoyarsk dock, ship-repairing enterprises (in Krasnoyarsk and Podtesov), and passenger agencies. There are 11 vessels of the river-sea class and nine vessels designed for cruises down to Yenisei bay to the port of Dixon and the islands in the Kara sea.

The development of water transport is a key question for the northern regions, because there are no other means of transport to the north from Lesosibirsk. Besides air transport, water transport is the only other means of transport in Evenky a.d.

Railroad transport

The region's railway system is unevenly developed. The centre of the region is crossed by the Trans Siberian railway -- the so-called Krasnoyarsk railroad (covering 648 kilometers), and also includes the northern interval of the Southern Siberian railway (805 kilometers). The cities and towns form a chain along the Trans Siberian or are connected to it by railway branches. The territory of Sayansk and the Low Angara TIC are linked to Siberian rail lines, while Norilsk has a rail connection to the Dudinka port. All other regions have no railroad connection. Railway lines in the region cover around 3 200 kilometers.

After 1992 the railroad network practically ceased expansion and investments were channelled into upgrading and supporting existing lines. Today, most of the rolling stock has been fully depreciated. Considerable drops in transportation loads and frequent defaults by the consignees of shippers have occurred. The turnover declines of the Krasnoyarsk railway have continued through 1994.

Escalating ticket prices have dampened the growth of passenger transportation, with 1994 passenger loads dropping by about one-fourth over the previous year's load.

Road-vehicle transport

A road network exists in the region's centre, in the Kansko-Achinski TIC, and is connected with the road system in Sayansky TIC. In other areas the roads are fragmented and cover relatively small areas. There are no road links to the North. The region of Norilsk has a very limited local road system, because roads are very difficult to build on permafrost terrain. The share of hard-surface roads continues to decline from a lack of reconstruction funds. The total length of roads is about 12 000 kilometers, of which 8 880 kilometers are hard-surfaced.

Approximately 4 000 organisations work in the road transport business. Around 33 large road vehicle transport enterprises are engaged in passenger transportation. There is a road vehicle transport loading terminal, 10 road vehicle stations and 20 passenger stations. The road vehicle park of these enterprises is estimated to consist of about 120 000 various vehicles. There are 3 100 buses for public transportation, which exceeds the average per capita level in Russia.

Total passenger transportation has fallen by 4 per cent and amounts to 618 million person trips. Freight transportation fell by 40 per cent to reach 27 million tons. Only 3 per cent of Krasnoyarsk's transportation enterprises were privatised by 1993, while 44 per cent of other Russian enterprises were privatised by this time. The small share of privatisation and the vulnerability of the state-owned enterprises to cut-offs in fuel supply have severely disrupted the provision of road transportation services.

Table 2.23. Selected indicators of road transport (1970-1993)

	1970	1975	1980	1985	1990	1992	1993
Hard-surface roads (per 10 000 m²)							
Russia	12.0	16.0	19.0	21.0	23.0	25.0	26.0
Krasnoyarski Krai	2.7	3.8	4.5	4.2	4.0	3.8	3.8
Buses (per 100 000 inhabitants)							
Russia	63.0	83.0	100.0	107.0	103.0	90.0	87.0
Krasnoyarski Krai	64.0	96.0	103.0	113.0	116.0	86.0	99.0
Cars (per 1 000 inhabitants)							
Russia	5.5	15.3	30.2	44.5	58.6	68.5	75.7
Krasnoyarski Krai	4.7	16.1	36.7	49.0	66.6	75.6	82.3

Table 2.24. Share of diesel transport in total transport (%)

	1985	1990	1993
Russia	57.3	67.3	65.6
Krasnoyarski Krai	69.8	73.9	71.0

The number of private cars in the region grew despite the continued economic crisis and now totals about 250 000. Due to the lack of roads in the Taimyr and Evenky autonomous districts, the number of cars in these regions remains negligible.

Air transport

Air transport represents a small share of the region's total transportation turnover, but it remains very important for the region, particularly for the northern districts in the winter. Air transport is the only way to reach Norilsk when sea or river transport become impossible in the winter. The region has 193 airports, with four serving air routes to other regions in Russia and 189 airports serving local routes. The airports in Krasnoyarsk (Yemelianovo), Norilsk and Khatanga (eastern section of Taimyr a.d.) are important to Russia and can receive planes of the TU-154, IL-62, IL-86 classes. Cargo, passenger aircraft and helicopters from the regional state-owned monopoly, "Krasnoyarskavia", have exhausted their technical reserves and now operate with a great deal of overstress, making flight safety a problem.

Air transport activity has dropped with 66 thousand tons of cargo and 3 thousand tons of mail transported in 1993, down 46.5 per cent from the previous year. Around 31 per cent of all flights experienced delays, with the average delay being more than nine hours. The number of passengers dropped 3 per cent, amounting to 1 714.4 thousand in 1993.

Pipeline transport

A pipeline delivers oil pumped from West Siberia to the Achinsk oil refinery. Pipeline transport also serves the Norilsk industrial plant and some local sites. Two multi-purpose lines with a total length

600 kilometers cross the southern part of the region. The pipeline, Messoyakha-Norilsk, which is 600 kilometers long, runs in the north of the region.

Infrastructure policy

To improve Krasnoyarsk's poor transportation infrastructure, the local administration has defined several priority projects that will develop internal transport and improve links with the rest of the world. For example, additional flight routes with south-east Asia and across the pole (the so-called transpolar route) will be developed. There are hopes to develop transportation in the Angara basin. Financing remains relatively uncertain, however, for these projects must be funded locally. To offset rising transport costs, the local budget supports grants for 50 per cent discounts on transportation costs for contracts concluded directly between manufacturers and producers.

Communication

Income from Krasnoyarsk's communication services reached 32.4 billion rubles in 1993, including 7.4 billion rubles obtained from individuals. The quality of communications is a serious problem for the region and for Russia. Communication is made difficult due to underdeveloped network systems and poor quality communication facilities.[3]

A survey of 550 enterprises in Krasnoyarsk showed that only 11 per cent had faxes and less than 1 per cent had telex machines. The northern region is connected by a satellite communication system.

Krasnoyarsk's telephone network (urban zones) is worse than the average level in Russia. Per capita telephone ownership among the region's population is considerably lower than for Russia as a whole. The total number of telephones is under 70 000.

Post offices show drops in the quantity and quality of mail service. According to a report published by the region's Statistical Committee, the delivery of newspapers and magazines dropped 35 per cent in 1993 compared with 1992; letters, cards and books, 30 per cent; parcels, 40 per cent; telegrams, 30 per cent; and postal orders, 37 per cent.

Table 2.25. Private telephone ownership (phones per 1 000 inhabitants).

	1980	1985	1990	1992	1993
Urban Population					
Russia	18.1	24.5	35.7	39.7	41.5
Krasnoyarski Krai	8.9	11.2	20.7	22.5	24.5
Rural Population					
Russia	5.3	8.2	13.9	16.2	17.2
Krasnoyarski Krai	3.3	7.7	13.2	14.9	15.2

Industry

Industry is the region's most important contributor to employment and GNP. The more consumer-oriented industries are extremely underdeveloped and account for only 2 per cent of total value added.

Krasnoyarsk industry has shown a startling degree of stability. The relative shares of physical output produced by different industrial sectors over the past decade has changed little (see table 2.28). Since 1985 the machine building and metal working industry's share of total output dropped by one percentage point, while other sectors showed minor changes. Since the beginning of the 1990's (i.e. since the intensification of economic reforms) little has changed in the industrial output structure. This lack of change suggests that transitional economic changes have affected all industries similarly and that very little restructuring has taken place, at least in a way to affect the aggregate output structure.

Non-ferrous metallurgy is Krasnoyarsk's most important industry, accounting for about 54 per cent of the region's gross industrial product (see table 2.26). Machine building and metalworking, chemicals and petrochemicals are also significant regional industries.

Table 2.26. Gross industrial product of industrial branches 1993

	Russia total (bn rubles)	**Krasnoyarsk Krai**	**Share of the total Russian Branch Output**	**Branch share of region's GNP (%)**
All industries	120,657	4,464	3.70	100.00
Non-ferrous metallurgy	10,026	2,406	24.00	53.90
Machine-building and metalworking	23,915	334.8	1.40	7.50
Chemical and petrochemical including:	8,684	317.0	3.65	7.10
• *Microbiological and medical industry*	1,322	17.9	1.35	0.40
Fuel	19,252	308.0	1.60	6.90
Power generation	10,974	263.4	2.40	5.90
Food industry including:	15,346	245.5	1.60	5.50
• *Flour-grinding, cereals and mixed fodder*	3,069	49.1	1.60	1.10
Forestry, wood processing, pulp and paper industry	5,102	214.3	4.20	4.80
Construction materials industry	5,208	125.0	2.40	2.80
Light industry	6,417	102.7	1.60	2.30
Ferrous metallurgy	10,044	40.2	0.40	0.90
Other	1294.4	40.1	3.10	0.90

A comparison of gross industrial output (see table 2.28) with the structure of assets (see table 2.30) supports the hypothesis that few structural changes have occurred in the country since 1990. The structural shares of assets for the different industrial branches have remained relatively constant. Only in the period from 1985 to 1990 did major changes in the asset structure occur, with machine building and power industry gaining and light industry losing.

Table 2.27. Industrial assets in constant prices, (% of total regional assets)

	1985	1990	1993
Non-ferrous metallurgy	43.30	40.20	40.30
Electro-power	16.00	18.40	18.50
Machine-building and metalworking	14.10	16.30	16.40
Forestry, wood processing, pulp-and-paper	6.80	6.70	6.70
Fuel	5.10	5.30	5.40
Chemical and petrochemical	3.70	3.20	3.00
Construction materials	2.80	2.70	2.50
Light industry	2.50	1.90	2.00
Food industry	1.90	1.70	1.70
Ferrous metallurgy	1.70	1.60	1.50
Flour-milling, cereals and mixed fodder	1.30	1.30	1.30
Microbiological and medical industry	0.80	0.70	0.70

For Russia as a whole, the energy and fuel branch has increased its share in total production from 9.1 per cent in 1992 to 13.5 per cent in 1993, while all other sectors have had declining shares. All non-energy industrial sectors in the Krasnoyarsk region were relatively harder hit by recession than they were in the rest of Russia between 1992 and 1993. Output in the all-important metallurgy sector dropped over 2 percentage points in just one year. An examination of the physical output recorded for selected items also reflects this trend (see table 2.29).

Table 2.28. Structure of industrial output in constant prices (%)

	1985	**1990**	**1993**
Non-ferrous metallurgy	31.8	30.8	30.7
Machine-building and metalworking	14.7	14.0	13.8
Light industry	10.8	10.9	11
Forestry, wood processing, pulp-and-paper	9.7	9.8	9.8
Power generation	7.3	8.1	8.1
Food industry	7.6	7.6	7.6
Fuel	6.7	6.9	7.0
Chemical and petrochemical	4.9	4.8	4.7
Construction materials industry	3.5	3.5	3.7
Flour-milling, cereals and mixed fodder	1.3	1.9	2.1
Ferrous metallurgy	0.9	0.9	0.8
Microbiological and medical industry	0.8	0.8	0.7

Unfortunately, there is no available official data on the physical volume of non-ferrous metal production (lead, zinc and aluminium). The most important indicators concerning the development of industrial production in the Krasnoyarsk territory are therefore lacking.

Table 2.29. Production of selected items in physical units (1970-1993)

	1970	1975	1980	1985	1990	1991	1992	1993
Production of electric power (billion kWh)								
Russia total	470.2	639.9	804.9	962	1082.2	1068.2	1008.5	965.6
Krasnoyarski Krai	33.6	42.3	50.4	50.7	51.8	53.3	53	50.5
Production of coal (million tons)								
Russia total	365	381	391	395	395	353	337	306
Krasnoyarski Krai	21.6	28.3	35.4	41.6	52.3	56.2	51.1	41.6
Production of rolled ferrous metals (thousand tons)								
Russia total	43164	54209	59712	62536	63737	55125	46824	42718
Krasnoyarski Krai	69.1	79.4	79.7	81.9	82.9	77.6	64.5	39.8
Production of steel (thousand tons)								
Russia total	63877	79879	84430	88706	89622	77100	67029	58346
Krasnoyarski Krai	181	225	247	279	301	290	241	148
Production of tins (million units)								
Russia total	4500.5	5901.5	5998.7	7057.5	8206.5	6943.5	5353.4	4517.0
Krasnoyarski Krai	81.1	111.1	101.7	98.2	113.3	79.8	83.2	95.5

Investments

During the 1980s, annual investments in Krasnoyarsk grew more slowly than in the rest of Russia. Between 1975 and 1980, investments in the region had grown more rapidly than elsewhere in Russia (an average annual rate of 30 per cent compared to Russia's average annual rate of 18 per cent). However, between 1980 and 1990, the annual growth rate of investments (in current prices) fell to 18 per cent, which was only about one-third of the annual rate for Russia (55 per cent). Since 1990, the annual growth rate in investments plummeted by about 20 per cent to 30 per cent annually. Average investments in 1993 amounted to only 55 per cent of the 1990s, and there is no sign that the downward trend is stopping.

The drop in investments varied greatly among the localities within the Krasnoyarsk region. Investments in remote Taimyr and the Evenky autonomous districts have almost stopped. The Krasnoyarsk region suffered an 89 per cent drop.

Table 2.30. Investments in real assets in constant prices (million rubles)

	1975	1980	1985	1990	1991	1992	1993
Russia	136400	161000	192000	249100	210500	128900	112200
Krasnoyarski Krai	4484.7	5817	5978.4	6871.2	5472.1	3939.9	2718.5

Table 2.31. Source of funding of investments, Krasnoyarsk and Russia, 1992-1993 (%)

	Krasnoyarski Krai		Russia	
	1992	1993	1992	1993
Federal budget	17	10	23	22
Municipal budget	7	13	13	19
Privileged state loans	1	4	1	2
Centralised investment funds	6	5	5	7
Stocks of enterprises	69	68	59	51

A tight central government budgetary policy has reduced to 10 per cent the federal budget's share of total Krasnoyarsk investments -- a much lower share than elsewhere in Russia. An examination of total investments made in different sectors of the economy (see table 2.32) reveals that developments in Krasnoyarsk resemble those in Russia as a whole -- the share of investment in housing construction has increased at the expense of industry. State-owned enterprises appear to have been harder hit by the reduction in funds than municipally-owned firms.

Table 2.32. Structure of investments, 1992-1993 (%)

	Russia		Krasnoyarsk Krai	
	1992	1993	1992	1993
Industry	40.9	37.0	49.7	45.5
Agriculture	10.8	7.9	7.6	7.1
Construction and building	2.7	2.4	1.7	3.9
Transport	10.2	10.4	7.6	6.6
Communication	0.6	0.6	0.4	0.6
Trade, public catering	1.0	0.9	0.9	1.0
Housing construction	21.7	23.1	19.8	23.7
Health protection	2.4	3.7	5.2	3.6
Education	2.7	2.4	2.4	2.2

Labour market

The working population

According to the federal statistics agency, Goskomstat, the total number of economically active in Krasnoyarsk has been decreasing slightly (from 1.62 million in 1992 to 1.58 million in 1993) in line with a general regional population decline. In 1995 this decline may have ended, as the influx of migrants and refugees from other CIS states increased to approximately 400 persons per month. It appears that the total number of population of able-bodied age will stabilise to around 1.6 million, as the effects of immigration, the rapidly growing death rate and the declining birth rate cancel each other out.

Structure of employment

Industry is the region's major source of employment, followed by construction and building, agriculture, and transport and communication (see table 2.33).

Table 2.33. Distribution of the labour force by economic branches (thousands)

	1992	1993	% variation
Industry	498.2	470.5	-5.6
Construction and building	231.4	198.4	-14.3
Education, science, culture, art	194.5	195.4	0.5
Agriculture	151.1	144.3	-4.5
Transport and communication	139.8	127.8	-8.6
Trade and industrial service	127.0	117.2	-7.7
Medicine, health protection	90.0	88.7	-1.5
Non-industrial service	72.3	69.1	-4.4
Others	102.9	91.7	-10.9
Employed	1,607.	1,5	-6.5
Total	1,619.	1,5	-2.3

Source: Goscomstat.

According to federal statistics, the economy lost around 104 thousand workers in 1993 or 6.5 per cent of the workforce. Regional statistics estimate a lower loss, about 51 thousand workers, or 3.3 per cent of the workforce.[4] An analysis of employment and demographic data suggests that the federal statistics are, perhaps, more realistic.

Changes in the distribution of the labour force followed the varying developments in the different branches. For example, the number of workers in finance, banking and insurance grew 3 per cent, while the number of workers in housing services grew less than one percent. The number of workers in administration significantly increased by 17 per cent, evidently related to a growing regional government apparatus. Ferrous metallurgy and machine-building and metalworking recorded a large reductions. The restructuring of the labour market appears related to the sharp decline in government funding, particularly in large-scale construction and building, science and engineering.

The majority of workers (nearly 43 per cent) are employed at state-owned enterprises. Over half of the economically active people are employed by large enterprises. Estimates for the number of newly

employed people show high numbers, almost 24 per cent of registered personnel are newly employed. This high share seems to reflect seasonal variations, caused by climatic conditions, in industries such as forestry, construction, transport (especially in the north), mining and extraction, and also the unstable situation at enterprises that are paying salaries late.

Table 2.34. Labour force flows in the Krasnoyarsk region, 1993

	Newly Employed ('000)	% of average registered personnel	Dismissed and dropped out ('000)	% of average registered personnel
Russia	11,963	21.1	14,284	25.1
Krasnoyarsk	305	24.0	357	28.1

Unemployment

Interpreting official Russian data for unemployment is difficult. Understatements arise from the fact that not all unemployed seek unemployment benefits -- many unemployed live relatively far from their labour offices and do not bother to register; others refuse because of the social stigma associated with receiving federal assistance. The following analysis only relates to the following categories of unemployment: those officially unemployed and receiving unemployment benefits; those officially unemployed whose eligibility for benefits have expired; and those officially unemployed who are actively looking for a job (this includes people who have not registered at a labour office as well as those formally employed who are on long, unpaid leaves of absence)[5].

Table 2.35. Unemployment estimates for selected months, 1993-1994

	Total number of real unemployed		Number of people officially searching for work		Number of officially unemployed		Number of people on unemployment benefits		% unemployed of working-age
		%		%		%		%	%
December -93	77,750	4.80	15,190	0.94	10,360	0.64	-	-	46.6
November-94	160,500	10.15	31,344	1.98	25,419	1.61	16,800	1.06	83.4
December -94	163,500	10.34	31,934	2.02	26,465	1.67	22,200	1.40	82.1

Official regional data show a three-fold increase in unemployed workers after 1992. On 1 January 1995, the total number of officially unemployed was 30 297, including 26 785 receiving unemployment benefits, -- i.e., an official unemployment rate of almost 2 per cent. At the same time the labour demand at local enterprises was extremely low with only 4 641 vacant places,[6] i.e., for every official vacancy there were 6.5 officially registered unemployed.

The distribution of the unemployed according to age, sex and education shows that women account for about half of the total number of unemployed and over three-fourths of registered unemployment. The mean age of the officially unemployed is 33 years. A typical unemployed person is

in his or her forties and has a secondary-level education. Unemployed individuals are finding the adaptation to new market conditions difficult. The lowest rate of unemployment is observed among people with higher education, and the highest unemployment rate is found among the young population.

Figure 2.1. Unemployment growth

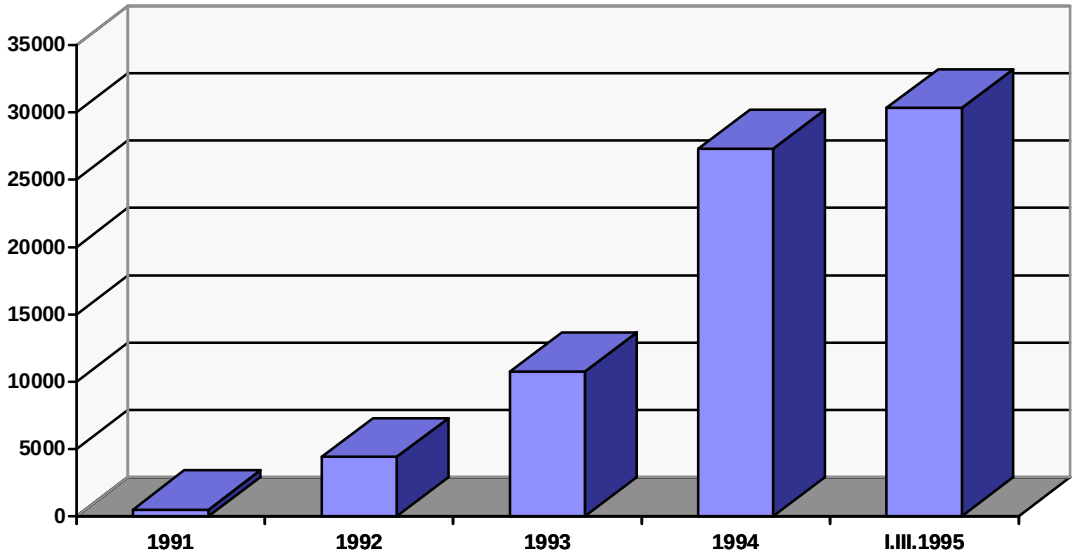


Figure 2.2. Distribution of unemployed by age, December 1993 (%)

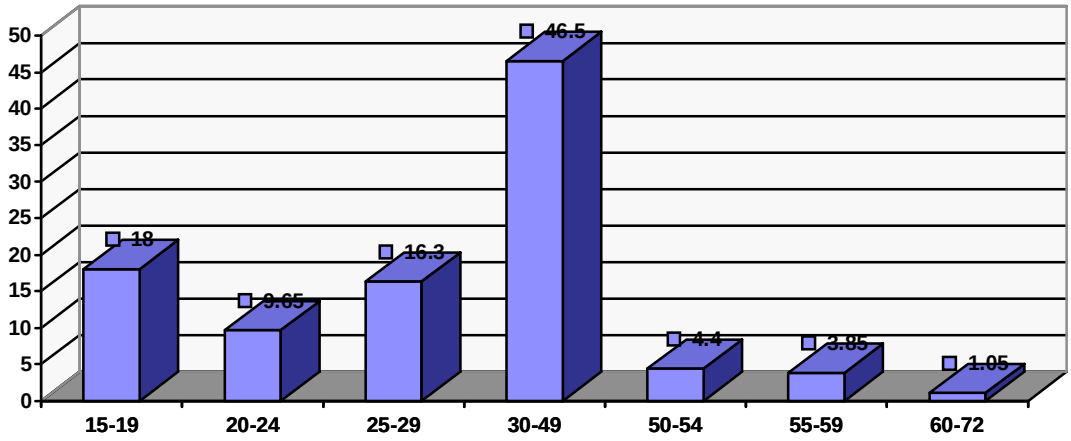
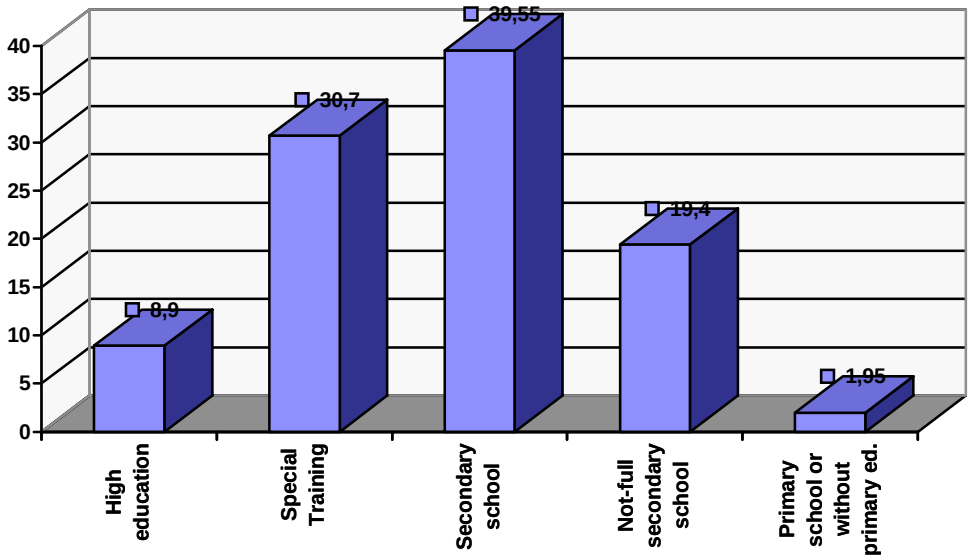


Figure 2.3. Distribution of unemployed by educational level, December 1993 (%)



Specialisation of industry within Krasnoyarsk

The following section analyses the product specialisation, regional structure and ownership structure of Krasnoyarsk's industry. The analysis is based on a set of detailed data on the location, employment, capital depreciation, product structure and type of ownership of 583 regional firms at the end of 1993.[7] Thus, the analysis is largely descriptive or static. To the extent that restructuring of industry requires closing of unprofitable enterprises and moving to other profitable industries, an analysis that focuses on more dynamic effects is preferred.[8]

The following three static elements might, however, help indicate priority development directions for Krasnoyarsk :

A) A large number of firms within the region. This criterion can be justified by the risk spreading function that is provided by the number of firms in a region. To the extent that each firm represents a "market experiment" of its own, the chances that an industry will eventually come up with a competitive product will increase together with the number of firms operating in the industry. In the context of transition, the number of firms within a region becomes even more important, because it is a good indicator of the degree of competition, which in turn influences the potential for product improvement of the industry. The more firms, the higher the degree of competition and the higher the potential for small scale product improvements.

B) A large number of suppliers and buyers in the local market. New firms and also new products of already existing firms are, at least in their market introduction phase, usually highly dependent on local market conditions. New products usually draw on the resources provided by the local market and are oriented towards satisfying the demand of the domestic market. This is particularly so in the transition context, where new firms are usually established in a situation of scarce information on the market, and estimations of the chances of success are very often drawn from the experiences of local markets. It follows therefore that industries with many local suppliers and buyers will develop better.

C) Economically healthy firms. This criterion, though it is intuitively clear that only healthy firms will be able to carry out the investments necessary to support competitive production, is extremely hard to test in transition circumstances: data is hard to come by in many transition countries and figures on profitability are burdened to a large degree by misrepresentation caused by inflated profit figures due to high inflation rates.

Criterion (C) may be considered a *sine qua non* condition for the possibility of endogenous development and is treated separately later. Criteria (A) and (B) are also interpreted in terms of the forces behind regional development. While criterion (A) is closely associated with the process of imitation, criterion (B) is closely related to the innovation processes. Porter (1990) has suggested that a nation's and therefore a region's development is closely associated with the development of industries that are "usually linked through vertical (buyer, supplier) or horizontal (common customers, technology) channels".

Sectorial and ownership structure

Structure of industry in Krasnoyarsk

The wood, food and building materials industry have the greatest number of individual firms in the region (see table 2.36), (the relatively low numbers of some types of ownership may reflect a bias in the data set). While state ownership prevails in all industries, the extent of other ownership forms varies considerably among the industries. In the mining industry, companies are exclusively owned by the state; in the food industry, the share of joint stock companies has reached almost 28 per cent. In Krasnoyarsk, most private activities are undertaken by relatively young firms

Only two joint ventures are included in the sample: the Tungissk timber industry enterprise, which is a medium-sized firm (333 employees) that produces wood and the Russian-Dutch joint stock company "Besotra", which is a large firm (8 997 employees) that produces trailers. This suggests that foreign investment plays a minor role in Krasnoyarsk's economy.

Table 2.36. Krasnoyarsk's industry structure by ownership category [1]

	State	Joint Stock	Mixed	Munic.	Collective	Public	Joint Venture	Private	Total
Wood	136	30	1	4	5	-	1	-	177
Food	59	28	2	10	5	-	-	-	104
Print/ Publishing	40	2	-	2	1	-	-	-	45
Building Materials	21	9	2	-	5	-	-	-	37
Clothing	15	9	-	1	6	1	-	-	32
Chemical	19	7	-	-	-	-	-	-	26
Machines	20	2	1	1	1	-	-	-	25
Metal	17	5	1	-	-	-	-	-	23
Power	18	4	-	-	-	-	-	-	22
Furniture	8	4	1	3	4	-	-	-	20
Vehicles	16	1	-	-	1	-	1	1	20
Mining	17	-	-	-	-	-	-	-	17
Electric	5	2	1	1	-	-	-	-	9
Other[2]	1	1	-	-	-	-	-	1	3
Total	392	104	9	22	28	1	2	2	560

Notes: (1) 23 firms had to be omitted because no ownership and/or no main product was available.
(2) This includes a toy factory (Biryusinka), a paper mill (Krasnoyarsk integrated paper mill) and a glass container producer (Sibirskoye Steklo).

The state sector accounts for over two-thirds of all employment. The wood and mining industries (especially of non-ferrous metals) each account for about one-fifth of total employment, and the power generating sector, over 10 per cent. The wood industry firms are generally much smaller in size and non-state owned. Krasnoyarsk's two largest firms are the Norilsk integrated mining and metallurgical works (50 419 employees) and the power company, joint stock company "Krasnoyarskenergo", (21 275 employees). The Norilsk firm alone accounts for almost 10 per cent of Krasnoyarsk's total industrial employment and over one-sixth of industrial output.

Table 2.37. Average employment in firms by industry and ownership type (1993)

	State	Joint Stock	Mixed	Munic.	Collective	Public	Joint venture	Private	Total
Wood	391	1018	322	172	479	-	333	-	20.0
Mining	4165	-	-	-	-	-	-	-	19.6
Power generation	776	6210	-	-	-	-	-	-	10.7
Machines	1630	371	56	38	612	-	-	-	9.0
Metal	1500	660	81	-	-	-	-	-	8.0
Chemical	1034	1220	-	-	-	-	-	-	6.9
Electrical engineering	2830	1966	282	66	-	-	-	-	5.1
Vehicles	421	293	-	-	317	-	8997	163	4.6
Clothing	561	752	-	315	238	198	-	-	4.4
Building materials	369	591	270	-	365	-	-	-	4.3
Food	155	98	73	185	126	-	-	-	4.0
Furniture	170	294	3138	127	202	-	-	-	1.9
Other	3102	265	-	-	-	-	-	600	1.1
Print/ publishing	32	51	-	15	35	-	-	-	0.4
Total	**68.5**	**24.3**	**1.3**	**1.0**	**2.2**	**0.1**	**2.6**	**0.2**	**100.0**

Notes: (1) The average size per firm is total employment/number of firms.
(2) Totals are the share of total employment by all firms in the respective category as a percentage of total employment in the sample. 27 firms had to be omitted because ownership and/or industry affiliation were not specified.

The state-sector produces almost 74 per cent of the gross production value. Industry is highly concentrated in mining, metals and the chemical production. These sectors account for just over 70 per cent of total production volume and have relatively high productivity.

Table 2.38. Average gross production in firms by industry and ownership type[(1)] (1993)

	State	Joint Stock	Mixed	Munic.	Collective	Public	Joint Venture	Private	Total
Metal	9,264.08	11,178.42	21.50	-	-	-	-	-	29.7
Mining	11,092.18	-	-	-	-	-	-	-	27.4
Chemical	4,186.72	4,683.56	-	-	-	-	-	-	13.9
Power generation	1,070.48	8,861.35	-	-	-	-	-	-	8.0
Food	457.84	231.94	165.55	182.39	283.93	-	-	-	5.3
Wood	158.88	447.23	65.20	45.60	210.72	-	61.60	-	4.3
Machines	789.13	681.50	860.00	23.00	3,000.00	-	-	-	2.9
Clothing	593.56	1,154.56	-	106.10	116.02	63.40	-	-	2.9
Electric engineering	2,570.60	1,208.80	601.70	6.20	-	-	-	-	1.9
Building materials	191.95	335.67	173.85	-	184.26	-	-	-	1.2
Vehicles	196.68	262.70	-	-	135.00	-	4,042.80	10.00	1.1
Other	3,608.10	176.50	-	-	-	-	-	1,609.8	0.8
Furniture	54.23	194.02	1,615.80	47.30	113.13	-	-	-	0.5
Print/ publishing	7.55	74.40	-	3.21	4.00	-	-	-	0.1
Total	**73.6**	**23.6**	**0.6**	**0.3**	**1.1**	**0.0**	**0.6**	**0.2**	**100**

Notes: (1) The average size per firm is given by total gross production value/number of firms. (2) Totals are the share of total gross production by all firms in the respective category as a percentage of the overall production value. 27 firms had to be omitted because ownership and/or industry affiliation were not specified.

Krasnoyarsk's industrial production appears more concentrated than its industrial employment (see table 2.39).

Table 2.39. Indicators of concentration

	Herfindahl index[(1)]	Five largest firms	Three largest firms
Volume of production[9]	0.10	57.93	47.52
Employment[10]	0.03	28.27	22.82

Note: (1) The Herfindahl Index is defined as the sum of squared shares of total employment (gross production). The maximum is 1. If all firms have the same size in terms of employment (gross production) then the considered index would be 0.0000029.

Interrelation between major industries

Mining and metals, wood, chemicals and power supply are the most important industrial sectors in Krasnoyarsk. Food production is a small-scaled, broad-based industry. There are a number of links between the individual firm in these industrial sectors. These cross-industry links may indicate potential

for the endogenous development of the relevant sector. The relative shares of the product groups in these sectors are as follows (tables2.40 to 2.44):

Table 2.40. Main products of the chemical industry (%)

	Wood - chemicals	**Varnish & paints**	**Fibres**	**Alcohol**	**Photo - materials**
Employees	11.25	1.40	16.34	10.75	6.91
Prod. volume	1.47	0.30	5.82	3.68	2.19
	Pharma	**Tanning extracts**	**Rubber**	**Petro-chemical**	
Employees	0.74	0.78	43.33	8.50	
Prod. volume	0.04	0.02	83.22	3.25	

Table 2.41. Main products of the energy industry

	Heating	**Electricity**	**Distribution**
Employment	588	31 297	4,435
Gross production value (mn rubles)	461	38 997	71

Table 2.42. Main products of the mining industry

	Coal	**Gas**	**Non ferrous-metals**	**Ferrous metals**	**Precious metals**
Employment (%)	16.67	1.06	73.55	2.04	6.67
Production volume (%)	7.49	0.50	87.80	0.983	3.23

Table 2.43. Main products of the metal industry

	Waste & scrap	**Non-ferrous metals**	**Fer. metal rolled & welded**	**Consumer goods**	**Producer goods**
Employment (%)	2.38	65.99	15.21	1.93	14.48
Production volume (%)	0.18	97.75	1.04[(1)]	0.09	0.93

Note: (1) Sibelelektrostal did not report its production volume.

Table 2.44. Main products of the food industry

	Grain processing	Pasta & confectionery	Bread	Beverages	Milk	Fish & meat
Employment (%)	14.68	7.94	18.65	17.14	26.93	14.66
Production volume (%)	42.48	4.63	7.48	10.18	21.98	13.24

Sub-regional specialisation

Analysing the sample of firms according to their location within five Krasnoyarsk territorial industrial complexes illustrates how industrial activity is distributed throughout the region. The five sub-regions are: the northern territories, the Angara basin (low Angara TIC), the central territory (Kansk - Achinsk TIC, stretching along the Transiberian railway from Achinsk to Kansk), the Sayansk TIC (the southern territory), and metropolitan Krasnoyarsk.

The economic importance of the sub-regions

Metropolitan Krasnoyarsk provides the largest share of the regional economy's total employment (39 per cent) and gross production volume (55.2 per cent) (see tables 2.45 and 2.46): it dominates the region's economy, accounting for a major share of employment and gross production volume in all industrial sectors except for mining and wood products. The Transiberian sub-region is also relatively important in a number of industrial sectors. In terms of employment, the central region is the second most important region (28 per cent) followed by the North (16 per cent). In terms of the share of gross production volume, the northern and central region reverse positions: the North accounts for 26 per cent of total production volume and the central region 13 per cent. The two other large regions (the South and the Angara regions) have relatively unimportant shares of gross production volumes (less than 5 per cent each). However, the Angara sub-region accounts for 15 per cent of the total employed in Krasnoyarsk.

Certain industrial sectors are highly important sources of industrial employment or gross industrial output for individual sub-regions. The wood industry accounts for almost three-quarters of all industrial employment in the Angara sub-region and one-quarter of the central sub-region. Mining accounts for almost all of the north sub-region's industrial employment. These industrial sectors contribute an important share to their sub-region's gross industrial output. The food industry similarly has a special importance for the south sub-region and the metal industry for Krasnoyarsk.

Table 2.45. Employment share according to sub-regions of Krasnoyarsk (%)

	Metropolitan Krasnoyarsk	Central	Angara	South	North
Machines	81.2	17.1	1.7	-	-
Chemical	77.5	15.2	6.4	0.9	-
Power generation	75.5	19.7	1.7	1.5	1.6
Electrical engineering	73.9	23.8	-	2.3	-
Furniture	71.6	20.6	-	7.8	-
Print / publishing	57.9	24.9	6.5	6.6	4.1
Metal	49.4	48.4	-	0.3	1.9
Construction materials	49.1	46.2	1.9	1.8	1.0
Vehicles	30.3	63.1	3.8	2.8	-
Clothing	26.0	63.9	0.2	9.9	-
Food	25.1	50.3	6.4	14.0	4.1
Wood	12.9	32.5	52.0	1.3	1.2
Mining	2.6	7.1	14.9	-	75.4
Other	93.3	6.7	-	-	-
Total (share)	39.9	27.9	14.7	2.0	15.5

Table 2.46. Share of gross production volume of sub-regions of Krasnoyarsk (%)

	Metropolitan Krasnoyarsk	Transiberian	Angara	South	North
Chemical	89.3	5.2	0.2	1.6	3.8
Metal	86.7	13.1	-	-	0.2
Machines	81.3	18.1	0.6	-	-
Furniture	80.3	12.9	-	6.9	-
Power generation	77.5	9.3	-	0.1	13.0
Electr.	76.8	18.5	-	4.7	-
Print / Publishing	58.5	34.8	2.4	1.7	2.6
Construction materials	54.0	43.4	1.4	0.9	0.3
Clothing	49.5	48.1	-	2.4	-
Food	41.1	42.4	5.1	11.1	0.3
Vehicles	33.5	61.7	1.0	3.9	-
Wood	13.8	21.4	57.2	.6	7.1
Mining	2.3	2.3	5.5	-	90.0
Other	96.7	3.3	-	-	-
Total (share)	55.2	12.9	4.4	1.1	26.4

Ownership structure by sub-region

There is very little variation in type of ownership among the sub-regions. Some slight variations appear related to the different sub-regional industrial structures, suggesting that privatisation was more affected by the type of industry than by its location. For example, employment and production in the south sub-region -- where relatively more food and consumer-oriented industries are located -- is relatively higher in non-state owned industries.

Table 2.47. The industry in Krasnoyarsk by ownership and region (%)

	Krasnoyarsk	Central	Angara	South	North
Number of firms					
State	67.6	72.1	67.8	61.7	80.8
Joint stock co.	17.6	14.0	26.1	25.0	11.5
Mixed	2.2	1.9	-	3.3	-
Municipal	2.2	3.7	1.7	5.0	3.8
Public Org.	7.4	6.0	2.6	3.3	-
Joint Ventures	-	0.9	-	-	-
Private	0.7	-	-	-	-
Production					
State	63.8	77.4	60.6	31.1	94.7
Joint stock co.	33.5	13.8	35.5	56.0	5.3
Mixed	0.7	0.6	-	8.2	-
Municipal	0.3	0.6	0.6	3.2	-
Public org.	1.2	2.6	2.2	0.4	-
Joint ventures	-	4.7	-	-	-
Private	0.4	-	-	-	-
Employees					
State	64.8	64.1	53.7	46.3	97.7
Joint stock co.	28.1	21.0	41.5	43.2	1.2
Mixed	2.5	0.8	-	5.2	-
Municipal	0.7	0.9	0.7	3.6	-
Public org.	2.7	2.9	2.1	1.8	-
Joint ventures	-	9.5	-	-	-
Private	0.4	-	-	-	-

The situation of firms in Krasnoyarski

Economic indicators of firms

The sample data on 583 firms in the Krasnoyarsk region contains information on each firm's degree of capital depreciation and on capital and labour productivity. The depreciation measure gives the value of depreciated capital stock in 1993 as a percentage of the original capital stock's value. Depreciation is purely a bookkeeping measure of the capital stock's age, not a measure of its technological level. It is possible that two industries have similarly aged capital stocks, but that the stock of one of them is far more technologically out-dated. (Soviet industry was well-known for producing capital stock with a wide diversity of technological levels.) This limitation on interpreting the depreciation data may be particularly relevant when assessing the low productivity of Krasnoyarsk's consumer-oriented industries. Central planners gave Soviet consumer-oriented industries low priority, and the technological level of capital stock for these industries was probably lower than in other industries.

To measure labour and capital productivity, we employ the ratio of gross product to labour and gross product to a residual cost of capital[11], the latter is used as a proxy for the capital stock. This method for estimating the productivity of the different industries has a number of weaknesses: first, using gross

production values rather than the more appropriate value added (i.e. gross production value minus the costs of material inputs) introduces a bias in our results. For example, it rewards inefficient users of inputs or those using high-cost inputs. Second, the residual cost of capital as the depreciation rate is only a bookkeeping value with which the capital stock is evaluated, so that different methods of accounting for depreciation may have impacts on the capital input measure. An estimate of the value of the capital stock based on actual usage would be preferable, but is not available.

Estimating the impact of the distorted capital measure on productivity is difficult, and one hopes that it averages out over the number of observations. The effect of the distortion caused by using gross output should, in general, overstate both the capital and labour productivity of those sectors that need more material inputs relative to those sectors that use fewer material inputs.

Depreciation

The degree of capital depreciation is similar for all ownership forms (see table 2.48). The capital stock of joint stock companies tends to be less depreciated than that of state-owned companies. The degree of capital depreciation varies more widely among industrial sectors. For example, the mining industry's capital stock has depreciated by 37 per cent, while that of the metal processing has depreciated by 50 per cent . These differences appear mainly due to large variations among firms, that is differences in depreciation rates seem to be enterprise specific rather than related to industries or forms of ownership.

Capital and labour productivity

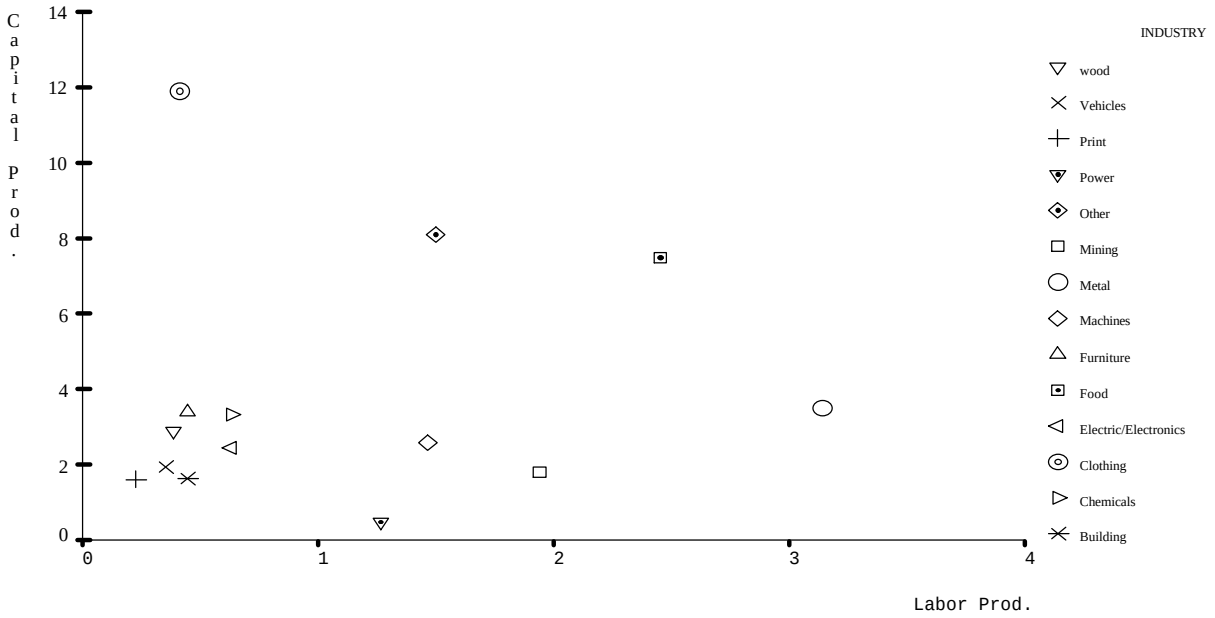
Capital and labour productivity are closely related. Capital-intensive industries tend to have higher labour productivity, and labour-intensive industries tend to have higher capital productivity. This tendency results from how productivity is calculated -- i.e., dividing total output by either labour or capital input assigns all of the product of an industry to only one factor. Therefore, where a lot of capital is used, labour productivity will be higher; where labour is the primary input factor, capital productivity will be higher. Some industries in Krasnoyarsk, however, recorded both low labour and capital productivity: the electrical engineering industry (labour productivity of 0.5 and capital productivity of 1.65), the furniture industry (0.4 and 3.4), and the power generation industry (1.3 and 0.4) (see figure 2.4). Individual outliers greatly affected some of the industry averages. When examining type of ownership, municipally-owned enterprises recorded both a relatively low labour productivity and a low capital productivity, while joint stock companies have an above average labour productivity and an above average capital productivity.

Table 2.48. Depreciation of industrial firms by industry and ownership type (%)

	State	Joint Stock	Mixed	Munic.	Collective	Public	Joint Venture	Private	Total
Print/ publishing	24.00	26.50	-	61.00	-	-	-	-	32.40
Mining	37.76	-	-	-	-	-	-	-	37.76
Vehicles	37.90	46.00	-	-	40.00	-	-	27.00	37.85
Power generation	46.11	23.50	-	-	-	-	-	-	42.00
Chemical	45.53	41.29	-	-	-	-	-	-	45.00
Other**	59.00	53.00	-	-	-	-	-	25.00	45.67
Wood	47.83	42.78	85.00	46.25	38.40	-	49.00	-	46.54
Machines	45.00	61.00	-	72.00	-	-	-	-	46.61
Construction materials	50.10	42.11	52.50	-	38.00	-	-	-	46.65
Clothing	49.00	43.75	-	50.00	39.60	69.00	-	-	46.73
Food	49.47	43.39	28.00	46.40	56.80	-	-	-	47.48
Electric	49.60	47.50	38.00	-	-	-	-	-	47.63
Furniture	51.75	49.00	60.00	27.00	49.50	-	-	-	48.53
Metal	53.27	39.80	34.00	-	-	-	-	-	49.70
	47.30	42.36	47.25	46.63	43.92	69.00	49.00	26.00	45.94

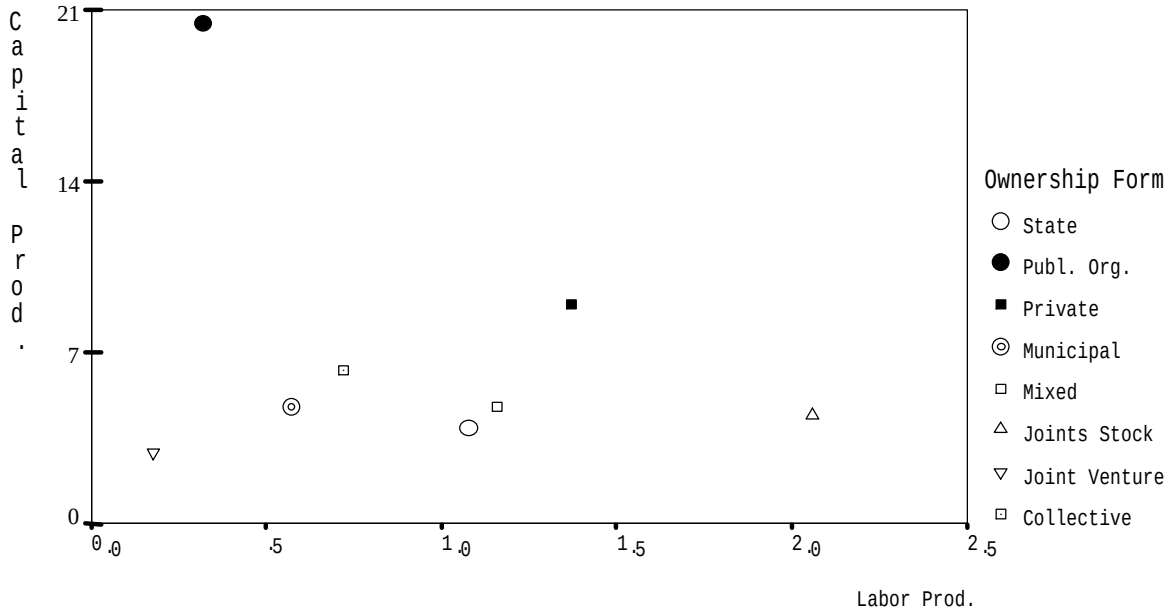
Arraying the values for average capital and labour productivity according to the different industries and ownership forms (see figures 2.4 and 2.5) illustrates the overall efficiency of an industry or property form -- i.e., the length of the ray from the origin to the respective industry. The further up and to the right of the figure a firm is the more efficient it is and the more it produces with given inputs.[12] Second, the flatter the angle from the X-axes to the ray connecting the origin and the respective point, the higher the capital labour ratio of the respective industry.

Figure 2.4. Labour and capital productivity by industry groups



Note: The averages were corrected for outliers by omitting single observations that reduce either the capital or the labour productivity by one-half. The firms that were identified as outliers by this method are listed in the text. A chi-square test for the independence of the subsamples was highly significant.

Figure 2.5. Labour and capital productivity by ownership form



Note: The averages were corrected for outliers by omitting single observations that reduce either the capital or the labour productivity by one-half. The firms that were identified as outliers by this method are listed in the text. The less represented ownership types public organisations: joint ventures and private are unreliable due to problems arising from the very small group sizes in these categories. A chi-square test for labour productivity was highly significant; for capital productivity, insignificant.

The more capital intensive industries -- power generation, mining and metal -- are found approximately along a single ray running from the origin to the metal industry, and they are characterised by very different levels of productivity. The wood industry, while not differing greatly in capital productivity, shows a much smaller labour productivity. This pattern suggests that Krasnoyarsk's most important industries differ substantially in their productivity. The relationship of productivity to type of ownership was not as clear.

Strengths and weaknesses analysis

The wood industry and the metal and mining industry dominate in Krasnoyarsk. They comprise many firms and a large number of buyers and sellers. Other industries of the region comprise a small number of producers, with a low level of integration in the economy. The wood and the metal and mining industries will be the major contributors to Krasnoyarsk's future economic development in the future, for they are the only two sectors providing a rich basis for endogenous development in the region. Should these two industries fall prey to a major crisis, then the future of Krasnoyarsk's economy will look bleak. At the same time, several of the region's industries are not well integrated and are structurally weak, but they have potential for further development. The power generation and the chemical industries could be alternatives for such economic development.

It seems that there is substantial room left in Krasnoyarsk to develop more upstream industries. Current industry groups focus almost entirely on the production of raw materials.

Aside from strength that comes with size, the wood and the mining and metals industries differ in their characteristics: the wood industry belongs to those industries in Krasnoyarsk that have intermediate efficiency. Its major buyer, the furniture industry, has a very low efficiency level. On the other hand, the metal and mining industry is split into two; the metal industry belongs to the more efficient industries in the Krasnoyarsk territory. Aside from the vehicles industry, which is similar to the furniture industry with respect to efficiency level, the machinery industry, the second most important buyer, is improving in performance. Thus, the mining and metal industry is the only industry connected to with an efficient local upstream industry.

Possible development options

Three of the major issues on regional development facing Krasnoyarsk are as follows :

1) Choosing a regional strategy based on export development or import substitution. Should Krasnoyarsk rely on international competition to trigger growth, or should it attempt to create new industrial branches to substitute for imported materials?

2) Determining the role of foreign capital. What role should foreign investment play? How large could this role be? What are the main impediments to foreign investments in the Krasnoyarsk territory?

3) Determining the chances of bottom-up development. What amount of growth could come from new industrial enterprises, or should the region's leading enterprises be used as the incubators for future growth?

All three issues must be viewed in the light of Krasnoyarsk's current economic structure, one characterised by an extreme specialisation, an almost complete absence of higher value added production, a lack of networks of supply or demand relationships within the market, and large scale production. Creating regional activities that provide the basis for endogenous development will require establishing new producer networks.

Krasnoyarsk's geography, its relatively small population and its unfavourable climatic conditions seriously constrain the possibilities for endogenous development in the region. The arctic climate precludes many activities, and the relatively small population limits the local demand.

Export-led versus import substitution

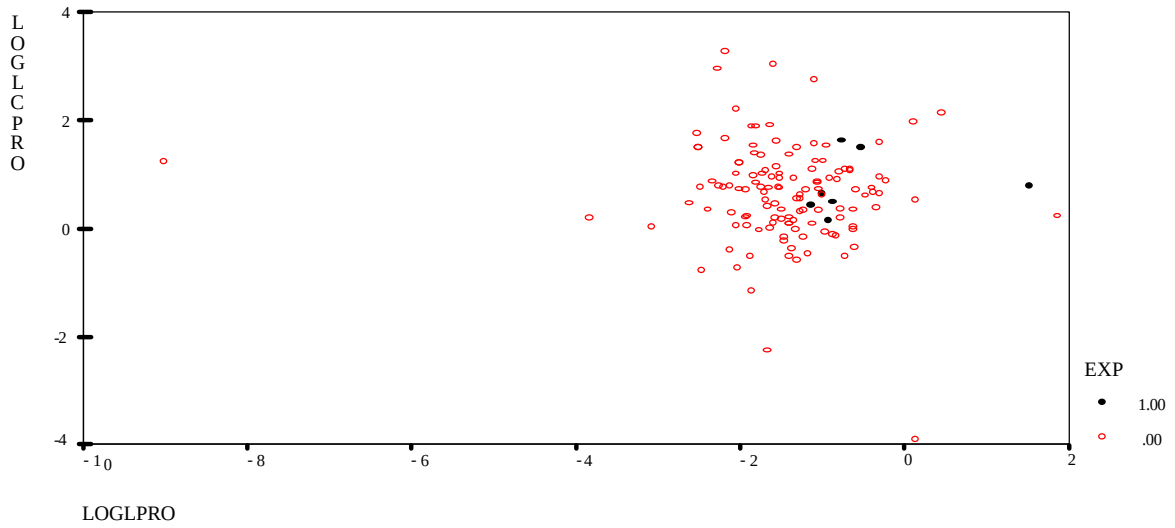
Krasnoyarsk's economy is relatively closed. Only 18 enterprises held export licenses in 1994. The three largest enterprises accounted for over 80 per cent of Krasnoyarsk's total exports. Non-ferrous ores -- copper, nickel, lead -- and all forms of rare metals are exported by the Norilsk integrated mining and metal works, aluminium is exported by three enterprises and oil and gas and machinery by one enterprise. The other enterprises export various types of "sawn-wood".

Krasnoyarsk's export structure strongly reflects its industrial specialisation, suggesting at first that Krasnoyarsk might specialise in goods for which it has a comparative advantage. However, this is not an argument for export orientation and against import substitution. The problem of whether an industry should focus on exports or on import substitution should be seen in the context of a dynamic development of new comparative advantages rather than in terms of an option for permanent import substitution, where a country permanently opts out of the international division of labour. The substitution of imports in production areas that have no chance of ever becoming internationally competitive will lead to welfare

losses in the country. This fatal strategy is exemplified in the situation of the Albanian economy and can also be seen in some former Soviet republics.

Based on the available data, we can crudely address the hypothesis that export orientation leads to higher efficiency: if export orientation increased efficiency, we would expect firms that actively export their products to be located further to the top right hand corner of the Labour and Capital productivity diagram (see figure 2.6). We analysed data for the wood industry which had seven enterprises with export licenses in 1993. In general, the exporting enterprises in the wood industry do seem to cluster in the top right hand corner, although there are many non-exporting wood enterprises that are more efficient.

Figure 2.6. Capital and labour productivity of exporters and non-exporters in Krasnoyarsk



Note: Both axes are measured in logarithmic scale. 1 refers to the enterprises that held an export license, 0 to those that did not.

Results concerning labour and capital productivity are more revealing: both exporting and non-exporting enterprises have similar average capital productivity (2.61 and 2.92 respectively) and the null hypothesis, that these averages are equal, cannot be rejected. Exporting enterprises have a labour productivity of 1.01 while non-exporting wood enterprises' labour productivity level is only 0.35. The null hypothesis that these means are equivalent can be rejected at the 1 per cent significance level. This result suggests that with the abolition of foreign trade organisations, firms that engaged in export have exhibited higher labour productivity levels due to the positive effects of a direct export orientation. However, capital productivity levels did not increase as significantly, because binding liquidity constraints put a ceiling on the amount of investments that could be undertaken. It appears, therefore, that at least the weak evidence available does not contradict the hypothesis that export orientation enhances efficiency.

An export-led approach will be up against hard constraints: first of all, the poor condition of the infrastructure. Industries that attempt to internationalise will face serious problems both in telecommunications and transport. Second, such a strategy is clearly not a short-run option: from its intention, it is much more of a long-term strategy that cannot be expected to bring short-term gains. This is a situation that could seriously limit the political feasibility of such an approach.

The role of foreign capital

At the beginning of economic transition, officials in both Western and transition countries hoped that foreign investments might play an important role in economic development. Foreign direct investments might help finance the transition economies' enormous capital requirements, transfer western management and marketing know-how to the transition economies, and finally aid the achievement of privatisation and thereby depolitization. Foreign investments (in per capita terms) in Russia have, nevertheless, remained small and analysts expect few changes in the future.

There are only two joint ventures among the database's 583 firms from Krasnoyarsk. These two joint ventures (one in the wood industry and the other in the vehicle industry) account for 2.6 per cent of the database's total regional employment and less than one percent of its production value. No information is available on the effects of foreign involvement on the firms' efficiency. Looking at the whole data set on Russian enterprises, no evidence can be found that would suggest that joint ventures are more efficient or that a substantial shift in productivity occurs through a transfer of knowledge.

The relevant policy questions are: what is causing the slow flow of foreign capital to Krasnoyarsk? And, what conditions would enhance foreign direct investments?

Studies on foreign direct investments stress the importance of the size of the market and the presence of risks. Nagaev (1994) assessed the presence of risks in Russian regions (oblasts) and ranked Krasnoyarsk, in terms of economic indicators, in the middle (48th among 88 in banking and 54th in privatisation). Krasnoyarsk ranked very low on the social scale, lawlessness and crime, and infrastructure. On the other hand, Krasnoyarsk ranked high both on the labour force quality scale and in terms of ethno-political stability.

Krasnoyarsk is relatively politically stable, which is a sine qua non for attracting foreign direct investments. At the same time, the average profitability of enterprises in Krasnoyarsk is relatively high. This suggests that careful investors can expect high returns on investments.

Table 2.49. Ranks of Krasnoyarsk according to economic and socio-demographic characteristics

Characteristic	Rank	Characteristic	Rank
Finance and banking	48	Demography	64
Privatisation	54	Social situation	65
Labour force quality	13	Ethno-political	15
Communication & infrastructure	61	Population behaviour (strikes, criminality)	72
Ecology	67		
		Overall rating	53

Source: Nagaev (1994).

Major hindrances to foreign direct investments remain in Krasnoyarsk, most of which relate to such issues as: lawlessness, crime, strikes and the lack of adequate infrastructure. In particular, a poor infrastructure seems to weigh most heavily on foreign direct investments in Krasnoyarsk, for most of the region's goods (e.g., wood and metal) are relatively transport-intensive.

The demographic trends, ecological problems, an underdeveloped banking sector, and the slow pace of privatisation may also hamper foreign investment. Investors interested in long-run returns on investment may be forced to pay relatively higher wages to keep workers in Krasnoyarsk and attract immigration into Krasnoyarsk territory.[13] The underdeveloped and the slow pace of privatisation are probably short to medium term impediments to foreign investments. As experience with international financial markets increases, the banking sector will develop and, in the long run, further privatisation will make more enterprises available to foreign investors.

Table 2.50. Estimates of capital requirements for Krasnoyarsk (US $ billion)

	g=0		**g=20%**		**g=40%**	
	NOM	PPP	NOM	PPP	NOM	PPP
a=0.6	136.68	99.10	123.02	70.03	110.22	54.42
a=0.5	173.02	145.39	164.58	115.89	156.35	101.94
a=0.4	193.28	177.40	188.41	150.03	183.58	139.64

Notes: a - measures the additional production per capita one additional unit of capital produces; g - is an indicator of the efficiency losses under socialism; PPP - signifies that investments needed were estimated using purchasing power parity exchange rates; NOM - means that investments needed were estimated using nominal exchange rates. For more details on the methodology used, see Collins and Rodrick (1991).

Estimating the capital requirements necessary to make Krasnoyarsk's productivity equal to that of the Canada's (Canada is used because it is comparable in size and climatic conditions to Krasnoyarsk) shows that between $ 80 billion and $150 billion would be needed (see table 2.50).[14] Such sums reveal the immensity of the restructuring costs and imply that foreign direct investments alone can't raise the region's productivity levels to western levels.

Policies designed to attract foreign capital have so far centred on the following three issues. First, sub-regions were emphasised through "regional marketing" efforts that publicise different localities within the region.[15] Second, large scale infrastructure development projects were promoted, such as the development of the Angara basin and the development of a new north-south air route to make the region more accessible from the south-east Asian area. Third, efforts were made to reduce investment risks in Russia -- namely the creation of an off-shore zone and possibilities for guaranteeing the investments of foreign companies (for instance with Krasnoyarsk's gold reserves).

Chances for "bottom-up" development

Bottom-up development refers to the process of starting new, small-scale businesses in the region. In most western countries, such new businesses provide much of the new employment and contribute substantially to the regional growth. In transition economies, the process of establishing new enterprises significantly helps privatisation and the depolitisation of the economy.

The formation and registration of new enterprises in Krasnoyarsk have been modest (see table 2.51). Only about 5.5 enterprises were registered per 1 000 between 1991 and 1994.[16] If the individuals who registered are included, then newly registered enterprises amount to about 10 per 1 000 inhabitants. Enterprise "deregistration" was rather low, suggesting a relatively high stability of newly registered enterprises.

Table 2.51. Registration and deregistration of new enterprises

	1991	1992	1993	1994	Total
Registered Enterprises	3388	5774	4860	3057	17079
Individuals Registered	526	2371	3146	7592	13635
Deregistered Enterprises	205	166	667	883	1264

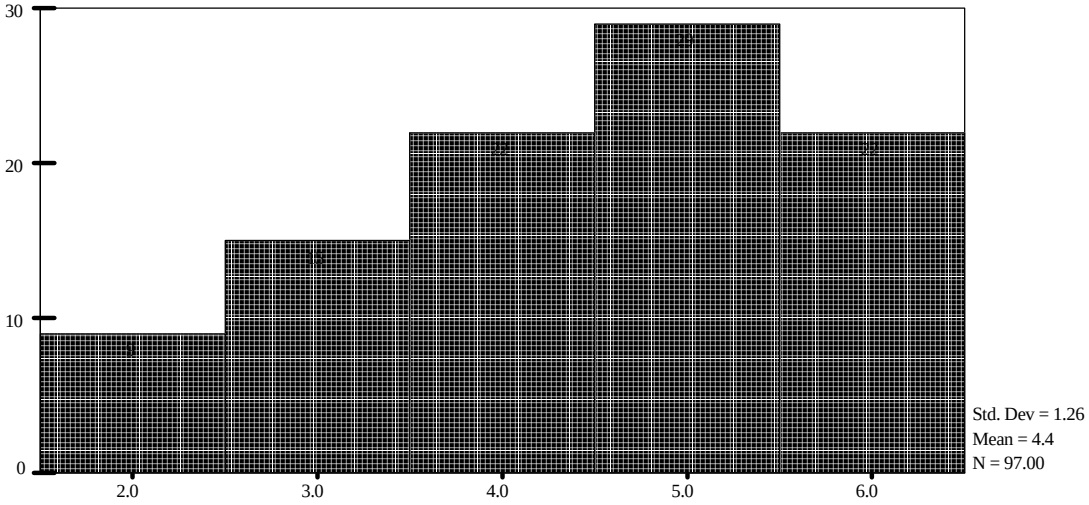
The sample data on firms in Krasnoyarsk includes a firm's founding date which allows an analysis of the subset of new firms. This data has some serious drawbacks[17] Of the enterprises founded after 1989, nine employ between 1 000 and 10 000 employees. The largest, "KANSKLES", which operates in the wood industry, employs 6 136 employees. Only 22 enterprises employ less than 100 employees. Similarly, of the 97 enterprises founded after 1989 seven were former state-owned companies, and one was formerly of municipal ownership. Among 97 enterprises 81 were joint stock companies, mixed enterprises or collective enterprises -- typical ownership forms for newly emerging entrepreneurs.

Excluding large enterprises or state-owned ones from the list of the newly founded enterprises is not always warranted, for some joint stock companies were founded by owners with sufficient capital to finance large scale production, or grew so rapidly that they became sizeable employers by 1993. Excluding certain size classes would then ignore these "success stories". In addition, it seems unwarranted to exclude the newly formed state-owned enterprises and the municipal enterprises. These may reflect a situation where enterprises owned by the government are taking on entrepreneurial roles. Therefore, rather than exclude cases, we focus on enterprises that registered as newly founded after 1989.

Despite the severe data problems associated with the founding date, the branch structure of the database's newly founded enterprises appears reasonable. One would expect new enterprises in industries with low failure costs, i.e. in less capital intensive industries such as wood, clothing, food and construction materials rather than in capital intensive ones (mining and power generation). Most newly-founded enterprises are in the wood, food, and construction materials industries. None were in the power industry or mining. The construction materials, food and furniture industries have the highest share of newly-founded firms and of the newly-founded joint-stock companies.

The data on newly-founded firms indicates that considerable restructuring has occurred in Krasnoyarsk. Around 30 per cent of all enterprises surveyed underwent organisational changes large enough to qualify them as newly-formed enterprises, with some industries reporting as many as half of the firms as newly-formed companies.

Figure 2.7. Size distribution of enterprises founded after 1989



Note: The group numbers have the following meaning: 2: 1000-9999 employees; 3: 500-999; 4: 250-499, 5:100-249; 6-1.

Table 2.52. Enterprises founded after 1989 by industry and ownership type

	State	Joint stock	Mixed	Municipal	Collective	Total	Sample size	%
Food	1	22	-	1	4	28	55	50.9
Wood	3	21	-	-	3	28	104	26.9
Construction materials	-	8	1	-	4	13	23	56.5
Clothing	-	6	-	-	3	9	21	42.9
Furniture	-	4	-	-	3	7	14	50.0
Metal	2	2	-	-	-	4	19	21.1
Chemical	-	3	-	-	-	3	15	20.0
Other	-	1	-	-	-	1	3	33.3
Elec. eng.	1	-	-	-	-	1	6	16.7
Vehicles	-	1	-	-	-	1	15	6.7
Print / Publishing	-	-	-	-	1	1	19	5.2
Machines	-	-	-	-	1	1	20	5.0
Mining	-	-	-	-	-	-	11	0.0
Power gen.	-	-	-	-	-	-	4	0.0
Total	7	68	1	1	19	97	329	29.5

There are distinct differences in the sector focus of newly formed enterprises in the sub-regions. In the central region and in metropolitan Krasnoyarsk, newly founded firms are more or less evenly distributed across industries. In the north and in Angara, the majority of new firms operate in the wood industry. In the southern region the majority operate in the food industry (see table 2.53).

Since there is substantial evidence that the data on newly founded firms is biased due to the number of organisational changes in the structure of industry in Krasnoyarsk, we use additional information on the depreciation of the capital stock in the territory[18] to measure the situation of new firms.

Table 2.53. Newly founded enterprises after 1989 by industry and region

	Metropolitan Krasnoyarsk	**Central**	**Angara**	**South**	**North**	**Total**
Wood	3	7	14	1	3	28
Food	3	8	6	11	-	28
Construction materials	6	6	1	-	-	13
Clothing	4	3	-	2	-	9
Furniture	2	3	-	2	-	7
Metal	3	-	-	-	1	4
Chemical	2	1	-	-	-	3
Vehicles	-	-	-	1	-	1
Print / Publishing	-	-	1	-	-	1
Other	-	1	-	-	-	1
Machines	1	-	-	-	-	1
Electrical eng.	-	1	-	-	-	1
Power generation	-	-	-	-	-	-
Mining	-	-	-	-	-	-
Total	24	30	22	17	4	97
Sample size	86	106	70	28	12	302
%	27.9	28.3	31.3	60.7	33.3	32.1

The regional government has supported the founding of new firms by guaranteeing substantial subsidies to newly founded enterprises and by providing a tax holiday for the first two years and a 50 per cent tax reduction the third year after founding. This policy, however, has resulted in a power struggle between the region's newly established enterprises and the older, large-scale enterprises. Many older enterprises have established dependent small "satellite" enterprises to qualify for tax concessions. It is difficult for newly-founded enterprises to counteract or to seek legal protection because Krasnoyarsk has no anti-monopoly or unfair practices legislation.

3 - ENTERPRISE RESTRUCTURING: A CASE STUDY OF KRASNOYARSK'S ALUMINIUM ENTERPRISE (KRAMZ)

by Junichiro Miyabe

Background

Nomura Research Institute has conducted a series of consulting projects that assist Russian manufacturing enterprises formulate their restructuring plans. This project is sponsored by the Ministry of International Trade and Industry (MITI), Government of Japan, as part of its effort to provide technical assistance to Russia and other former Soviet Union and Central and East European countries. A team of management consultants, technology specialists, and economists has worked closely with enterprises and their management to formulate a viable restructuring plan. NRI, MITI, enterprises, and the State Committee on Industrial Policy (Goskomprom) of the Russian Federation have all worked together on this project.

This paper presents a case of an enterprise that is struggling to adjust to the continuing process of transformation from a command economy to a market economy. One case may not tell the entire story for each of Krasnoyarsk's enterprises; however, we believe that many of the issues we have encountered here are indeed common to all Russian manufacturing enterprises. Therefore, we believe that the general conclusion and recommendations in this area can be adopted by other enterprises.

Basic standpoint

We approached the restructuring problem by first accepting the following three tenets:

- the peculiar business environment facing Russian manufacturing enterprises must be recognised;
- conclusions must consider an enterprise's past history and experiences, for management is a continuous process and past experience prevails;
- a dual approach that faces the present economic situation and prepares to secure growth in the mid- to long-term is needed.

Issues to be addressed

Russia's manufacturing enterprises are facing unprecedented change in their business environment. Faced with a radically changing economic system, their immediate concern is survival. A state-owned, state-operated enterprise's transformation into self-governed, 'private' concern is an all

encompassing process that requires all of the resources an enterprise can muster. As the economy has adopted the characteristics of a market economy, new and more complicated issues have emerged and uncertainty continues.

The fundamental transformation issues can be summarised as follows: First, the enterprise's decision making process must be internalised. Although management previously participated in the planning process, the decisions on production, delivery, and investment were made externally. Management now decides what to produce and where to sell it, and it bears full responsibility for the outcome of these decisions. Their new responsibility includes being able to adjust plans to business realities. Second, the enterprise's management must face market realities. Previously, sales activities were completed when the product was shipped out of the factory gate according to the plan. The collapse of the command economy has extended the sales activity to the customer's gate and includes searching for clients. Third, product quality and efficiency have become keys to the enterprise's acquisition of a stable client base. Management must now undertake to motivate employees to adopt these new concepts in their daily work. These issues require a complete restructuring and reorientation of an enterprise's activity.

Overview of KraMZ

The Krasnoyarsk Metallurgical Plant (KraMZ) is an aluminium product manufacturer located in the city of Krasnoyarsk. During the Soviet era KraMZ was a major manufacturer of aluminium parts and equipment for the aircraft and other military-related industries. KraMZ is now a joint stock company.

KraMZ was selected as a client enterprise because: first, it met all programme criteria and was willing to formulate a restructuring plan. It also expressed a willingness to work with Japanese consultants. KraMZ can be considered to be a model for other Russian enterprises undergoing the restructuring process. Second, since KraMZ is an aluminium product manufacturer, export markets are not automatically open to its production. Resource-related enterprises, such as aluminium foundries, can more easily turn to export markets to offset domestic sales declines, but manufacturing enterprises have no such alternative. The latter are forced to restructure.

KraMZ mainly produces cast, extruded and forged products. The cast products, aluminium billet and alloy, are primarily for internal consumption. Extruded products comprise tubes, rods and construction materials. Forged products are aluminium wheels for automobiles and centrifugal equipment for food processing industries. KraMZ is planning the completion of a rolling mill to produce aluminium foil.

KraMZ's 1990 production volume was 280 000 tons, but more recently production volume has declined. 1994's production equalled only 55 per cent of the 1990 level. The decline was strongest in extruded and forged products. The share of cast products has increased from 50 per cent to to 80 per cent of the 1990 level.

Employment at KraMZ has declined significantly since 1992. The previous work force level of 9 200 declined to 7 100 by November 1994. 73 per cent of the labour force are factory workers, 17 per cent are engineers and technicians, 9 per cent are administration and management, and 1 per cent are other workers.

The decline in domestic demand, including a drastic contraction in the demand for military-related products, has forced KraMZ to turn to export markets. KraMZ first relied on the export of billet to help their cash flow. However, since such exports are conducted under spot contracts, KraMZ hasn't yet found a stable, long-term foreign partner for their products.

Export activities are important to Russian enterprises and KraMZ for reasons beyond the acquisition of hard currency income which can be used to finance the renovation of their production equipment. The export markets of advanced countries -- including Western Europe, the United States, and Japan -- are the most difficult and challenging markets for emerging Russian enterprises. Selling in these markets gives management the valuable opportunity of objectively evaluating their products and their technological capability against foreign competition. This experience will be a learning process of marketing know-how, a sort of on-the-job training for Russian enterprises.

KraMZ has actively sought export markets and has set up joint ventures with European firms to produce aluminium wheels for automobiles. At first, they encountered quality problems and difficulties in sales and marketing. They are quickly learning from these experiences. Even if current exports are through spot contracts, the fact that their product succeeds in western markets has significant meaning for KraMZ.

Sales in monetary terms have expanded rapidly because of high inflation, and KraMZ has successfully recorded profits every year. However, the profit rate is declining, for production costs have escalated faster than product prices. Material, labour, energy, and other costs have grown significantly. Barter trade has also strained profit levels, though it might be the only viable means of keeping business with other former state-owned enterprises.

Besides the overall change in 'the rules of the game', the major business environment issues confronting KraMZ are that:

- the business links previously taken for granted were disrupted by the dissolution of the Soviet Union;
- military spending was drastically reduced, resulting in far fewer military orders. The defence budget cut was felt across the entire industry;
- rapid inflation, brought on by the liberalisation of January 1992, saw large price increases exacerbate the linkage problems and create arrears;
- a general uncertainty and unpredictability has affected the business thinking of managers.

Business environment changes have forced enterprises to change their internal organisation and how they do business. They must make the following necessary adjustments:

- internalise their decision making process;
- establish procurement, production, sales and marketing activities based on a notion of efficiency and profit;
- adjust internal organisation to conform to new activities;
- adjust their relationship with employees; and
- change their employees' views on a for-profit organisation.

KraMZ's products and technology

An analysis and evaluation of KraMZ products and production technology was conducted by the project team together with engineers from the Japan Light Metal Association (JLMA). The materials used in their product passed Japan Industrial Standard (JIS) specifications. Thus, there seem to be no major problems on the basic quality of KraMZ products. However, Japanese manufacturers use more stringent standards for their procurement, so KraMZ needs to pursue further quality control measures to anchor their competitiveness in export markets.

Forged and extruded products appear to have some quality problems. However, these problems can be solved without major investment. Figure 3.1 shows the summary of SOWT analysis from an engineering point of view.

JLMA engineers also found possibilities for improving productivity and product quality through improving the layout of the shop floor.

Financial management and internal organisation

Financial management

The accounting and financial management challenges faced by KraMZ are common to all Russian enterprises. Although accounting practices have been improving in Russian enterprises, much more needs to be done. While individual enterprises need to improve their accounting practices, a solution requires governmental initiative in creating and establishing accounting rules and conventions.

Enterprises rarely ask an outside CPA to audit financial statements. When our team worked with KraMZ's Accounting Department managers, we found that they had no experience with outside auditing. There seems to be no incentives for enterprises to voluntarily accept outside auditing, except if conditions demand it, such as in the case of joint venture negotiations with western corporations.

In a related area, it appears that management information, including financial data, is shared by only a few top executives. Thus, those responsible for day-to-day operations often make important decisions that are directly related to the well-being of the enterprise without being able to consider the overall status of the enterprise. This tendency to piecemeal decision-making has led to unnecessary declines in productivity and/or to failures in seizing opportunities. The concepts of cash flow management and return on investment are something new to the management.

The existence of barter trade poses another financial management problem. The widespread use of barter trade was a spontaneous effort to cope with arrears and a desperate attempt to keep inter-enterprise links. However, barter trade tends to force suppliers to discount product prices. It also forces on suppliers the extra effort of disposing of the received bartered goods, and it strains their cash flow.

Internal organisation

Top KraMZ management consists of nine directors, including the president. They are responsible for: technology, production, economy and finance, personnel, quality control, procurement, sales and marketing, renovation and development, and computer systems.

Production workers account for the largest share of work force reductions. Thus, the ratio of non-production employees has been rising. Despite the decline in employees, KraMZ continues to recruit workers in relatively large numbers. This indicates that the retention ratio of workers has decreased and that the turnover ratio is on the rise. A high turn over ratio suggests that KraMZ may be having difficulties in retaining the production skills embodied in workers.

Internal organisation issues are summarised by the following three points. First, management's goal was too vague. Top management has a high level of managerial capability. To exert fully their potential capacity, goal setting is essential. Second, information flows poorly within the organisation, resulting in lack of co-ordination. Third, KraMZ employs over 1 000 employees in its special welfare section. These employees maintain the health, education, recreational and housing facilities at KraMZ and have a direct impact on the living conditions of the workers.

Sales and marketing efforts require strengthening. The number of KraMZ customers has declined significantly since 1990. This drop led KraMZ to establish a sales and marketing department three years ago. If one considers that sales and marketing activities were non-existent during the Soviet era, then KraMZ's effort is significant indeed. Yet, a further strengthening of sales and marketing personnel is essential to the stability and growth of KraMZ. Market information and customer preference should be linked to product development and production planning.

Recommendation by NRI

The restructuring of KraMZ spans every aspect of corporate activity and should underscore the concept and convention of corporate behaviour. Thus, the restructuring plan that KraMZ management and the NRI consultant discussed started with a corporate vision and overall goals. Figure 3.2 schematically summarises the fundamental strategy for KraMZ.

Short-term management goals should be threefold: securing profitability, improving the technology base, and strengthening the sales capability. This plan establishes the base for survival in the current turbulent condition and also provides for healthy and stable growth in the future. Long-term goals focus on re-establishing KraMZ as one of the leading Russian companies with technological leadership and high quality products. Specific recommendations covering technology, products, organisation, financial and personnel management reached well over 200 items. A summary of our recommendations is presented here.

Technology

Our recommendations centred on improving productivity and the quality of products and most of them could be implemented immediately. Moreover, most of them require no major investments. Our recommendations include putting the shop floor in order, readjusting the layout of production equipment, reducing the number of products, and re-establishing the quality control system. Mid- to long-term measures centred on improving competitiveness in export markets.

Accounting and financial management

Our recommendations on accounting and financial management aimed at securing the survival of KraMZ in the short-term and at forming a foundation for stable growth. Most of our recommendations are common practices for developed-country corporations. The introduction of cash flow management is crucial for KraMZ in view of the underdeveloped commercial banking sector. Cost reduction is required for financial health. However, cost reduction is not the responsibility of the accounting department alone,

but that of every manager, from the president to the foreman on the shop floor. Effective cost reduction and efficient operation thus require every manager to share information on the status of the operation.

In making our recommendations, we assumed that the high inflation of several percentage points per month or more will eventually subside. The nominal profit for the past years has been produced, at least partly, by high inflation. Across the board price hikes enabled enterprises to realise nominal profit by, for example, holding materials for a short time and then reselling them. Such 'easy' profits will disappear the moment inflation subsides.

Organisation, personnel management. and marketing

At the core of our recommendations is readjusting the KraMZ's internal organisation, human resource development, and its review and evaluation system. Reducing non-production departments, including headquarters, is recommended, as is shifting more resources to the sales and marketing departments. The organisation should also adopt a divisional structure according to major product lines.

When heated discussions are over

The project team's task was to formulate a restructuring plan for KraMZ together with its management. Throughout the project period, top managers of KraMZ and NCI's consultants had intensive discussions over every aspect of the KraMZ operation. Many suggestions were made during those discussion meetings and some of them were adopted immediately.

Four months after the final discussion and delivery of NCI's report, KraMZ began internal discussions on implementing their restructuring plan. We can confirm that KraMZ renewed its efforts to strengthen the marketing activity on aluminium wheels and food processing machinery. KraMZ engineers began working on rearrangement of their production machinery to improve both productivity and quality. Moreover, KraMZ began preparation for auditing by an outside CAP within one or two years.

Some personal thoughts

Based on the experience gained from participating in this project as an economist and from other micro-economic analyses made during the past four years, I conclude with some personal thoughts.

The three years following January 1992's price liberalisation have been, perhaps, the harshest and most turbulent period 'enterprise' has experienced in modern history. Rapid and complete transformation of the economic system from a centrally-planned, command economy to a market economy has forced Russian enterprises to restructure themselves in a very short time. This restructuring is indeed the creating of an 'enterprise' from its basic concept; this process took perhaps over a hundred years in western industrialised countries. Managers of Russian enterprises undoubtedly exerted all their capacity to cope with such turbulent conditions. In general their track record is well over the passing mark.

The past three years can be considered as a moratorium period for Russian enterprises. Most of them were able to conduct many 'experiments' without fear of insolvency. There exists the law on bankruptcy, but it has been rarely executed. Russian managers' seemingly conflicting behaviour often turned out to be quite logical reactions if viewed in light of their past experience.

This moratorium period will inevitably end when general economic conditions stabilise, as recent macro-economic indicators seem to be showing. It is time to adopt the lessons learned through the 'experiments' of the past three years. The remaining part of 1995 and the first half of 1996 will be the

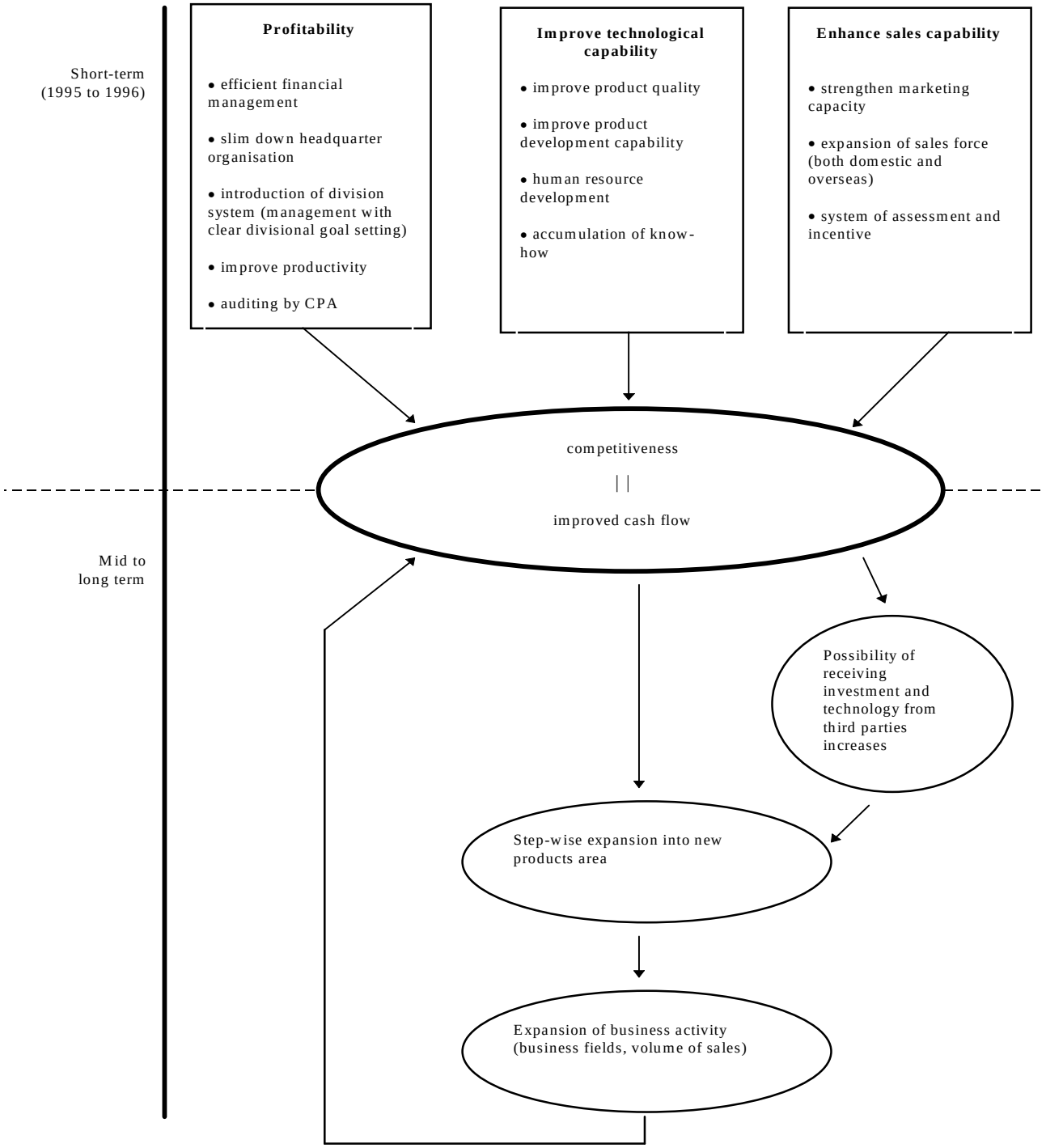
'final examination' period for Russia's manufacturing enterprises. There is much to be done by both central and local governments to support enterprises' efforts.

KraMZ has the will and capacity to face this challenge. Whether they succeed is beyond our capacity to forecast. However, they will certainly try their best.

Figure 3.1. SOWT Analysis of KraMZ Technology and Products

	Strength	**Opportunity**	**Weakness**	**Threat**
Common to all products	- Product price is low - Major aluminium product manufacturer in Russia - Possess high-level manufacturing facility and equipment	- Expansion of export	- Weak sales and marketing - Insufficient product quality - Low profitability and difficulty in funding investments out of its cash flow	- Soaring material prices - Soaring transportation costs - Delay in recovery of domestic market
Casting	- Possess high-level melting facility	- Expansion of products into downstream product area	- Insufficient quality in terms of purity and mechanical strength - Relatively low production capacity of casting equipment	
Extrusion	- Possess capacity to produce variety of products - Already possess more than enough equipment	- Recovery of domestic market	- Surface precision - Low productivity	
Forging	- Possess high-level facility	- New market opening	- Does not possess inspection facility - Does not obtain quality certificate	- Requires time to open to new market

Figure 3.2. Restructuring plan for KraMZ



4 - THE FORESTRY SECTOR

by Michael Obersteiner

Summary

Krasnoyarsk's forest resources, especially the coniferous stock, are enormous and little used -- about 20 per cent of the annual increment of standing wood is used. A large share of Krasnoyarsk's forestry output is sold internationally. Forestry harvests have declined since 1989, largely from infrastructure problems and a lack of investment.

Most control over forests remains in the federal government's hands. While an increasing number of forest product enterprises have become joint-stock companies, the forest lands remain federally owned. Local control remains relatively weak in comparison to many Western countries. Recent legislative and tax code changes have at times created a cumbersome regulatory framework, with little emphasis placed on enforcement and engendering some corruption.

The forest industry's factor costs are presently both internationally and interregionally competitive for high-value added products. Increasing competitiveness, however, will require raising product quality and establishing a professional marketing infrastructure. The latter will require an improved communication infrastructure and an accumulation of business experience. Increasing transportation and energy tariffs are undermining the competitiveness of Krasnoyarsk's forest industry. The efficient use of fibre also remains a problem at many enterprises. The forest industry will soon face fundamental changes, especially in environmental regulations, to meet future international market requirements. Long-term production increases will require major investments in infrastructure and capital improvements, many of them to meet the new requirements.

Krasnoyarsk's forest industry is overstaffed and will probably need to halve its labour force in the near future. A three-fourths reduction of staff is likely over the long run. Additions to capacity -- either through domestic or foreign investments -- seem unlikely, so most layoffs would be permanent.

Major impediments to expanding production lie in the lack of technological and co-operative ties between logging, woodworking, and pulp and paper enterprises at the regional and interregional levels; low technological production levels; inefficient transportation; insufficient social infrastructure; lack of personnel who are knowledgeable about working under market conditions; and a weak legal basis for proper forest use.

Institutional uncertainties (property rights, tax system, physical security of plant and equipment, etc.) and uncertainties about the future transport system and its tariffs are deterring investments. The forest industry possesses a factor competitiveness and the standing timber is high quality, so a reduction of uncertainties could lead to a flow of investment.

The resource base

Krasnoyarsk's forested area is 111.261.900 km^2, which equals 28 per cent of the inventoried forested area of Canada (see table 4.1). Its growing standing stock equals about 60 per cent of Canada's, 97 per cent of Western Europe's, or 5.1 per cent of the world's total exploitable forest resources. Krasnoyarsk could be a major national and international player in the forest industry.

Krasnoyarsk uses a relatively small share of its total forestry resources. The total annual volume harvested in Krasnoyarsk is only 13 per cent of Canada's total harvest. Annual increments to stock were five times larger than the annual harvest. Harvest levels, when compared to the Annual Allowable Cut (AAC), are considerably lower than the levels elsewhere in Siberia for almost all tree species.

Structure of ownership and forest management

Russia's present legal and forest management systems foster high, short-term profitmaking while degrading the forest ecosystem. They also fail to provide the regional administration with sufficient revenue. About 95 per cent of Krasnoyarsk's forest fund[19] is under federal State Forest Management, 1.6 per cent belongs to other industries, and the rest, to agricultural organisations.

The legislation affecting Krasnoyarsk's forest management emanates from the central state powers. Forest industry producers have sought ownership of or long-term leases for some of the forests, but the Russian Duma remains wedded to the 1993 legislation keeping federal control. In response to ownership pressures, the Russian Duma gave large federal budget subsidies -- mostly to the company Ruslesprom, a spin-off from the former Ministry of Forest industry. Forest management, as currently practised, mainly involves 50 years of large-scale, clear-cut harvesting in one area, followed by moving to the next virgin site, an approach far from any system of sustainable forestry.

The size of Krasnoyarsk's leasing fees are minuscule in comparison to Western leasing fees. These low fees subsidise the forest industry, but at the same time provide insufficient revenues for regional budgets, especially for basic forest management (reforestation and fire protection).

Annual allowable cut (AAC)

The Annual Allowable Cut (AAC) may indicate potential harvest levels[20], but it cannot determine a long-term, sustainable cutting regime. Krasnoyarsk's AAC issues from a complicated procedure -- the Russian Federal Forest Service, different provincial authorities, and the Ministry of Ecology and Natural Resources recommend estimated AACs. (Scientific and political questions often surround the levels of the AACs, and the AACs are subject to changes during the year.) The established AACs are distributed to the different regions. They vary according to regional climatic and geomorphic differences. Only a small fraction of Krasnoyarsk's AAC is currently being harvested.

The AAC does not reflect a volume that could be harvested technically or economically, for some forest areas are inaccessible by roads or do not permit ecological exploitation. A survey of several hundred Siberian harvesting enterprises revealed that they were not located where the growing stock was high, but where infrastructure was already built for other industries, principally in the 'Territorial Production Complexes'. One such currently planned complex in the Lower Angara region (Nishnee priangarje) would, however, feature the forest industry. One expert concluded that this region's forest industry had a greater economic potential over other industries and could become one of Russia's most profitable regions.

Harvest levels and trends

The AACs and reported harvest levels often differ.[21] In Siberia only 37 per cent of the AAC was harvested, and in Krasnoyarsk, only 27.4 per cent. Some experts have explained the relatively low harvest levels in the European part of the former USSR by the following general causes:

- too many authorities involved in the decision process;
- defective administration and planning systems;
- regional overharvesting and deforestation;
- mismanagement and lack of silviculture measures;
- waste of raw material;
- forest fires;
- lack of skilled labour; and
- inefficient forest industry.

Forestry harvests have declined since 1989. This downward trend does not stem from any arbitrary AAC reductions, but is linked to a general deterioration of the infrastructure and reduced investments in the harvesting sector.

A statistical analysis revealed that the Tyumen, Krasnoyarsk and Irkutsk regions accounted for the largest total output of timber and the largest harvesting enterprises. This concentration of logging operations has increased the average extraction distance. In Krasnoyarsk the average hauling distance for one cubic meter was calculated to be around 55.6 km in 1989 and 56.2 km in 1992.

Forest harvesting enterprises were designed to operate for a limited time (40 to 80 years). After most of the timber was harvested, the sites were abandoned and closed. Future harvesting operations should be designed to support the practice of sustainable harvesting. The present economic and legislative situation favours such management options.

Quality of wood harvested

About 79.2 per cent of Krasnoyarsk's total 1989 harvest (76.6 per cent in 1992) was delivered as industrial wood (see table 4.2). The rest of the harvest was consumed as fuel wood, roundwood for construction, inputs for the chemical industry, harvest losses and transportation losses to processing facilities (located at the lower landing or beyond the lower landing). The declining share of industrial wood in the total wood harvested indicates that buyers are becoming more aware of quality.

Limits on exploitation of resources

The classification of forests establishes the permitted usage. Russia classifies its forest according to the following functional groups:

Group 1: protected forests. There are 23 sub-groups, 13 of which prohibit industrial felling and 10 permit felling only under strong ecological restrictions. This group accounts for 31 per cent of the total forest fund area.

Group 2: protected forests with restricted possibilities for industrial exploitation (2 per cent of total forest fund area).

Group 3: forests chiefly for industrial exploitation (67 per cent of total forest fund area).

Labour constraints

Siberia's forest industry and harvesting enterprises have traditionally faced an acute labour shortage and high labour turnover. Stalin's labour camps gave forestry work the reputation of being for criminals or people who cannot get other employment, i.e. of not being a respectable job.[22] In Siberia and the Far East the labour turnover has exceeded one hundred per cent from 1965 to 1975 (Blandon 1983). Of the people leaving forestry in 1975, one-fifth complained about the poor living conditions and the lack of facilities associated with a career in forestry and the concomitant necessity of living in remote areas. Nearly a third left for reasons concerning the nature of work in the logging industry, the heavy physical nature of the job (Traktinski 1977; cit. Blandon 1983). Moreover, the housing, social services (such as child-care), educational and medical facilities, and retail shops available to forestry personnel are relatively inferior.

Productivity constraints

Only a few Siberian enterprises are estimated to work with highly-productive equipment (5 per cent of all employees were employed by enterprises of this category). Future investment in the harvesting sector will likely have to include a training programme for workers; yet, a high labour turnover could make such programmes costly and difficult.

Krasnoyarsk's 1989 physical labour productivity (at 550 CUM per production worker) exceeded the Siberian average. However, most equipment needs replacing in the next 3 to 5 years. Krasnoyarsk is competing with other regions of Siberia to attract investment of high productive machinery. Productivity will also depend greatly on the local environmental conditions and on the harvested area's previous cutting regime.

Efficiency of fibre use

Large amounts of wood fibre are left out of the forest industry's fibre supply circle in Krasnoyarsk. While production complexes were designed to minimise waste, wood waste reduction has proven difficult to achieve in practice. In Krasnoyarsk 83 per cent of the 5618.600 CUM of wood waste were reported as utilised (of which about 5012.100 CUM comes from lumber production and other processing industries).

Fibre necessary to support the forest industry is mainly derived through harvesting operations. In 1989, principle harvest represented about two-thirds of Russia's total estimated fibre supply. Since 1989 the use of wood residues has declined. One expert estimates that only up to 10 per cent of the wood

supply in East Siberia is contributed by secondary fibre. Yet, in Russia's third largest saw milling town (Lesosibirsk in the Krasnoyarsk region)[23], wood residues are not used, nor burned. When wood residues are burned, it is often inefficient, in self designed or self-made incinerators. The present economic situation does not allow the transport of wood chips and other wood waste over long distances.

The transportation system

Railways transported most timber in the former USSR. In 1989, 68.4 per cent of total timber freight was transported by railway and 26.7 per cent by river transport. By 1992 railways accounted for the transport of 75.2 per cent of all timber products. The total volume of timber product shipments has, however, sharply declined. Timber producers fear that increased transportation costs could ultimately isolate the regions of Central Siberia.

Krasnoyarsk's overall transportation density largely reflects the geographic production distribution for timber products (see table 4.3). The Kansk-Achinsk ecoregion, which is crossed by the Trans Siberian Railway, has the most developed transportation links. From Yeniseisk, which is located in the Angara Southern region, northward transportation is virtually limited to river and air transport.

With railway tariffs increasing, producers would likely choose to combine storage with summer use of ship transport if long-term contracts could be established. Most of the forest products can easily be stored in wintertime without considerable deterioration of quality. If transportation prices continue to rise at last year's pace, the export of roundwood and low lumber grades will become unprofitable.

Railway

Recent increases in railway tariffs undermine the profitability of shipping timber from eastern Siberia to European Russia and other CIS countries. Transportation costs are higher than the cost of the timber. Railway is by far the best developed transportation infrastructure in Russia and especially in the Asian part of Russia. The forest industry usually possesses its own freight cars for carrying products and supplies.

In 1989, timber products accounted for 7.2 per cent of the total weight of products shipped via railways. Transport costs have increased faster than inflation. Real railway costs increased between 1991 and the middle of 1994 by a factor of 4.9.

Although a railway's costs vary among Russia's regions, a fixed tariff scale is applied to all regions. The scale allows only for differences for products, type of car, and tonnage. The structure for calculating the railway tariffs has not fundamentally changed since 1978, and is based on the profitability of the cargo being shipped, the expenses incurred while loading, unloading and transporting, and special privileges for goods such as for products, medical supplies, and agricultural equipment. The railway tariff is calculated according to the following equation[24]:

Total railway tariff = (Base rate according to the distance, type of merchandise and type of wagon) x (coefficient to absorb inflation)

Railway tariffs per metric tone of timber cargo vary also according to type of car and tonnage (see table 4.4). How tariffs will continue to change is uncertain. It is believed that the costs of construction and maintenance will soon be more accurately reflected in future prices, which could seriously affect Krasnoyarsk's forest industry. Railway subsidies are likely unavoidable in the near-term for remote regions like Krasnoyarsk.

Road vehicles

Krasnoyarsk's road infrastructure is also used by the forest industry (see table 4.5). Harsh climate and enormous distances prevent an efficient transport of timber products over long distances by roads. In 1994 there were 2 584 logging trucks registered, of which 2 135 were technically allowed to work. About 6.5 per cent of the logging trucks were owned by the government or municipal agencies.

River and sea transport

Krasnoyarsk's only export port for forest products is Igarka, situated in the north on the Yenisei. The port is open only 3-6 month per year and problems now surround financing and maintaining the technical readiness of the ice-breaking fleet. Limits on port access would be a major export barrier for timber products, for river transport costs much less than railway transport. Port access is especially important for the enterprises that were designed as purely export-oriented producers.

Structural changes in the forest industry

Current structure

Large enterprises dominate output in the various branches of the Russian wood processing industry. In many cases forest industrial enterprises are located in small towns and can act as a monopsonist on the labour market.

Krasnoyarsk to a large degree does not process its harvest in the region. Some 46 per cent of the total harvest was not further processed in 1989; however, the degree of processing is still high compared to other regions in Siberia.

Compared with other regions in Siberia, Krasnoyarsk has a relatively high wood processing capacity (see table 4.6). In 1989 Krasnoyarsk was a major Siberian producer of pulp and paper.

About three quarters of Krasnoyarsk's forest industry enterprises are mostly involved in harvesting activities.[25] Krasnoyarsk's large lumber mills are usually well linked with railroads and shipping ports, for their high quality output is mostly targeted for export. The large woodworking production plants are usually highly integrated, permitting technological synergies. For example, a lumbermill's woodchips and its roundwood not useable for lumber production can immediately, with little transportation and wood losses, be used for pulp, fibre- or particle board production. The bark can be burned to produce energy for cooking. However, integrated production in Russia is often designed on such a gigantic scale (or incompletely built) that it creates its own inefficiencies and serious supply problems. As a result, large piles of unused wood waste near the mill are common sights in many parts of Russia.

Production decline

1989 was the last net growth year for the Russian forest industry (1 per cent) and in 1992 there was a steep production decline (14.6 per cent). However, the forestry industry fared better than the overall Russian economy (which grew 1.4 per cent in 1989, but declined by 18.8 per cent in 1992).

An analysis of microeconomic data showed that enterprises along major railroads suffered less from the production downturn than other enterprises. Larger enterprises with market power also suffered less. This general analysis applies to Krasnoyarsk's lumber industry, for large producers (over 100.000 CUM) showed lower output declines than smaller ones. An econometric analysis of physical

inputs shows that returns to scale are marginal for enterprises in this size class, i.e. the factor competitiveness of larger enterprises cannot be explained by the size of output. Quite possibly the better performance of large enterprises stems from the fact that they had information on their former customers and were able to establish successful contracts themselves, they also dominated the board of directors of the region's Forest industry associations which had, at the time of analysis, an actual monopoly on trade and better access to state subsidies and bank credits. Large enterprises could purchase raw material cheaper because of a better bargaining position, and therefore could produce higher quality products.

Ownership

In 1993 state enterprises were still the dominant form of ownership in the Russian wood industry (see table 4.7). Most enterprises are probably now joint stock companies. (Reforestation and fire protection enterprises will probably stay 100 per cent state-owned.) The state will likely maintain a majority ownership of strategically important enterprises -- i.e. highly efficient enterprises with large export volumes and high quality.

Much uncertainty surrounds the real ownership of enterprises, for the relevant information is often held secret, known only by a firm's directors or investors. No reliable data exist for analysing the ownership structure, the evolution of multi-enterprise conglomerates, and inter-enterprise financing and investment.

Non-wood products

Non-wood products and non-timber forest activities comprise a relatively small share of the forest industry's output (see table 4.8). Development of these products might help the forest industry diversify its activities and keep more labour employed, especially in remote areas. Calculated with Western prices[26] the total volume of mushrooms harvested in Eastern Siberia is estimated to be worth 0.8 billion dollars. However, the potential harvest could be a lot higher if organised professionally. (Experts estimate that the total harvested volume of non-wood products in Siberia does not exceed 6-7 per cent of its total stock.) Marketing of non-wood products should be especially important in times when capital is difficult to acquire. Picking mushrooms and drying them is not very capital intensive and is highly labour intensive. Other such non-wood products are: fruits, berries, nuts, tree sap, resin and medical plants. Other non-timber activities include production of herbs from hay, grazing, beekeeping, hunting, fishing and recreation.

The administrative system and forestry legislation

Recent developments

The Federal Forest Service's organisational structure has hardly changed during the transition period. The old, top-down hierarchy is still present. Regional and local forest administrations implement forest policies based on legislation or regulations set by central authorities. One expert summarised the status of forest legislation in 1995 noting that:

- current forest laws and their legislative framework are still largely based on centrally planned administrative and economic paradigms;

- 1993 forest legislation resembles strongly that of the 1970s;

- the current matrix of legislative and executive bodies is extremely complex and difficult to administer;

- forest legislation is largely normative and descriptive, lacking an efficient mechanism for implementation;

- there are many loopholes that foster large-scale corruption; and

- the overall Russian legal framework contains severe contradictions that affect the administration of natural and forest resources.

There are two types of forest utilisation rights: short-term (less than 1 year) and long-term (1 to 50 years). A new clause permits both juridical and physical persons (not including foreigners) to be forest users. There are also new licenses for long-term leases, but these licenses must be combined with permits through logging or forest cards. Leases can be assigned in closed bidding, open auctions or direct negotiations with the authorities (a potential source of corruption). State companies acquire leases by direct negotiations.

Forest use payments include moneys for forest reproduction, control and protection, forest dues and rent. Payments are made to a special state fund as a percentage of the harvested timber's sales price (see below). Forest dues include stumpage fees, fees for by-products (tapping of trees, hunting, berries and mushrooms, etc.), and fees for hunting rights and tourist recreation activities.

How to enforce forest legislation is rather vaguely described. No concrete mechanism is established for solving legislative disputes and violations. The regional Dumas are still being established and have paid little attention to the environment, to natural resources, or to the forests. All provinces were forced to develop local forest lease propositions and to determine forest payment rules. The acts were developed by the forest and natural service staff and were approved by the provincial administration head.

The so-called economic decrees, issued by the president of the Russian Federation to stimulate economic reform directly violated parts of the Basics of Forest Legislation Law of 1993. Property rights were clarified in a presidential decree on the State Privatisation Program (1994), which stated that the Forest Fund is the property of the federation and cannot be privatised. However, it is not clear if the resolution includes Forest Fund areas jointly owned by the Federation and the provinces. According to a resolution by the Russian State Property Committee (Decree of the President of the Russian Federation, 1994), the non-wood functions of the Forest Fund, such as hunting, mushroom picking, etc., may be privatised if it is co-ordinated with the departmental levels.

Many experts assert that Russian forest management practices do not follow the forest legislation. Besides the inherent value of ecological considerations, forest management practices are increasingly important for marketing products on important international markets. In Western Europe environmental certificates for producers are already in place and will soon be obligatory. Successful Western market penetration will soon depend on product quality and forestry practices.

Krasnoyarsk's Forestry Institute has the technology to implement ecological sound and sustainable forest management practices. It would make economic sense to implement sustainable forest management practices if the calculation were correctly carried out. However, recent legislative initiatives indicate that Russia is not going to support a system of sustainable forest practices.

Forest industry policy

Because of its ability to generate export earnings, the forestry sector has been mentioned among the most important future motors for the national and regional economy in Russia. The majority state owned company *Roslesprom* received considerable federal funds for renewal of the Russian forest industry. In 1994 a special federal program for the development of the forest industry complex was created. Between 1994 and 2005, 95.6 billion dollars[27] are to be invested to double the production of pulp and paper and expand production for other timber products by a factor of 1.6 to 2.5. Reality proved harsher, for in 1994 and 1995 the forest industry did not received the promised share of federal funds.

Taxation policy

The Russian government has focused much attention on taxation and currency control to manage the faltering economy. Tax legislation is unclear and lacks consistency. It is based on laws, presidential decrees, government resolutions, and a multitude of law-based acts, instructions and orders.

Forestry industry executives insist that if they paid all taxes owed, the amount would exceed their retail turnover. Russian companies creatively decrease their total tax burden, through evasion and avoidance. Such strategies are probably too involved for foreign companies. The current tax system, with its constant changing, makes investment feasibility studies practically impossible and has developed into one of the main barriers to foreign investment.

Competitiveness

Interregional competitiveness

In the former USSR the Russian forest industry was, as were other Russian industries, bulk oriented. Product differentiation was limited. Only those pulp and paper producers that supplied the military and export markets were concerned about product quality.

Severe data problems hamper any assessment of an individual enterprise's factor competitiveness at the product level.[28] This lack of transparency discourages potential investors.

From individual enterprise data we know that the cost partitioning, e.g. lumber production, is very similar to the Austrian lumber industry. Assuming that roundwood prices do not change considerably and other input costs stay proportionally constant across regions, one can compare Krasnoyarsk's cost competitiveness with other regions (see table 4.9). The roundwood costs are below the Siberian averages. Lumber production is very expensive in Krasnoyarsk -- mainly a reflection of the large volumes of export quality goods. The cost of pulp and paper production was higher in Krasnoyarsk.

Even under the old system quality norms were very elaborate and strict, and quality differences were reflected in the prices set[29]. Lumber seems to be produced with high quality equipment in Krasnoyarsk. The lumber industry of Krasnoyarsk was to a great extent designed for export. Nowadays it is even more export oriented. This also explains why most of the best experts always and still have great interest in this region. The value of the productive assets is also well over the Siberian norm.

International competitiveness

Roundwood input is the most crucial cost factor for the wood working industry. Around 50 per cent to 60 per cent of the total costs of lumber production and about 40 per cent to 60 per cent of the total costs of pulp and paper industry can be attributed to roundwood costs in Western Europe. Future

price levels for roundwood will be the crucial factor for the price competitiveness of the entire Siberian forest industry.

To predict roundwood costs, a model was developed using labour, fuel and capital as inputs and a range of ecological and geomorphic indicators. The model was applied to individual enterprise data available at the IIASA. The data should reflect the economic and technological conditions as of 1 January 1994.

A model of costs and physical input requirements for roundwood production[30]

Logging costs vary according to: species, average log volume, relief, hauling distance, and type of road. Capital investment was divided into long-term investment in logging roads and short-term investment in logging machinery and equipment, logging trucks and assets at lower landing (including housing and social infrastructure if the logging operation is located in a remote area).

Major taxes according to existing practice are: (i) charges to the Federal fund of forest resource reproduction (5 per cent of the roundwood sales price); (ii) stumpage (minimum is at 5 per cent of the roundwood sales price); (iii) road construction fees (0.4 per cent of the hauling asset value); and (iv) charges for social security and pension funds for labour.

Data accommodating for all the variables described above were analysed by using a multiple regression technique. Before analysing the data, a specialist for logging operations was consulted for a consistency check of the physical indicators with Western technology. Further, this data was cross-checked with officially published productivity indicators for Austria[31]. The weighted averages of these physical productivity indicators calculated from the Russian data were well within an acceptable range taking into account the technology differences.

The predicted cost of 1 CUM roundwood deliverable at the lower landing on board in January 1994 for the Krasnoyarsk region decreased in 1992 by 10 per cent (see table 4.10). This drop mainly reflects a selection of better logging sites (e. g. species selection and higher log volumes) and smaller transportation distances to the lower landing. The costs were calculated from a sample of large logging enterprises in Krasnoyarsk. West European production costs for 1 CUM of roundwood are 4 to 6 times higher for similar qualities. (The large difference stems from the low Russian stumpage prices.) Pure logging costs are 3 to 4 times higher in Western Europe, due mainly to higher capital costs, but also higher personnel and fuel costs for similar diameter classes and geomorphologic conditions.

In the last 1 1/2 years production costs have at least doubled. Many enterprises remain unaware of the need to look more at the cost side of production and to start thinking of how to lower costs. If the production and transportation costs continue to rise at last year's rate, roundwood and lumber production will no longer be a profitable export. At present only high quality lumber can profitably be shipped to Western Europe.

Logging equipment does not last very long under the harsh Siberian conditions. Logging equipment needs to be amortised in at least 3 to 7 years in Siberia. Much of existing logging equipment needs replacement soon. New equipment costs will increase the share of capital costs dramatically, even if domestic machinery is acquired taking the productivity differences into account.

Unit output costs for roundwood and for lumber vary greatly in the region. Unit output costs do not seem to depend on the location or the scale of roundwood production. Due to the large variation in the

costs, it is reasonable to assume that the decline of output of roundwood production will not be spread evenly among enterprises.

The higher transportation costs caused by Krasnoyarsk's remoteness can only be compensated by cheaper raw material, labour, and energy inputs[32]. Krasnoyarsk's 1994 roundwood production costs made its production quite competitive internationally. However, an alarming increase in overall production costs is making Krasnoyarsk's forest industry largely uncompetitive. To offset these growing costs, Krasnoyarsk's forest industry will need new investments, especially in high-value added sectors, for which the most likely sources appear to be export profits or foreign investors.

Employment outlook

About one-third of Krasnoyarsk's total employment comes from forest-related activities. The Ministry of Forest industry reported the forest industry's total 1989 employment to be 116 620, of which about 57 per cent were production related.

In estimating the technical requirements of employment for roundwood production, one concludes the number of production-related workers could be halved.[33] This estimate is probably exaggerated, for the Russian definition of production-related personnel is rather broad (including, for example, people working in enterprise repair shops). Yet, enterprises have little detailed awareness of their production costs, for they do not divide costs into different production activities.

Estimates of employment requirements for the wood working industry suggest that a similar halving of staff would be possible.[34] Russian enterprises show about 3 to 6 times more production-related personnel than Western producers. (Again definitions of production-related personnel and the Russian enterprises' preferences for in-house services make comparisons difficult.) Employment statistics are also difficult to interpret, for some workers are listed as officially employed, but rarely report for work.

Enterprises finance a number of social activities that they now need to shed. However, forest industries are typically located in small or medium-sized communities where poor tax collection prevents local governments from shouldering most of these activities. Nevertheless, the enterprises will probably need to halve the number of these workers, making the total layoffs in the near future total about 55.000 in the region. Investments in more productive equipment, outsourcing of services and a withdrawal from most social activities would result in even larger reductions, i.e. approximately three-quarters of 1989 employment levels.

Trade and investment trends

Wood and wood products accounted for 4.6 per cent of total 1989 Russian non-CIS exports and 2.1 per cent of imports. These goods accounted for 5.1 per cent of Russia's total 1989 exports to other CIS and 0.7 per cent of imports (calculated at world prices).

According to official regional statistics, Krasnoyarsk exported 204.577 CUM industrial wood (1 per cent of the output in 1989[35]) and 15004.3 MT of paper (14 per cent of the output in 1989) to CIS in 1994. Official statistics for exports to international markets for the first half of 1995 are shown in table 4.11.

The forest industry stopped investing in new capacity during 1991. From 1986 to 1990, 370 000 CUM was added to annual production capacity for lumber, and in 1991, 100 000 CUM. For

particleboard and fiberboard production new annual capacities increased by 135 000 CUM and 1 130 000 CUM respectively between 1986 and 1990.

Continued lack of investment will soon undermine the forest industry's competitiveness. Yet, Russia's business environment doesn't motivate its managers to reinvest much of their profits.

Table 4.1. Dynamics of the forest areas and management of Siberia and comparison with the forest resources of Canada

	1966	1973	1983	1988	Canada 1986
Total forested area[36]	105.803	107.264	111.962	111.262	397.920
Coniferous	87.305	89.616	94.280	93.951	-
Pine	11.235	10,538	11.004	11.080	-
Fir, Spruce	14.153	15.810	16.381	16.278	-
Siberian Cedar	10.322	1.055	10.385	10.261	-
Softleaf hardwoods (Birch, Aspen)	18.498	17.648	17.683	17.311	-
Total Growing Stock	14.198	13.494	13.937	13.806	23.154
Coniferous	12.530	11.903	12.383	12.282	17.834
Growing stock; mature and overmature stands (for Canada nonreserved forest land)	11.264	11.065	11.123	11.023	15.736
Group I forest (mostly reserved forest land)	906	835	1.436	1.471	-
Coniferous	10.136	9.947	10.111	10.052	10.407
Pine	1.658	1.470	1.435	1.423	2.940
Fir, Spruce	2.108	2.217	2.155	2.149	4.919
Siberian Cedar	1.459	1.338	1.297	1.309	-
Softleaf hardwoods (Birch, Aspen)	1.127	1.118	1.012	971	1.744
Growing stock of mature and overmature stands accessible for exploitation	4.371	4.726	5.353	5.860	-
Annual Allowable Cut (AAC) '000' cubic meter	69.716	71.369	80.174	80.173	-
Actual cut '000' cubic meter	21.565	22.740	21.444	22.790	177.097
Coniferous '000' cubic meter	20.812	21.755	19.945	21.229	161.863
Annual total increment '000' cubic meter	127.050	122.460	124.130	113.640	-

Notes: Area in '000' ha. Stock in '000.000' cubic meter
Cit.: Lesnoj dinamika, Gosudarstveni Komitet po Lesu, 1989. Moskow
Data refers to inventoried forest land (total forest land is 453.3 Mio. ha)
Cit.:Selected Forestry Statistics Canada 1990. Information Report E-X-44. Economics and Statistics Directorate, Ottawa, Ontario

Table 4.2. Wood quality category distribution over ecoregions in Krasnoyarsk

		species					
Region	Wood quality category	birch	cedar	fir	larch	pine	spruce
Angara Southern Taiga	% industrial wood of harvest	0	79	76	73	79	83
	% small dimension of industrial wood	0	15	22	14	17	28
	% medium dimension of industrial wood	0	32	52	26	35	35
	% large dimension of industrial wood	0	32	2	33	27	20
	wood unused	0	12	17	17	10	9
	fuel wood	0	9	7	10	11	8
Kansk-Achinsk Forest Steppe	% industrial wood of harvest	47	76	79	0	77	81
	% small dimension of industrial wood	12	11	18	0	12	17
	% medium dimension of industrial wood	24	27	43	0	32	38
	% large dimension of industrial wood	10	38	18	0	33	26
	wood unused	7	13	11	0	11	11
	fuel wood	46	11	10	0	12	8
Khakass Mountain Southern Taiga	% industrial wood of harvest	46	74	77	68	73	0
	% small dimension of industrial wood	13	6	12	7	7	0
	% medium dimension of industrial wood	25	27	41	28	31	0
	% large dimension of industrial wood	8	41	24	33	35	0
	wood unused	8	13	11	17	12	0
	fuel wood	46	13	12	15	15	0
Putoran Mountain Northern Taiga	% industrial wood of harvest	0	0	0	72	0	0
	% small dimension of industrial wood	0	0	0	19	0	0
	% medium dimension of industrial wood	0	0	0	51	0	0
	% large dimension of industrial wood	0	0	0	3	0	0
	wood unused	0	0	0	20	0	0
	fuel wood	0	0	0	8	0	0
Putoran-Anabar Sparse Taiga	% industrial wood of harvest	0	0	0	73	0	66
	% small dimension of industrial wood	0	0	0	23	0	36
	% medium dimension of industrial wood	0	0	0	50	0	30
	% large dimension of industrial wood	0	0	0	0	0	0
	wood unused	0	0	0	21	0	22
	fuel wood	0	0	0	6	0	12
Sajan Mountain Middle Taiga	% industrial wood of harvest	0	77	79	76	77	0
	% small dimension of industrial wood	0	6	12	6	7	0
	% medium dimension of industrial wood	0	25	42	27	31	0
	% large dimension of industrial wood	0	46	25	43	39	0
	wood unused	0	13	11	13	11	0
	fuel wood	0	10	10	11	12	0
Tunguss Middle Taiga	% industrial wood of harvest	0	74	0	73	78	76
	% small dimension of industrial wood	0	9	0	16	17	46
	% medium dimension of industrial wood	0	40	0	50	55	29
	% large dimension of industrial wood	0	25	0	8	6	1
	wood unused	0	15	0	18	15	16
	fuel wood	0	11	0	9	7	8

Table 4.3. Distribution of means of transportation and communication in km

Ecoregion	River	Railway	Auto (total)	Auto (hardcover)	Trsm-line	Gas-line
Taimir Tundra	300	0	0	0	0	0
Putoran-Anabar Sparse Taiga	320	110	130	95	375	240
Putoran Mountain Northern Taiga	760	0	13	13	250	0
Tunguss Middle Taiga	2.000	0	186	25	390	0
Angara Southern Taiga	1.180	210	6.547	1.110	785	0
Kansk-Achinsk Forest Steppe	320	1.180	9.900	2.700	4.750	1.100
Khakass Mountain Southern Taiga	300	500	6.050	1.720	2.700	680
Sajan Mountain Middle Taiga	400	150	7.100	1.670	1.170	110

Table 4.4. Railway tariffs per metric ton of timber cargo as of July 15 1994

		Distance (km)							
		50	100	200	500	1.000	2.000	5.000	10.000
Rbl per tonne	State owned	6.489	7.384	9.282	15.212	24.725	43.630	102.241	200.794
	Private owned	5.032	5.814	7.498	12.643	20.916	37.475	88.823	175.066
US$ per tonne	State owned	3.24	3.69	4.64	7.61	12.36	21.82	51.12	100.40
	Private owned	2.52	2.91	3.75	6.32	10.46	18.74	44.41	87.53

Notes: This data concerns 44t-capacity freight cars
Tariffs are variable according to product (here timber products), type of car and tonnage.

Table 4.5. Distribution of forestry roads and roads relevant for forestry in different ecoregions

Ecoregion	Classes of roads	Main	Secondary	Tertiary	Hauling road	Common-use
Putoran-Anabar Sparse Taiga	All season roads	0	0	0	0	0
Putoran-Anabar Sparse Taiga	paved	0	0	0	0	0
Putoran Mountain Northern Taiga	All season roads	0	0	0	0	25
Putoran Mountain Northern Taiga	paved	0	0	0	0	0
Tunguss Middle Taiga	All season roads	0	0	0	500	0
Tunguss Middle Taiga	paved	0	0	0	0	0
Angara Southern Taiga	All season roads	276	1.140	2.234	3.525	2.479
Angara Southern Taiga	paved	18	0	0	1.171	1.613
Kansk-Achinsk Forest Steppe	All season roads	96	1.892	2.293	2.589	1.509
Kansk-Achinsk Forest Steppe	paved	0	0	0	669	717
Khakass Mountain Southern Taiga	All season roads	337	1.161	760	1.723	1.788
Khakass Mountain Southern Taiga	paved	0	237	0	866	1.555
Sajan Mountain Middle Taiga	All season roads	472	569	1.608	2.896	1.859
Sajan Mountain Middle Taiga	paved	0	0	0	581	1.321

Table 4.6. Summary of indicators describing the Siberian forest industry

Political region	Land area	Forested area (1)	Annual Allowable Cut	Harvest	Harvested Industrial wood	Lumber production	Plywood production	Particle board production	Fiberboard production	Paper production	Paperboard production	Chemical pulp production	Mechanical wood pulp production	Furniture production
	'000 ha	*'000 ha*	*'000 CUM*	*'000 CUM*	*'000 CUM*	*'000 CUM*	*'000 CUM*	*'000 CUM*	*'000 CUM*	*'000 MT*	*'000 MT*	*'000 MT*	*'000 MT*	*mn rbles*
Altai territory	26,170	4,927	5,153	3,484	2,353	1,121	16	10	0	0	44	0	14	96
Kemerovo region	9,550	4,584	8,285	3,214	2,790	1,604	5	7	5	0	18	0	0	89
Novosibirsk region	17,820	2,379	1,661	1,404	1,125	727	0	0	0	0	0	0	0	132
Omsk region	13,970	2,531	6,266	2,065	1,649	1,031	19	88	0	0	46	0	0	63
Tomsk region	31,690	17,030	34,373	8,634	6,954	1,774	0	112	22	0	0	0	0	26
Tyumen region	143,520	41,769	47,719	16,132	12,975	2,863	22	391	0	0	0	0	0	62
West Siberia	242,720	73,220	103,457	34,933	27,846	9,120	62	608	27	0	108	0	14	468
Krasnoyarski Krai	240,160	111,262	80,171	26,266	21,709	7,123	0	143	27	107	161	215	54	98
Irkutsk region	76,790	51,839	66,623	37,858	34,646	8,817	224	189	44	11	201	1,623	0	72
Chita region	43,150	23,681	16,081	4,684	3,361	1,167	0	0	0	0	0	0	0	26
Buryat ASSR	35,130	16,978	8,228	4,618	3,682	1,306	0	68	0	0	145	163	0	32
Tuva ASSR	17,050	7,671	3,254	517	423	174	0	0	0	0	0	0	0	3
East Siberia	412,280	211,431	174,357	73,943	63,821	18,587	224	400	71	118	507	2,001	54	231
Primorski territory	16,590	11,110	14,969	5,001	3,956	1,325	21	115	2	0	0	0	0	107
Khabarovsk territory	82,460	35,832	36,978	13,765	11,780	2,165	10	111	22	9	174	298	0	100
Amur region	36,370	19,825	10,916	6,457	5,357	1,024	2	0	0	4	0	0	0	37
Kamchatka region	47,230	5,330	2,198	829	608	254	0	1	0	0	0	0	0	7
Magadan region	119,910	9,732	362	311	219	165	0	0	0	0	0	0	0	10
Sakhalin region	8,710	5,007	6,000	3,370	3,060	458	0	0	0	204	91	320	58	17
Yakutsk ASSR	310,320	125,627	33,041	3,716	1,943	862	0	0	0	0	0	0	0	10
Far East	621,590	212,463	104,464	33,449	26,923	6,253	33	227	24	217	265	618	58	288
Siberia total	1,276,590	497,114	382,278	142,325	118,590	33,960	319	1,235	122	335	880	2,619	126	987
Canada	997,614	397,920		177,097	170,263	60,706	51,296	54,713	18,358	13,881	2,674	13,092	10,407	

Notes:

(1) Forested area is defined here as forested area including only major species managed by the forest authority

(2) Unprocessed harvested wood was calculated using the following conversion figures:

- lumber production: 1.8 CUM of logs per 1 CUM of lumber
- plywood: 2.5 CUM of logs per 1 CUM of plywood
- particle board: 1.5 x 0.9 CUM of logs per 1 CUM of particle board
- fiber board: 1.66 CUM of logs per 1 CUM of fiber board
- chemical pulp: 4 CUM of logs per 1 MT of chemical pulp
- mechanical wood pulp: 5 CUM of logs per 1 MT of mechanical pulp

Table 4.7. Ownership structure of the Russian wood industry in 1993

	State	Joint stock	Mixed	Municipal	Collective	Joint venture
Number of enterprises	126	30	1	4	5	1
Average employment	391	1018	322	172	497	333

Source: Huber et. all 1995

Table 4.8. Selected non-wood products of East Siberia and Siberia

	1980	1985	1990
Fruits and Berries			
East Siberia	0.22	0.09	0.39
Siberia	0.65	0.87	2.1
Mushrooms			
East Siberia	0.13	0.08	0.12
Siberia	0.2	0.28	0.59
Nuts			
East Siberia	0.81	0.36	0.87
Siberia	0.97	1.09	1.8
Vegetational raw material for medical plants			
East Siberia	0.1	0.17	0.13
Siberia	1.01	1.45	1.34

Notes: Actual and projected harvest volume of harvested non-wood products (in million tons) - Isaev 1991

Table 4.9. Optional prices and prime costs for different timber products in 1990

	Roundwood		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	13,962	21	18
Irkutsk region	19,818	21	18
Kemerovo region	1,533	21	21
Omsk region	1,236	16	15
Tomsk region	5,732	19	19
Tyumen region	10,308	18	17
Chita region			
Buryat ASSR			
Yakutsk ASSR	802	30	22
Altai territory	1,238	18	18

	Industrial wood		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	9,923	26	
Irkutsk region	16,336	25	
Kemerovo region	1,009	26	
Omsk region	803	22	
Tomsk region	3,784	26	
Tyumen region	5,503	24	
Chita region	1,029	30	
Buryat ASSR	1,732	28	
Yakutsk ASSR	599	37	
Altai territory			

	Lumber		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	3,036	135	104
Irkutsk region	2,751	86	69
Kemerovo region	315	58	54
Omsk region	275	51	46
Tomsk region	945	70	60
Tyumen region	837	80	72
Chita region	195	65	58
Buryat ASSR	458	78	62
Yakutsk ASSR	73	87	81
Altai territory	2	76	73

	Export quality lumber		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	1,710	192	139
Irkutsk region	608	183	111
Kemerovo region			
Omsk region			
Tomsk region	44	132	85
Tyumen region	164	142	106
Chita region	4	229	127
Buryat ASSR	33	203	125
Yakutsk ASSR			
Altai territory			

(continued)

(table 4.9. continued)

	Fiber board		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	26,352	0.66	0.51
Irkutsk region	44,200	0.68	0.51
Kemerovo region	4,882	0.71	0.56
Omsk region			
Tomsk region	17,834	0.69	0.70
Tyumen region			
Chita region			
Buryat ASSR			
Yakutsk ASSR			
Altai territory			

	Pulp		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	16	320	491
Irkutsk region	1,109	466	439
Kemerovo region			
Omsk region			
Tomsk region			
Tyumen region			
Chita region	5,516	330	324
Buryat ASSR			
Yakutsk ASSR			
Altai territory			

	Paper		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	85	372	390
Irkutsk region	10	235	147
Kemerovo region			
Omsk region			
Tomsk region			
Tyumen region			
Chita region			
Buryat ASSR			
Yakutsk ASSR			
Altai territory			

	Paper board		
	Production output representing prices and costs	Optional price per 1 CUM round	Prime costs per unit
Krasnoyarsk territory	104	317	298
Irkutsk region	168	398	310
Kemerovo region			
Omsk region			
Tomsk region			
Tyumen region			
Chita region			
Buryat ASSR	138	351	324
Yakutsk ASSR			
Altai territory			

Table 4.10. Predicted prime cost of 1 CUM roundwood deliverable in January 1994

1989	1992	1989	1992
Rbl		US$	
12867	11603	10.25	9.25

Note: The data represents the prime costs calculated at an individual enterprise level for 1. January 1994. The input data for the model runs stem from the year 1989 and 1992.

Table 4.11. Exports to international markets (first half 1995)

product	volume
Lumber ('000 CUM)	346.2
Particle board ('000 CUM)	2401.7
Paper board (MT)	697.4
Newsprint (MT)	4665.6
Corrugated (MT)	3235.6
Mechanical pulp (MT)	1762.2
Viscose (MT)	4700.6

Table 4.12. Output distribution of the Krasnoyarsk timber industry (1989)[37]

Variable	Maximum	Sum
Harvest	1789	33647
Ind.wood	1320	17266.00
Lumber	515	4027.00
Plywwood	0	,00
Particleboard	0	,00
Fiberboard	20140	26700.00
Paper	107	107.00
Paperboard	133	133.00
Pulp	21.6	21.6

Source: Database

Table 4.13. Number of enterprises involved in different output activities (1989)

Activity of enterprises	Number of enterprises
Harvest	108
Lumber	12
Furniture	7
Harvest & Lumber	12
Lumber & Fiberboard	2
Lumber & Furniture	2
Paper & Paperboard & Pulp	1

Source: Database

Table 4.14. Distribution of railroads according to ecoregion

Ecoregion	Railroad type	Log transportation	General use
Putoran-Anabar Sparse Taiga	Railway, total	0.00000	0.00000
Putoran-Anabar Sparse Taiga	broadgauge	0.00000	0.00000
Putoran Mountain Northern Taiga	Railway, total	0.00000	0.00000
Putoran Mountain Northern Taiga	broadgauge	0.00000	0.00000
Tunguss Middle Taiga	Railway, total	0.00000	0.00000
Tunguss Middle Taiga	broadgauge	0.00000	0.00000
Angara Southern Taiga	Railway, total	139.00000	193.00000
Angara Southern Taiga	broadgauge	69.00000	193.00000
Kansk-Achinsk Forest Steppe	Railway, total	11.00000	365.00000
Kansk-Achinsk Forest Steppe	broadgauge	9.00000	365.00000
Khakass Mountain Southern Taiga	Railway, total	0.00000	347.00000
Khakass Mountain Southern Taiga	broadgauge	0.00000	347.00000
Sajan Mountain Middle Taiga	Railway, total	0.00000	219.00000
Sajan Mountain Middle Taiga	broadgauge	0.00000	219.00000

5 - KRASNOYARSK TELECOMMUNICATIONS SECTOR

by Jens Teagan

Executive Summary

This case study surveys the policy issues on providing telecommunications services in the Krasnoyarsk region. It reviews the regulation process, analyses existing tariffs, and makes recommendations concerning financial targets and investment.

Telecommunications in Krasnoyarsk reflect many of the evolving trends throughout Russia. Demand for local telephone service far outstrips the ability of the region's major state-controlled operator (Electrosviaz) to provide supply. Demand is particularly strong in the private business sector, where many firms are able and willing to pay a full economic price for modern services.

Electrosviaz can't meet demand, because the relevant tariff regulation prevents it from effectively raising additional money from customers and lending institutions. In addition, its ownership structure prevents it from raising additional equity capital. Consequently, its change of legal status with privatisation has not improved its ability to meet demand. As a result, new operators are planning to provide services. By agreement with the Territorial Administration, they have been allocated different areas within the region to develop.

Except for international tariffs and inter-region tariffs for state budget organisations (SBO), all tariff regulation has been delegated to the region or deregulated. Despite this, both Electrosviaz and the Pricing Policy Committee have continued past policies. Electrosviaz's increases in residential usage charges track the Ministry's increases of SBO inter-region charges. Electrosviaz has not increased business rental and usage charges in real terms since mid 1994.

Maintaining tariffs at constant prices will not be sufficient to meet demand. To fund investment, tariffs need to be increased in real terms. We estimate that such increases can be made without driving existing customers off the network. In particular, residential customers should bear the burden of additional increases, because business tariffs are already high compared to other regions in Russia and other countries.

If the regulatory authorities give Elecrosviaz more tariff flexibility (and the new operators are free from tariff regulation), about 450 000 lines can be funded over the next ten years. Half of this number will be a refurbishment of the existing network, the remainder are net new lines to meet demand. Assuming 50 per cent self-financing and debt from international financing institutions, the external financing requirements are about US$225 million.

In addition to local network operators, regional companies are providing or proposing other services. For example, Rustel operates an international by-pass service. Two other companies offer e-mail and access to the Internet. There are also proposals for expanding transmission capacity for intra-region traffic to the North region through satellite technology.

Cooperation among the operators is enhanced through the regulatory process. The Territorial Administration and the Ministry's Gossviaznadzor influence the sector through the Coordinating Council. This Council is established to coordinate sector development and resolve disputes between operators.

An evolving licensing policy has created a situation where some operators have more demanding licence obligations (in terms of number of lines and timetables) than others. Consequently, the actions of some operators with few obligations could undermine the ability of other operators to meet the terms of their licence.

The Coordinating Council considers interconnection arrangements a matter of bilateral commercial arrangements between operators. Although the current status of negotiations is unclear, the Coordinating Council may need to take a more proactive approach in determining interconnection terms. This critical issue should be an area for further study.

Introduction

This report[38]:

1. describes telecommunications in Krasnoyarsk in the context of the Russian telecommunications sector;
2. analyses current tariffs;
3. applies an OECD tariff basket and BMP investment model to recommend future tariffs needed to fund investment;
4. identifies sector structure and regulation issues affecting investment; and
5. reviews revenue sharing and interconnection arrangements between the major operators.

Current situation in Krasnoyarsk

The geographic, demographic, and economic conditions of Krasnoyarsk have direct implications for the telecommunications sector:

- the regional (intra-zonal) network must cover huge, unpopulated distances; therefore, obsolete, radio relay tropospheric technology is used in the North;
- climatic conditions in the northern regions are extremely inhospitable and increase the telecommunications operating and capital costs;
- because it is in the centre of Russia, considerable transit traffic passes through Krasnoyarsk, and
- since most of the economy is in transition, it is difficult to predict future demand for services.

Existing network

The Krasnoyarsk Territory has about 500 000 total lines. Krasnoyarsk City has the largest percentage of lines with 120 000. Electrosviaz, the major state-controlled operator in the region, has 365 000 lines. The remainder of the lines are provided by other operators (large industrial enterprises).

The distribution of lines throughout the region varies considerably. Although Krasnoyarsk City accounts for 30 per cent of the region's population, its teledensity is only 12.5 per cent. In contrast, Krasnoyarsk-26, a formerly closed (and favoured) city, has a teledensity of almost 40 per cent.

The development of the network was, until recently, based on the Development Plan for 1985-2000, developed by Giprosviaz No. 4 in Novosibirsk. The region had implemented 60 per cent of the old plan, but it is now working on a revised version. Electrosviaz believes that the long-distance network has enough capacity for the next five years. As is the case in the rest of Russia, the major network bottlenecks are in the local network.

Demand

The actual demand for new lines is difficult for operators to determine. In Krasnoyarsk City, the residential waiting list is estimated at 120 000, which is the size of the existing city network. This total may partly reflect past low tariffs. Given this figure as a benchmark, we estimate that the waiting list throughout the region is 200 000.

There is a growing demand for other services as well. The extent and nature of this demand, however, remains unclear. Rustel, for example, operates an international by-pass service from a teleport in Krasnoyarsk City. It provides higher quality international access, and its international tariffs are only 10 per cent more than the PSTN tariffs. Nonetheless, it only has six customers since beginning operations in the autumn of 1994.

Similarly, SABLE, part of the Electrosviaz, offers a variety of services including e-mail and access to the Internet (it even has its own World Wide Web site). In operation for over a year, it has 300 subscribers. The customer list is dominated by government agencies, mainly because the Government issued a decree requiring Government agencies to connect to the network. The extent of business demand or awareness for these services is more uncertain. There were two other companies offering e-mail. One has gone bankrupt, and the other, SibChallenge, is running its e-mail service at a loss.

Demand for basic, local telephone service remains strong. The high demand in Krasnoyarsk is primarily a reflection of the relatively low rental charges. Fixed charges (connection and monthly rental) affect the demand for new lines more than usage tariffs. Since the beginning of 1993, official residential connection charges have risen from US$14 to US$80. The absolute amount of this increase is not high relative to those in other eastern Europe and CIS countries which are aggressively investing in their network. Aside from residential connection charges, however, fixed charges have decreased in real terms. Official business connection charges have actually decreased slightly in real terms since 1993. Also, rental charges for both residential and business customers have dropped considerably in real terms since the beginning of 1993. These recent trends in fixed tariffs have actually encouraged demand for new lines.

Household income

Household incomes greatly influence residential demand. Russian monthly wage estimates for the beginning of 1995 are about US$80 per month. Assuming more than one source of income, household income would be higher, perhaps US$100. Over the last few years, real income has actually dropped due to the combined effects of high inflation and reduced subsidies of key services. In addition, many people have not been paid, although they are still 'employed.'

If the economy continues to stabilise and grow, household income should increase as least as well as the economy in general. A diminishing government role in the economy should help real

disposable household income to increase. The implications for demand and tariff setting is that customers will be able to afford much higher rental tariff levels, as household income is an important indicator of ability to pay for services.

When determining ability to pay, it is important to define a 'typical' residential bill. Our experience in other CIS countries suggests that a very small proportion (less than 5 per cent) of residential customers make more than 90 per cent of long distance phone calls. The proportion may be slightly higher in Krasnoyarsk because of its location, and thus the average residential bill in Krasnoyarsk would probably be much larger than the median bill. The implication is that average revenue per line estimates will overstate what a typical customer is actually paying.

International experience indicates that households typically spend 2-4 per cent of disposable income on telecommunications. Countries with aggressive development programmes are usually at the top of this range. We estimate that the typical telephone bill for residential customers in Krasnoyarsk is about 2 per cent of household income. Therefore, some tariffs could be raised immediately without a sharp decline in demand.

Another complicating factor for tariff setting is defining a 'typical' customer. The proportion of subscribers who are pensioners and war veterans is high relative to the population, due to service obligations of the operators and the waiting list. Consequently, the average household income of US$100 may be more than the average income of the typical residential customer.

Structural changes in the economy

Other factors influencing future demand for telecommunications services in Krasnoyarsk relate to the region's structural economic changes. Demand for telecommunications will increase faster than general growth in the economy, for as Krasnoyarsk adjusts to a market economy, its service sector will grow dramatically. These service sector businesses, such as banks, retailers, and financial firms, are more telecommunications intensive than manufacturing and heavy industry sectors. As throughout the CIS, Krasnoyarsk's service sector is small. Current estimates suggest that the service sector in Russia accounts for 33 per cent of Gross Domestic Product (GDP) as opposed to 45 per cent for Poland and 60 per cent for Germany.

A second macroeconomic factor affecting demand is the change in trade flows. Trade with western Europe, East Asia, and North America is increasing. For example, there are about 200 firms with foreign capital registered in Krasnoyarsk, most with German and Chinese partners. Calling patterns will inevitably follow this shift in trade patterns, increasing sector revenue due to a higher proportion of expensive international calls.

A modernisation of the network will probably stimulate demand independent of economic changes. For example, the spread of international direct dialling will increase traffic volume. A higher quality service will make it easier to complete calls and encourage customers to use the phone more often. Also, a higher quality network will enable sophisticated users to subscribe to more value-added services. Business will begin to use the phone more as a business tool. In our tariff modelling, demand is represented by price and income elasticities chosen to reflect these demand factors.

Electrosviaz

Electrosviaz is Krasnoyarsk's major operator. As are other Electrosviazy in Russia, it is a holding company for the region's main telecommunications assets: some (but not all) local networks, the

long distance exchanges, and most intra-regional transmission. Besides telephony, it also offers other telecommunications services such as mobile radio, telex and telegraph.

The State Property Commission, GKI, owns 38 per cent of Electrosviaz. Since 25 per cent of the shares are non-voting, the Government has a majority of voting shares and, therefore, formally maintains control. A single Russian company owns 14 per cent of the shares and the remainder are owned by individual investors with no more than 1-2 per cent of the stock.

The main focus of Electrosviaz is to modernise its existing network. It is enthusiastic about the 50x50 plan which envisages a new long distance and local digital network. Starting this year, Electrosviaz has decided not to buy from Russian manufacturers because they believe manufacturers cannot produce good quality digital equipment.

The Ministry of Communications acknowledges this quality problem and has not pressured the Electrosviazy to buy Russian equipment. As part of this policy, at the end of 1994, the Government waived import tariffs on telecommunications equipment. Consequently, Tesla Ericsson has provided direct financing for equipment and delivered AXE-10 exchanges to Electrosviaz. [39]

Other existing operators

There are a number of other existing operators in the region that complement Electrosviaz's network. However, their exact number and capacity is unclear. Most of these other networks provide local service in cities other than Krasnoyarsk City. For example, Krasnoyarsk-26, formerly a military-sensitive, closed city (the location of NPO-PM, the largest Russian manufacturer of satellite equipment), has three company networks.

Other local operators are large industrial concerns, many of which are in the North Region. For example, in Norilisk, the large non-ferrous plant is the local operator of about 90 000 lines. The construction company operates 10 000 lines. There are also other firms operating local networks in Norilisk and nearby cities.

As in other parts of Russia and the former Soviet Union, there are analog overlay networks. In Krasnoyarsk, the energy companies operate their own networks, but these are of limited capacity and not fully connected with the public switched network (PSTN).

New operators

Besides the traditional operators, a number of new operators have licences to operate a variety of services. Because Russia's Ministry of Communications (hereafter 'Ministry') maintains an open licensing policy, it gave licences to companies which apparently have little intention of starting operations. Some new operators are providing local services and their licences collectively require the installation of over 200 000 lines by 2000.

SibChallenge

The most important new operator is SibChallenge. The company started five years ago as an American-Soviet joint venture involved in timber. Since then, it has restructured itself and is a Russian private company focusing on telecommunications. The company has three licences: for e-mail, AMPS 800 Mhz cellular, and local telephony network with an obligation to build 150 000 lines (the local telephony licence is being implemented by a SibChallenge subsidiary, SibChallenge Telecom).

The licences are intended to complement each other. SibChallenge has agreed to renovate existing exchange stations, construct fibre optic cable transmission, and provide local network and cellular services. Under the terms of the local telephony licence, SibChallenge Telecom must install 150 000 lines by 2000; 70 per cent of which in the next three years.

SibChallenge is currently in the process of establishing its networks, including installation of Ericsson equipment and a billing centre. Although they will use Siemens EWSD switches, the first customers will be connected to analog equipment. According to their licence, they are obliged to connect the first 20 000 local network customers by August 1995. The cellular mobile operations should be in operation by autumn 1995. Three cells will cover Krasnoyarsk City and the road to the airport.

The company is considering other telecommunications ventures. For example, it would like to offer mobile services at 1.8 Ghz. Assembly and distribution of PABX equipment is another business option they are considering.

Smaller new operators

Although SibChallenge is the largest new licensee by far, there are other new enterprises with licences. Because their exact intentions (whether they actually will use their licence) is unclear, it is difficult to determine how many lines they will install. Based on our discussion with Electrosviaz and others in the sector, there are five or six companies with licences of 10 000 lines each, representing an additional 50 000 lines planned for construction. The timescale for these plans is not known.

Providers of other services

Rustel and SibTelecom are firms in Krasnoyarsk offering services other than local telephony.

Rustel

Rustel was established to develop satellite communications by a general agreement with Rostelekom. In accordance with this agreement, they would supplement long distance capacity and collect traffic from remote Northern areas to be routed through the backbone long distance network. Ownership of the company includes Rostelekom, NPO-PM, and an American firm, International Business Communications Services. The company has been operating a teleport in Krasnoyarsk city since September 1994.

The company's development plan involves a three-stage process: 1). installation of an earth station in Krasnoyarsk City, which now routes international traffic to two teleports operated by Deutsche Telekom in Germany; 2) Seeking investors to set up a similar teleport in Moscow; aand 3) establishing exchanges along the Trans-Siberia railroad. These exchanges would collect traffic through Rostelekom or Rustel and route international traffic through the Moscow teleport.

The existing operation is very similar to other international by-pass operations in Russia. Subscriber lines are connected directly to the earth station and are not connected to the public switched network (PSTN). Current telecommunications licensing prevents Rustel from interconnecting this operation with the PSTN. Given that high quality service is a major selling point, it is not clear whether it would be in Rustel's interest to connect to the PSTN, even if its licence enabled it to do so.

The venture also demonstrates the degree of cooperation between the participants in the region. SibChallenge has acted as a partner to Rustel by identifying customers and helping to install the network. In exchange for this assistance, they have entered into a profit sharing agreement.

The teleport charges in rubles at the prevailing US dollar market rate. Customers are billed weekly. In addition to direct customer lines, they are providing one fax channel each to the long distance and city exchanges. They do not have installation charges and their monthly rental is US$50. Usage charges are about 10 per cent above the PSTN rates.

In addition to the three-stage plan described above, Rustel is also considering providing transmission capacity to the North. Currently, there are 150 channels between Krasnoyarsk City and Norilisk. Other towns in the North are connected by 2-15 channels with tropospheric relay. Rustel is considering a satellite project that would add 120 channels, connecting 20 towns in the region directly with Krasnoyarsk city. Since this project would be fully-connected with the PSTN, Rustel needs to apply for a new licence.

SibTelecom

SibTelecom was established three years ago. Rostelekom, regional manufacturers of satellites and earth stations, and Electrosviaz own about 15 per cent of the shares, individual investors the rest. SibTelecom has been involved in a number of satellite communications projects in Krasnoyarsk and neighbouring regions, including one on long-distance capacity to the North region and another on a private network for the Central Bank and its associated banks in Siberia.

SibTelecom, as well as Rustel, have a proposal for extending long-distance capacity to Norilisk and other northern cities. The plan envisions by-pass satellite network with earth stations in Norilisk and Krasnoyarsk-26. Within the local area of Norilisk, they would use radio relay links. The earth stations would have their own numbers to by-pass the existing intra-region radio relay network operated by Rostelekom. SibTelecom is considering a similar approach in two other regions. The line would be fully connected to the PSTN at either end. SibTelecom has also had discussions with SibChallenge about interconnecting their networks for intra-regional traffic. Rostelekom will lease the capacity from SibTelecom.

In terms of technology, they propose using a 103 Gorizont satellite for the first phase, with plans for using an Express satellite in the future (Express is a new satellite funded by Russian investors and developed by NPO-PM). Leasing the whole transponder would cost US$1 million so they are starting with 10 per cent of the bandwidth, or 480 channels. The original Development Plan for 1985-2000 called for 1 500 channels to the North (more than ten times existing capacity). Given the uncertain economic prospects of the North Region, both Rustel and SibTelecom are proposing to start with fewer channels to assess demand requirements and limit exposure.

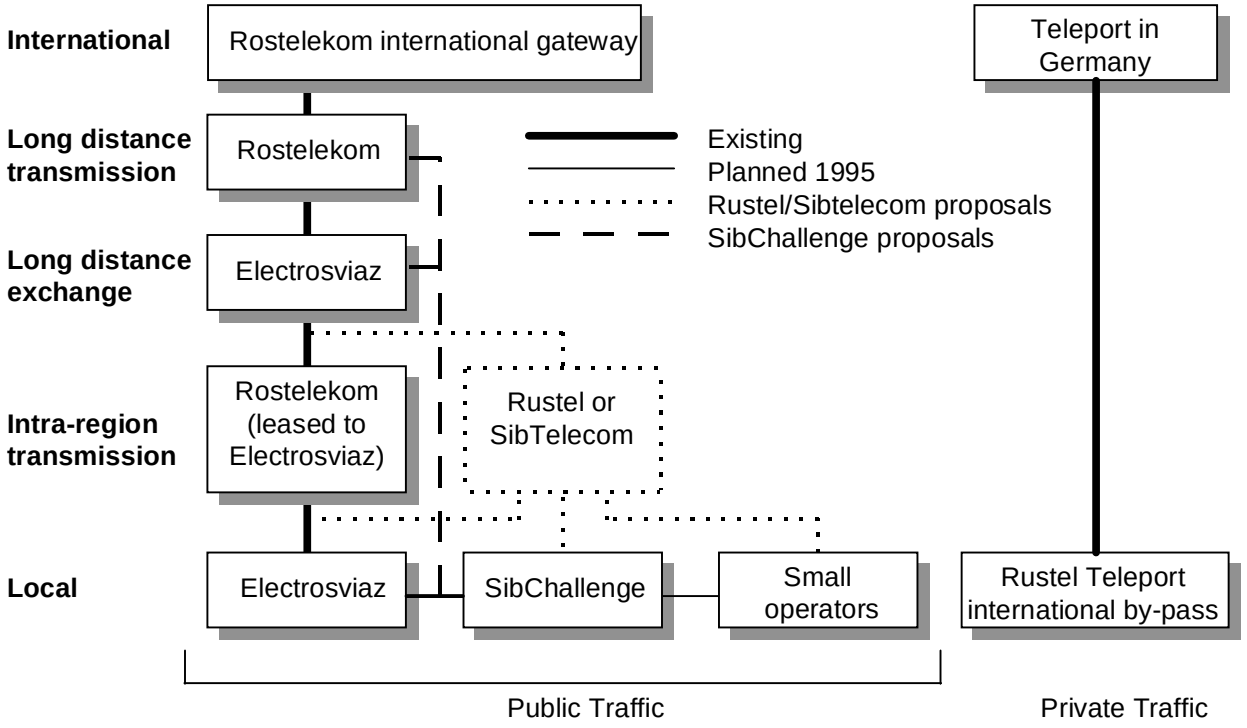
SibTelecom has recently set up a bank clearance satellite communications network for the Central Bank. The have established the network in Krasnoyarsk and Irkutsk requiring twelve and twenty remote stations, respectively. Each network cost about US$2 million to install, paid for by the Russian Central Bank. The company is now considering similar networks in other regions.

Sector Structure

The evolving sector structure in Krasnoyarsk region has reflected changes in the sector structure in Russia. Until now, Electrosviaz has operated some local networks and the long distance exchanges. Intra-region traffic has been routed over Rostelekom capacity leased by Electrosviaz. Inter-region traffic has passed on to Rostelekom, which has the monopoly on interregion PSTN traffic.

This relatively simple structure will change this year as the new service providers, described in the previous section, become operational. The new sector structure is summarised in figure 5.1.

Figure 5.1. Telecommunications structure in Krasnoyarsk



The emergence of bypass operators is one of the more significant recent, national developments. Rustel is Krasnoyarsk's only bypass operator and its presence is extremely minor. More important for Krasnoyarsk has been the emergence of local operators fully connected to the region's PSTN.

According to the development plans of the region's Coordinating Council and agreements between the major participants, the new operators are not intended to compete directly. Each operator is allocated an area to develop. Therefore, although there will be private operators, there is no direct competition for subscribers in the local network. These operators will be allowed to charge higher tariffs.

For technical and capacity reasons, SibChallenge is to be the only local network connected to the Electrosviaz network. Other local operators are to be connected to the SibChallenge network. Initially, all intraregion and long distance traffic from the new operators will pass through Electrosviaz exchanges. SibChallenge, however, can connect directly with Rostelekom. Therefore, SibChallenge might switch interregion traffic directly to Rostelekom, bypassing the Electrosviaz long distance trunk exchange.

All intraregion traffic is passed over the Rostelekom transmission network. For the northern region, existing capacity of 120 channels does not meet current demand and the tropospheric radio relay quality and reliability are low. Rustel and SibTelecom have proposed additional intra-region capacity supplied through satellite communications. Rostelekom owns shares in both companies and, at least in the case of SibTelecom's plan, will most likely pay SibTelecom for this new capacity.

Rostelekom does not have a monopoly on the transmission of intraregional traffic. Currently, Electrosviaz leases some transmission capacity from Rostelekom. However, there is no regulatory constraint preventing Electrosviaz or any of the new operators from switching their intraregion traffic through another operator's transmission network. As the chart above indicates, future proposals include the new operators and Electrosviaz switching their intraregion traffic through the new transmission providers' infrastructure. Whether the new intraregion infrastructure is paid for by Rostelekom remains to be seen.

Although the sector structure could evolve into direct competition, the different participants do cooperate with each other. As table 5.1 shows, the major companies in the sector are interrelated through share ownership. However, the percentage of share ownership is usually relatively small.

Table 5.1. Financial arrangements between Krasnoyarsk participants

Investor	**Recipient**		
	Rustel	**SibChallenge**	**SibTelecom**
Electrosviaz			S
Regional equipment manufacturers	S		S
Rostelekom	S	S	S
SibChallenge(1)	P	S	

Notes: S = equity ownership
P = profit sharing
(1) SibChallenge is the parent company of SibChallenge Telecom

Regulation

The sector's regulation is implemented through a mixture of federal laws, Ministry orders, decisions of regional regulatory authorities, and negotiations between participants. Regulation seems relatively straightforward from a national perspective, with a series of policies and procedures. Although these are used as a guide on the regional level, the actual implementation of plans requires a considerable amount of negotiations and mutual agreement between the different participants.

The primary regulatory authorities are:

- Territorial Administration
- The Ministry's Gossviaznadzor
- Territorial Pricing Policy Committee.

Co-ordination

The Territorial Administration and the Gossviaznadzor chair a Telecommunications Coordinating Council, which co-ordinates the different operators according to a regional development plan. These three bodies are described below.

Territorial Administration

The Territorial Administration is the region's highest political authority. As Russia is a federation, the regional Governments have a large degree of autonomy from Moscow. Although the Administration's Department of Transportation and Communications' primary emphasis is on the transportation sector, it also promotes telecommunications within the region. It prefers to focus on manufacturing, rather than on services. The director of the Department chairs the Coordinating Council (see below). The Coordinating Council is the Administration's primary vehicle for influencing the service sector.

Gossviaznadzor

The State Telecommunications Monitoring Board (Gossviaznadzor) also has considerable influence in the region, acting as the Ministry's regional representative. Gossviaznadzor has the following responsibilities:

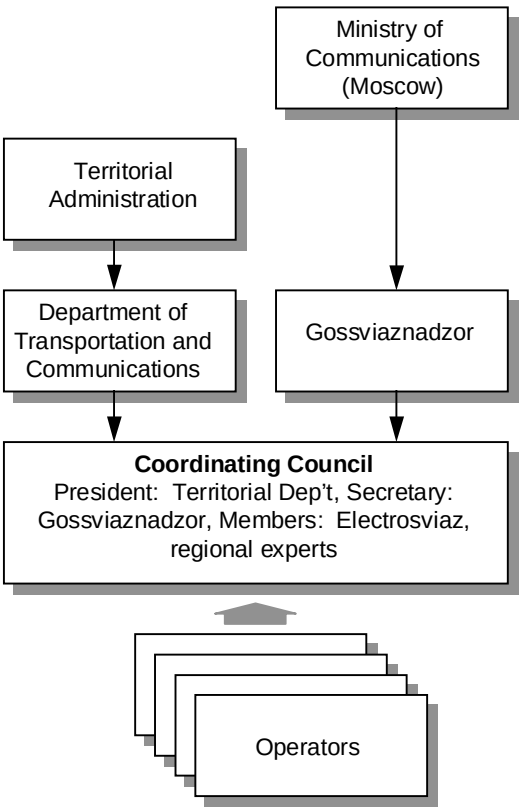
- represents the interest of the Ministry in the region;
- monitors compliance with the Communications Law;
- monitors compliance with licences; and
- ensures official tariffs are being paid.

Gossviaznadzor ensures that official tariffs are paid by visiting end-users and reviews their bills. The regional director of Gossviaznadzor is the Secretary to the Coordinating Council.

Coordinating Council

The Coordinating Council is comprised of the major participants in the telecommunications sector in Krasnoyarsk. The Territorial Administration's Director of the Department of Transportation and Communications is the chairman, and the head of Gossviaznadzor is secretary. Other members of the Council include Electrosviaz and regional academics. Figure 5.2 summarises the relationships between the Coordinating Council and sector participants.

Figure 5.2. Coordinating Council of Krasnoyarsk



The Coordinating Council has three major responsibilities:

1. authorise service providers;

2. resolve disputes between operators; and

3. make recommendations to the Ministry.

Only the Ministry can issue operator licences in Russia, but the regions can influence the terms of a licence. Any company wanting to operate in the region must present its plans to the Coordinating Council. The Council reviews these plans within the context of the region's overall development plan.

Upon receiving authorisation, new operators apply for a licence from the Ministry of Communications in Moscow. The terms of the licence are effectively what was agreed between the operators and the Coordinating Council in Krasnoyarsk.

Not all operators with licences for the region have received them under this process. In the early years, companies based in Moscow, for example, could apply for a licence to operate in a number of cities throughout Russia, including Krasnoyarsk. These licensed companies did not have the Coordinating Council's agreement for their plans. Although we have not seen the actual terms of such licences, it appears that the obligations for these companies are less demanding than those now imposed by the Coordinating Council.

This situation could generate conflicts. For example, it is our understanding that an operator with a licence for 10 000 lines has installed a small exchange within SibChallenge's allocated territory and is planning to connect directly with Electrosviaz. If other small operators have similar strategies and freedom in their licences, then problems may arise for SibChallenge. If the new licensees become operational, they would represent about 50-60 000 lines -- almost one-third of SibChallenge's network. They will inevitably seek the most rewarding customers and as we understand, they do not have to use any profits from these services to fund investment in lines to less commercially attractive customers, as does SibChallenge.

If SibChallenge is denied a high revenue earning customer base, it may have difficulty in meeting its license investment obligations. In short, the Coordinating Council's policy aims may be undermined by the previous licensing policy implemented solely from Moscow.

Similar situations happen in countries undergoing policy and regulatory changes. Usually, the earlier licenses are "grandfathered", i.e, they are allowed to continue, while new licences must conform to the new terms. The Ministry is aware of the potential problem of licensees with different obligations. To change licences that have already been issued would undermine the Government's credibility. Consequently, its policy is to amend existing licences when licensees apply to the Ministry for additional licences.

The Coordinating Council resolves conflicts between operators through negotiations and agreements. Conflicts, as the one described above between SibChallenge and the other operators, would be discussed at the Coordinating Council. Since the major participants are members of the Council, they could impose their objectives on new operators, which may promote or inadvertently slow network development.

An important example is interconnection. Although the smaller operators may be free to focus on high revenue customers, Electrosviaz and Rostelekom could raise interconnection rates to the new operators, raising their prices to customers, and reducing their competitive advantage over SibChallenge or Electrosviaz. This may be desirable to a point -- interconnection fees can be a way of sharing the costs of universal service obligations.

If the Coordinating Council cannot resolve disputes, it can recommend, through Gossiaznadzor, further action to the Ministry. The most likely case would be an operator who fails to comply with the terms of its licence. Gossiaznadzor could recommend to the Ministry that the licence be repealed. This has not happened yet.

Another potentially difficult dispute scenario could develop. Electrosviaz could make the terms for interconnection unfavourable to new operators, lowering profitability and increasing the difficulty in meeting network development obligations. Electrosviaz could then appeal to the Council, arguing that they are not able to service demand from customers in the new operator's region, and the new operator is not meeting the terms of its licence. If this were to happen, Gossiaznadzor would recommend to the Ministry repeal of the new operator's licence. In this situation, it is not clear what the Ministry policy in Moscow would be.

The Council would have to decide whether an operator's inability to meet licence obligations is a function of unfair commercial practices (such as interconnection terms misapplied) or a result of the licensee's own managerial weaknesses.

Tariff regulation

The Territorial Committee on Price Policies has responsibility for tariff regulation in Krasnoyarsk. It regulates regional prices in many sectors, including housing, fuel, and other utilities. While the Pricing Committee has traditionally taken policy guidance from Moscow, the last few years have witnessed a devolution of regulatory responsibility to the regions.

A March 1995 Government decree regulating tariffs for natural monopolies in March 1995 calls for lists of services to be regulated at the federal and regional levels. Goods and services are categorised into three groups, those:

a) which must be regulated at the federal level;

b) which must be regulated at the regional level; and

c) that the regions have the option of regulating.

Federal departments are to decide what tariffs should fall under the above categories. Consequently, tariff regulation is currently open-ended. In this uncertain environment, the Pricing Committee has maintained its traditional policies and procedures.

The Pricing Committee regulates installation and rental tariffs for residential customers. Electrosviaz is free to set its own tariffs for fixed charges for business customers. The Ministry regulates international tariffs for all PSTN traffic, as well as interregion traffic for state budget organisations (SBO). Regulatory responsibility by tariff type and customer is summarised in table 5.2.

Table 5.2. Tariff regulation responsibility

	Res	**Bus**	**SBO**
Installation	K	O	O
Rental	K	O	O
Local	O	O	O
Intraregion	O	O	O
Interregion	O	O	M
International	M	M	M

Key K = Krasnoyarsk Pricing Policy Committee
O = Operator (e.g., Electrosviaz)
M = Ministry of Communications (Moscow)

Although Electrosviaz is theoretically free to set most categories of tariffs, the Pricing Policy Committee still exercises a high degree of control, for Electrosviaz's profitability (profit measured as a percent of operating costs) is regulated at 50 per cent.

Tariff review process

The Pricing Committee does not see its role as dictating residential tariffs, but as reaching agreement with Electrosviaz on the overall level of tariffs. Tariff review starts with Electrosviaz sending the Committee a request for tariff changes. The Committee compares the request's projections with a coefficient of inflation. It can also ask Electrosviaz to explain any big changes in their cost projections. In theory, Electrosviaz can request reviews as often as it wants. In practice, Electrosviaz submits requests two to three times a year. As part of the tariff review, Electrosviaz must prepare the following information justifying the tariff increases:

- current and projected costs;
- current and projected revenues;
- description of factors influencing projections;
- proposed tariffs; and
- comparisons with tariffs in other regions.

The Pricing Committee considers the following three criteria when reviewing tariffs (in order of importance): (i) inflation trends; (ii) maintenance of a 50 per cent profitability (gross operating margin), and (iii) assurances of the customers' ability to pay.

The Pricing Committee's most important objective is seeing that residential rental tariffs keep up with inflation without increasing in real terms. The tariff analysis in the following section shows that the Committee successfully kept residential rental tariffs pegged to inflation since the middle of 1993.

Moscow decreed a 50 per cent level of profitability between 1992 and 1994. If profits were more than 50 per cent, the tax authorities would take the difference from Electrosviaz. The 50 per cent objective is no longer set by decree, but without an alternative method, the Pricing Committee still uses 50 per cent as a benchmark.

Determining the customers' ability to pay is an extremely subjective matter. No benchmarks -- say, rentals at 2 per cent of household income -- are used. In fact, no specific benchmarks are used for the other sectors under price regulation, except for state housing (which should be no more than 10 per cent of household income). The Pricing Committee commented that part of the reason for not having clear criteria on the ability to pay is the difficulty in determining household income. For example, many people have not been paid their official wages for months.

There is no overall limits for regulating utilities (e.g., electricity, gas), although these prices are looked at together. The most important price the Committee regulates is fuel. Typically, when fuel prices are raised, other utilities' tariffs, including telecommunications, are also raised.

Maintaining the 50 per cent profitability objective will not enable tariff increases. The current financial approach neglects two important financial aspects: financing costs and depreciation.

Tariffs should generate enough revenue to cover operating costs and financing costs (e.g. interest on borrowing). These costs would increase significantly as modern equipment is purchased. Yet, the current definition of profitability does not include financing costs. Moreover, it is likely that depreciation

charges considered in profitability reflect historical costs of equipment. To generate enough cash flow, depreciation charges should be readjusted to account for depreciation at replacement cost.

New, local operators have yet to present residential fixed tariff proposals to the Pricing Committee. Such proposed tariffs will likely be significantly higher than those of Electrosviaz. In addition, as private companies, they will have different profitability targets and may have alternative accounting approaches. How the Pricing Committee will address these new issues is not known.

Finally, tariffs in the northern region are twice as high as those in the southern. During the Soviet Union, the government doubled wages and costs for the northern region. Therefore, although tariffs were twice as high, so were wages. Many northern areas are economically depressed and official wages, although high, have not been paid. Consequently, although the northern region has higher tariffs, they are being subsidised by Electrosviaz through late payment and credit extensions.

Tariffs

Tariffs are analysed according to three principal aspects: 1) a review of tariff policy objectives, 2) a discussion of historical tariffs and what they imply for tariff policy, and 3) a look at future tariffs and investment.

Tariff objectives

Tariff regulation must usually balance a number of competing objectives. The priority of these objectives vary, depending on the development of the sector. Krasnoyarsk's key objectives should probably be in the following priority:

- stimulating investment;
- balancing supply and demand;
- covering costs; and
- protecting the interests of customers.

Stimulating investment

Krasnoyarsk's tariff policy needs to stimulate investment in network development. Any tariff strategy must address the Territorial Administration's objectives of modernising and expanding the network.

Tariff policy can encourage investment in many ways. First, tariff increases could improve cash flow, allowing the Electrosviaz and other operators to self-finance investment. In western countries, firms typically finance over 70 per cent of their investment. Large enterprises in transition economies finance much lower shares for:

- existence of large, long-term investment demands;
- short-term cash flow problems tied to the state of the economy and public service obligations;
- use of accounting methods that discourage cash accumulation (e.g., low depreciation).

Although self-financing ratios are relatively small in transition economies, the ability to fund investment from internal cash flow is extremely important in unlocking other forms of investment finance. Generating a stable cash flow demonstrates commitment, confidence in future profitability, and ability to pay interest on further lending. The ability to self-finance will attract other sources of finance, in particular International Financial Institutions (IFIs) such as the EBRD and World Bank.

Recently, IFI has lent little to the Russian telecommunications sector. Therefore, tariff policy must encourage investment from the private sector, either as loans or equity. Siemens and Ericsson Tesla have already provided supplier financing to Electrosviaz and the new operators. Russian private equity capital is starting to enter the sector and will become more important as the number of issued licenses grow and the economy becomes more stable.

Balancing supply and demand

All development plans should aim to meet demand for telephone services. The future demand for services in Krasnoyarsk will be influenced by a number of factors related to changes in the economy. Nonetheless, demand is primarily a function of price. With relatively low priced fixed charges in Krasnoyarsk, the demand is naturally quite high. Experience in other countries shows that real increases in tariffs result in a drop in the waiting list. It is possible to meet demand by increasing tariffs to the point where the number of lines businesses and households will pay for equals the number of lines which can be financed by the new tariff levels. Consequently, finding the right balance between prices and demand is crucial for financing the supply of telephone services.

Covering costs

Tariffs must cover all costs if telecommunications operations are to continue in business. If modernisation and expansion are to be funded, then capital and financing costs, as well as operating costs, must also be covered by tariff revenue. Yet, the Pricing Policy Committee's present concept of profitability only relates to operating costs. Moreover, operating and capital costs will rise to western levels as modern equipment replaces old plant and equipment. Tariff strategy must be linked with medium-term development objectives, not just tied to past costs.

Two key policy questions relate to costs:

- What contribution to capital and financing costs should be made out of tariffs?

- Should tariffs generate revenue to cover total costs, or should individual tariffs cover costs associated with the particular service (i.e. long distance tariff covering long distance costs)?

The general level of tariffs should cover total costs. In practice, of course, decisions have to be made about specific tariffs, such as rental or long-distance charges. Nonetheless, as long as the tariffs generate enough total revenue to cover total costs, the actual level and structure of tariffs are less important.

Tariff structures may be determined many ways. For example, individual tariffs could reflect the costs associated with that particular service. Although we use individual costs as a guide, our tariff policy and model do not reflect this approach in the short term. The reasons for this are:

- Advocates of rapid tariff rebalancing are mainly concerned with tariff effects on competitive entry rather than efficiency. This environment does not yet exist in Krasnoyarsk.

- Even in competitive markets, operators do not necessarily match specific tariffs with associated costs. Cellular phone operators in the UK use different pricing strategies to gain market share in a very competitive market. They do not match individual tariffs with costs. For example, some operators will subsidise the cost of handsets to attract residential customers and generate revenue with high call charges.

- Maintaining constant rental charges for all customers is a clear policy of the Pricing Policy Committee and Electrosviaz. Residential customers currently cannot afford the actual costs of local calls.

Over the next five to seven years, as the economy develops, the ability to align tariffs with costs will increase. Tariffs will begin to converge, as they have in the western countries. However, the use of discounts (volume and time-of-day charging) means that, in practice, customers will still be paying different prices for the same services.

Protecting the interests of existing customers

Krasnoyark's current economic situation has severely reduced the purchasing power of many residential and business customers. It is undesirable, economically and socially, to force these customers off the network. Thus, tariffs that do not affect these customers, such as connection charges, may be raised more rapidly than other tariffs.

In summary, tariff objectives should encourage investment in the sector, subject to protecting existing customers. Tariffs should generate enough cash flow to enable the operators to self-finance some investment and unlock other sources of finance.

Current tariffs

The following analyses Krasnoyarsk Electrosviaz' tariffs. While new operators have their own tariff strategy, their tariffs have yet to be finalised or submitted to the Pricing Policy Committee for review.

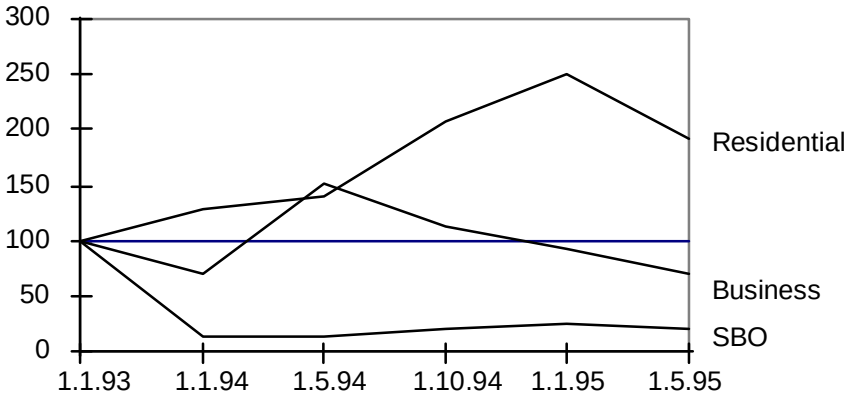
Real growth

Figure 5.3 indicates how tariffs have changed in real terms. Tariffs as of January 1993 are used as an index to indicate real changes.

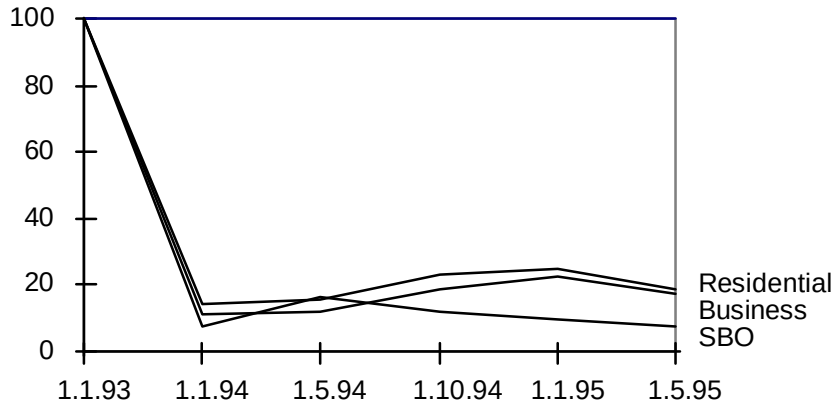
Figure 5.3. Krasnoyarsk fixed tariffs

(Real growth since 1 Jan. 1993)

Installation



Rental



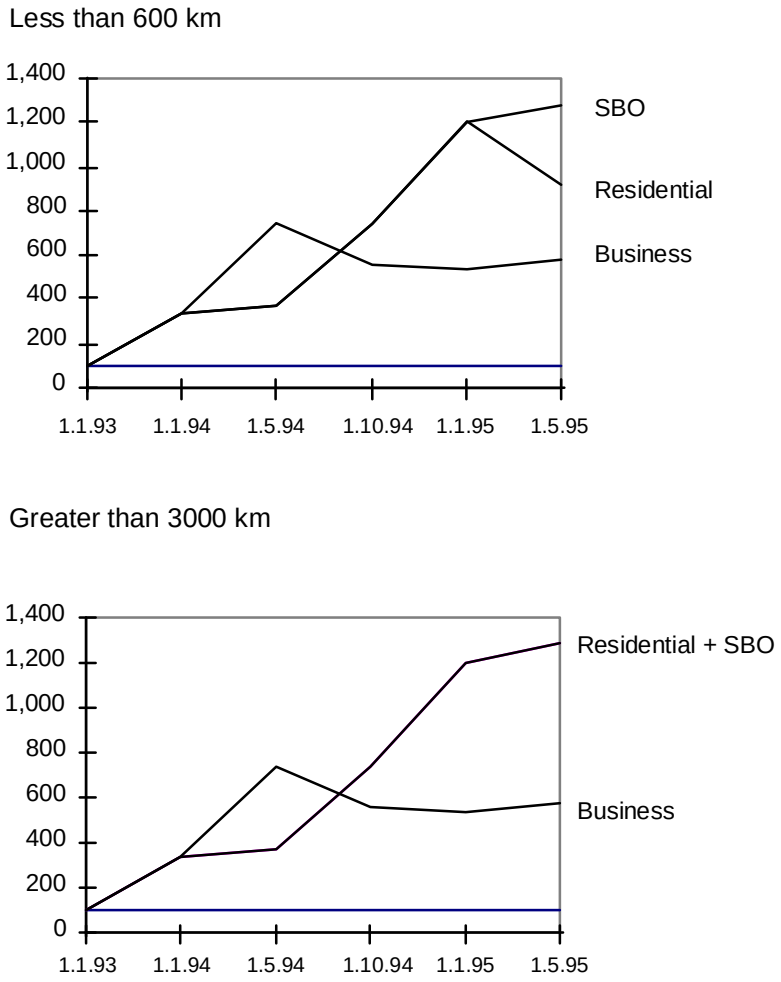
Among fixed tariffs, the installation charge for residential customers has increased the most in real terms since 1993. Still, it was not changed in nominal terms in 1995, so it has recently decreased in real terms due to the effects of inflation. The business installation charge dropped slightly in 1993, was readjusted at the beginning of 1994, and then remained unchanged in nominal terms. (Meaning it has actually dropped below the real 1993 level.) It still remains above the 1993 level. After a large drop during 1993, the SBO installation charge has tracked inflation since the beginning of 1994. Consequently, it is considerably below the real level of 1993.

Rental charges for all customer groups have followed the same pattern. They all decreased in real terms during 1993. Since the beginning of 1994, however, they have remained relatively constant, tracking inflation.

Real growth of usage tariffs in constant January 1993 prices is shown in figure 5.4.

Figure 5.4. Krasnoyarsk usage tariffs

Real growth since 1 January 1993



Usage charges for all customer groups have increased considerably in real terms since 1993. Business charges have remained relatively constant since May 1994. Residential and SBO tariffs, however, have continued to increase, closing the gap between customer groups.

Policy implications

Electrosviaz appears to be increasing usage tariffs at the same rate that the Ministry increases SBO interregional tariffs. Despite freedom in raising domestic usage tariffs for residential customers, Electrosviaz has still chosen to follow the Ministry's lead.

Electrosviaz's reasons for not raising business tariffs since mid-1994 are unclear. There are two most likely explanations. Tariffs, particularly usage tariffs, are already relatively high and approaching world levels. Electrosviaz may believe that raising tariffs further would hurt business customers. Second, pressure from the Pricing Committee to maintain a 50 per cent profitability margin may prevent Electrosviaz from raising business tariffs further.

The Pricing Committee has obviously ensured that residential rental charges remain constant and do not increase in real terms. Nonetheless, it has allowed residential installation charges to increase in real terms. Electrosviaz's approach to business and SBO fixed charges has been different. SBO fixed charges, after a large real decrease in 1993, have remained constant. Similar to business usage charges, Electrosviaz has chosen not to increase business fixed charges.

Relative weighting between fixed and usage charges

The OECD has developed a tariff basket model for Russia and applied it to Krasnoyarsk (see table 5.3).

Table 5.3. OECD Krasnoyarsk tariff basket

Residential		**1.5.94**	**1.10.94**	**1.1.95**	**1.5.95**
Fixed	USD	28	33	38	30
Usage	USD	32	38	57	55
Total	USD	51	71	95	86
Fixed	%	55	47	40	36
Usage	%	45	53	60	64
Total	%	100	100	100	100
Business					
Fixed	USD	318	200	151	122
Usage	USD	707	441	399	453
Total	USD	1,025	661	550	575
Fixed	%	31	31	27	21
Usage	%	69	69	73	79
Total	%	100	100	100	100

Since the beginning of 1994, fixed charges, as a percent of the total basket, have been decreasing relative to usage charges. The primary reasons are that: rental charges have decreased in real terms and usage charges have increased significantly more than installation charges.

This trend contrasts with trends in OECD member countries, where fixed charges are increasing relative to usage charges. The increasing fixed charges reflect the different cost structure of the digital networks being installed, with relatively high fixed costs and low variable costs. For many countries, usage charges are falling faster than fixed charges. Although both usage and fixed charges are falling in real terms, fixed charges are becoming a relatively higher proportion of a customers' bill.

Some European countries, which are still aggressively developing their infrastructure (e.g. Greece, Portugal, and Spain), have raised fixed charges in real terms. Connection charges in central and eastern Europe have increased even more dramatically, also reflecting this trend.

Countries investing heavily in their network, such as Russia, might want to increase the connection charge to:

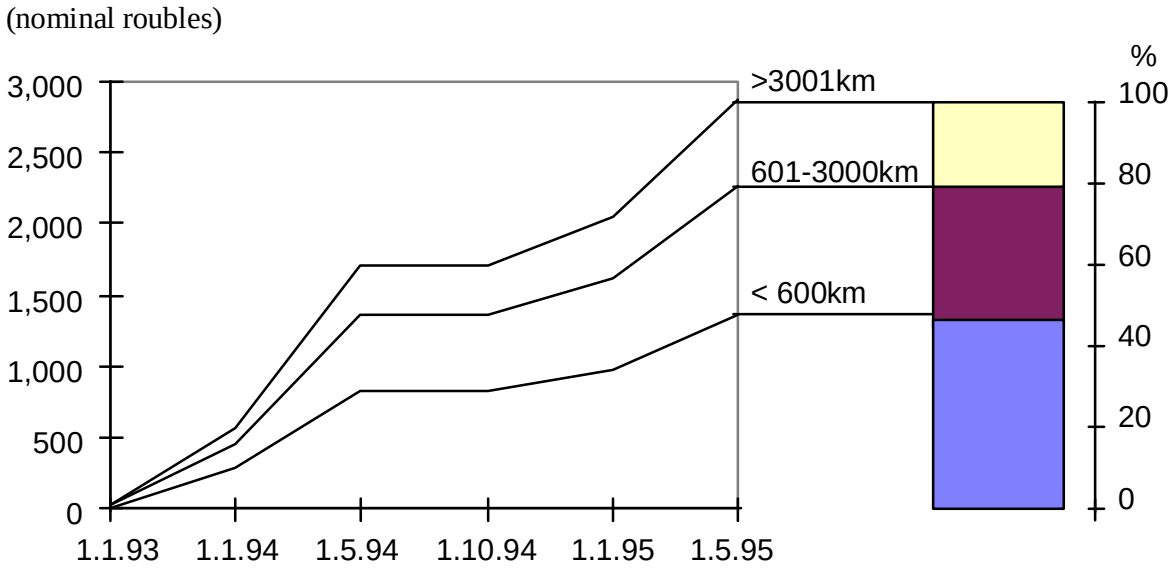
- reduce the waiting list, enabling the operator to match demand with supply;
- recover installation costs more quickly;
- increase revenue without affecting existing customers; and
- deter customers who do not have the ability to pay.

Rebalancing between tariffs according to distance

In OECD countries, the structure between fixed and usage charges has changed and usage charges are being rebalanced. Since 1990, tariffs for local calls have increased or stabilised, and real term long distance charges have decreased. These changes have been particularly strong in countries with competitive environments.

In Krasnoyarsk, there has been no tariff rebalancing since at least 1993. All usage tariff categories have increased at the same rate. Figure 5.5, showing business tariffs, demonstrates this.

Figure 5.5. Krasnoyarsk business usage tariffs

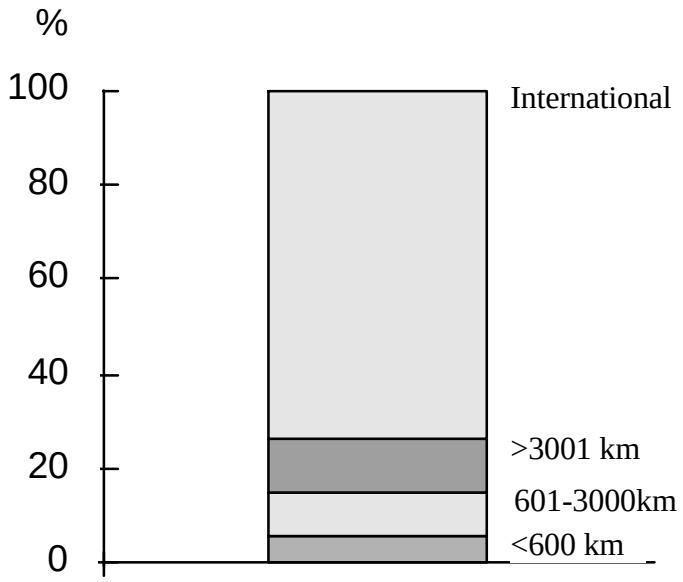


Since 1993, business tariffs for traffic over 3001km have been more than double those under 600km and one quarter more than those between 601km to 3000km. Residential and SBO tariffs follow a similar pattern.

Call charges in most former Soviet Union countries and regions have been out of balance with major differences between inter- and intra-region tariffs. This is not the case in Krasnoyarsk. Indeed, the ratio between the different distance tariffs is comparable to other OECD countries. Krasnoyarsk's current international tariffs are at world standards. Domestic intra- and inter-region tariffs are much lower than international tariffs. This gap will decrease over time as international tariffs decrease rapidly in response to international pressures (e.g. call back, competition) (see figure 5.6).

Figure 5.6. Krasnoyarsk business usage tariffs

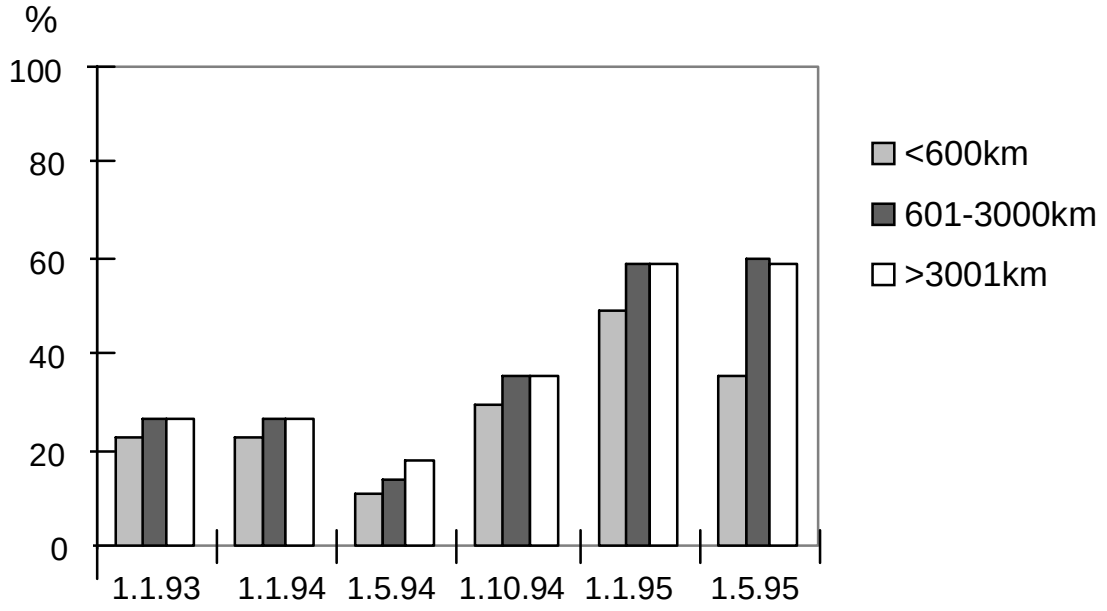
(% average international tariffs)



Rebalancing tariffs between customer groups

Tariff rebalancing has occurred between customer groups. Business usage tariffs have been much higher than residential and SBO tariffs; however, since mid-1994, the gap has closed (see figure 5.7).

Figure 5.7. Residential and SBO usage tariffs (%of business tariffs)



Given the economic situation in Krasnoyarsk, this rebalancing trend should continue. Because of Krasnoyarsk's geographic location, business is at a cost disadvantage compared to other regions closer to foreign trading partners. Business tariffs are already high, so some of the development costs should be borne by residential and SBO customers.

Tariff Model: Financing investment

Our tariff model for forecasting the effects of tariff changes and investment programmes requires a number of inputs, including:

- tariffs;
- number of lines;
- traffic volume;
- demand (e.g. waiting list);
- demand elasticities;
- financial information (e.g., operating costs, taxes);
- financing costs; and
- financial objectives (e.g. return on capital employed).

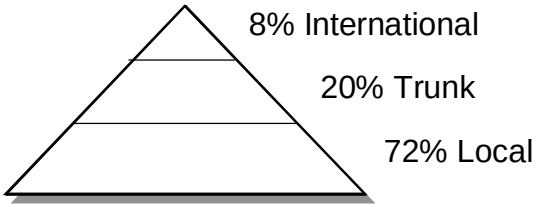
Electrosviaz, Rostelekom, and the Pricing Policy Committee provided some of this information for the model. Where information specific to Krasnoyarsk lacked, assumptions found to be consistent in other CIS countries were used.

Capital costs

Estimating capital costs in the former Soviet Union is always a difficult task. Estimates vary widely among countries. The World Bank estimates that the average capital investment per line is US$1 500 for developing countries. Because many costs in transition economies are not at market levels, the cost per line in eastern Europe is estimated at US$1 200 and for CIS countries, US$1 100.

The estimates are for the entire national network, but regional costs vary. Experience in western and eastern Europe shows that the local network (including junction) component of developing a national network is typically 70-75 per cent of the total cost (see figure 5.9). The cost of developing the trunk component is 20 per cent, and the international component, about 8 per cent of the total.

Figure 5.9. Typical Network Cost Elements



According to SibChallenge and Electrosviaz, line costs for the local network, including junction, ranged from US$800 to over US$1 200 for Krasnoyarsk City. Costs may be greater in other Siberian cities, so we have conservatively estimated capital cost for a new digital line of US$1 000.

Refurbishing existing lines costs about 80 per cent of the cost of a new line. Some reuse of existing plant will be possible. However, resulting cost savings will be small since existing plant is beyond its useful life and obsolete. Refurbishing a line still involves installing a modern, digital exchange and transmission equipment.

Operating costs

Current operating costs (including all taxes and depreciation) are about US$100 per line. According to Electrosviaz, its last year's profit after tax was 20 per cent. (No financial data to support this figure was provided.) The implicit operating cost per line is much higher than other CIS countries. Future operating costs will combine the costs associated with the existing analogue network with those of modern, digital equipment. Operating costs for the exisitng network will probably increase in line with economic growth in Krasnoyarsk. These costs can be added to the operating costs associated with the modern lines, which are dependent on world price levels. General operating costs, maintenance and inventory are the major operating costs associated with the new equipment.

In the model we assume operating costs to be 5 per cent of cumulative capital expenditure. These costs would include training personnel to operate modern exchanges, operating new computer

systems for billing, and establishing marketing functions to sell services possible with digital equipment. We estimate maintenance and inventory costs at 2 per cent of cumulative capital expenditure, a share consistent with western experience, as maintenance and inventory will be provided at world price levels.

Financing costs

A tariff strategy's primary objective should be to encourage investment. The three principal forms of financing investment, in order of preference, are: internally generated funds, debt and equity. Firms typically use all three sources. For telecommunications, half the investment is usually self-financed, with the remainder divided between debt and equity.

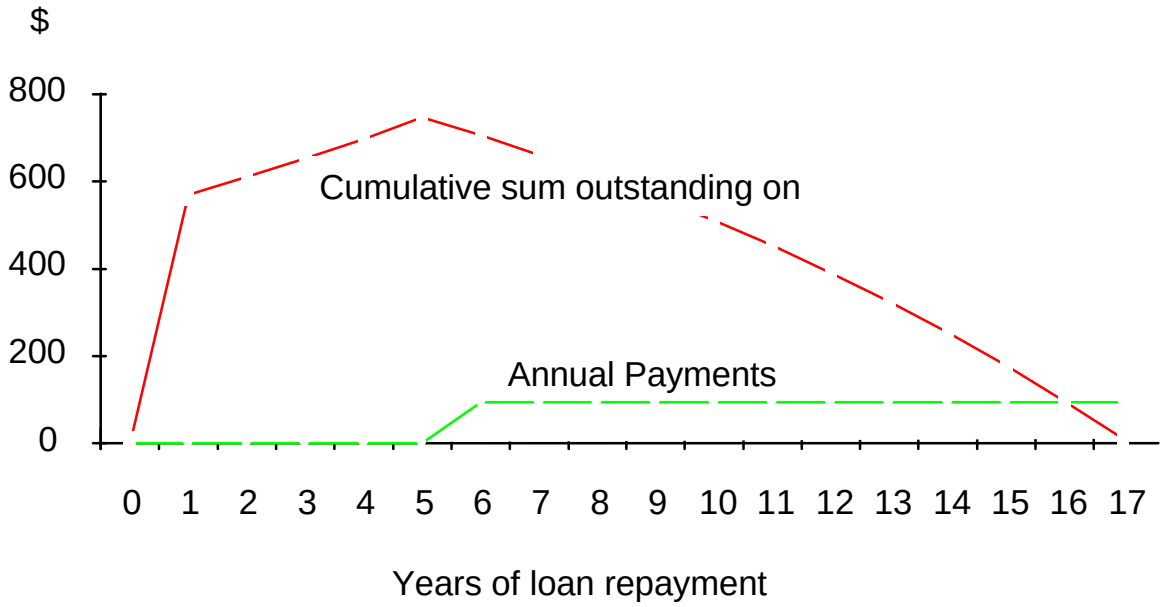
In the model for Krasnoyarsk, we have assumed financing through borrowing, not through issuing equity. At this stage in Krasnoyarsk, external financing is mostly done through supplier credits (and, in the case of the new operators, profits from other operations), which are typically costly. In the future, private equity may well take a larger role. Cost of debt is lower than the cost of equity, so our 50 per cent borrowing assumption is a conservative estimate.

We also assume that half of the required investment can be financed by a loan from an IFI. The typical terms of a World Bank loan are:

- 17 year term;
- 5 year repayment holiday (grace period);
- 7 per cent interest rate per year; and
- even repayments over the last 12 years of the loan.

Given this loan profile, financing costs -- repayment of principal and interest -- for one line are about US$100 per year starting in year 6 (see figure 5.10).

Figure 5.10. Repayment of interest and principal for one $1,000 line with 50% debt finance



Average revenue per line must be able to cover these financing costs. The total network -- new lines plus existing lines -- will generate revenue to cover the financing costs of the new lines. However, total revenue must also cover operating costs described earlier which will increase from US$100 per line to US$180 per line by year 2005. In addition, total revenue must be enough to meet a profitability target to satisfy investors. Therefore, average revenue per line will increase from US$129 now to US$226 by the year 2000 and US$260 per line in the long term.

Financial performance and measurement

Tariff policy must ensure that the total costs described are covered by revenue. Tariff policy must also maintain the general financial health of the sector. An investment programme that is too aggressive may increase the number of new lines in the short term, but it will result in extremely high interest charges in the next five to ten years, eliminating cash flow and preventing further investment.

Because CIS financial accounts differ from western accounts, investors have a difficult time determining the financial health of enterprises. Consequently, they use simple financial ratios to measure performance. Typical operating margins (operating profit before taxes and interest as a percent of revenue) of major telephone operators in OECD countries are around 20 per cent.

Operating margins for operators in developing countries are sometimes much higher. For example, Telmex of Mexico has one of the highest operating margins at 42 per cent (although this is expected to decrease to the 30s as competition enters the market). The Krasnoyarsk telecommunications sector must maintain a high margin as financing costs begin to grow as interest becomes due. To be able to pay interest and maintain profitability, an operating margin of at least 30 per cent is required.

Another important measure of return on investment is Return on Capital Employed (ROCE). ROCE is defined as: *Operating margin/Capital employed x 100*. Operating margin is profit before the payment of interest and taxes on profit. Capital employed can either be defined as long term debt plus equity, or total assets less short term liabilities. Given Russia's accounting standards, it is usually difficult to determine capital employed. However, this situation should change as accounting practices are revised.

In short, ROCE figures enable investors to see what type of return is possible deploying all sources of capital (borrowing and equity). British Telecom, a successful company by world standards, has been achieving a 20 per cent ROCE for the last five years. Investors in telecommunications in Krasnoyarsk will require a higher ROCE to account for the risks unique to Russia, such as:

- uncertain licensing policy (ability of new entrants to compete);
- economic instability of Krasnoyarsk; and
- possible government policy changes (e.g., taxation, employment laws).

Given the risks associated with investing in Krasnoyarsk, we estimate that investors should expect a 25-27 per cent ROCE. This benchmark has been used in the model.

Development projections

About 450 000 lines can likely be funded over the next ten years. Half will come from modernisation of the existing network, and the other half, from net new lines to meet demand. Assuming 50 per cent self-financing and debt, the external financing requirements are about US$225 million over ten years.

The tariffs required to meet this target are close to the current tariffs. However, there may be a variety of tariff regimes in Krasnoyarsk with the introduction of new operators. In the model, residential rental tariffs rise to a level that is 2 per cent of average household income. In reality, new operators may charge a higher rental tariff to a selected wealthy customer base.

In the future tariff scenario, business usage charges remain the same, with continued residential and SBO rebalancing. In order to match demand with supply and cover more costs of installation up front, installation charges for all customer groups are increased 100 per cent for the next two years. The residential installation charge in 1997 is US$320. Business and SBO installation charges are raised to US$790 over the next two years. All rental charges are increased 50 per cent over the next two years, since there is some opportunity for residential rental tariffs to increase in real terms. Over the next ten years, residential tariffs are raised every three years to track growth in household income. International tariffs decrease over 2 per cent per year after 1997 in response to worldwide downward pressure on international rates.

The revenue and cost per line forecast show that the impact of financing costs appears around 2005 as principal and interest comes due on the borrowing from the late 1990s (see table 5.4). Consequently, profitability does decrease slightly.

Table 5.4. Summary of revenue and cost per line forecast

	1995	2000	2005
Revenue/line	129	226	255
Operating cost/line	100	137	177
Financing cost/line	0	2	20
Profit/line	22	77	65

The waiting list is cleared by 2005 as a result of higher connection charges and installation of new lines installed (see table 5.5). Teledensity for the region increases from 14 per cent to 20 per cent. After 1998, we assume that 5 per cent of the network is refurbished every year. The result of refurbishment and net new lines is that the entire network is 60 per cent digital by 2005. Because determining capital employed for the existing network is difficult, we have calculated ROCE based on new capital expenditure only.

Table 5.5. Network projections

	1995	2000	2005
Average revenue/line	129	226	255
Teledensity	14%	17%	20%
% of lines digital	-	30%	62%
Waiting list	250 000	60 000	0
ROCE	-	34%	25%

Revenue sharing

One of the key issues for Russia has been the nature of revenue sharing between the Electrosviaz and Rostelekom.

Rostelekom

Rostelekom's administrative office in Krasnoyarsk covers zone number 17 (of 19 zones). The geographic area under the responsibility of the office does not correspond directly with the Krasnoyarsk region. In fact, Zone 17 covers an area much larger than Krasnoyarsk region, encompassing most of the northern area of Siberia, stretching from the Kula peninsula in the West to Dixie Island in the East.

Rostelekom maintains and operates most of the long distance intra-region transmission in Krasnoyarsk. Because of various climatic and demographic conditions, a number of different transmission technologies are used, including tropospheric radio relay, microwave, and cable channels.

The same revenue sharing arrangement is used for every region in Russia. Electrosviaz pays Rostelekom a fixed accounting rate per 50 channel kilometres. Rostelekom headquarters increases this accounting rate by 10-15 per cent every month to track inflation.

Rostelekom's regional office is dissatisfied with the revenue sharing arrangements. Part of their dissatisfaction relates to the geographic coverage of Zone 17. Although the same revenue sharing arrangement is used for every region, costs are much higher in the northern region. For example, helicopters are used to access radio towers and equipment in remote areas.

Another issue is Krasnoyarsk's obligation, being in the centre of Russia, to assume the costs for transmitting transit traffic from one part of the country to the other. For example, if the Electrosviaz in Moscow sends traffic to Vladivostock, Krasnoyarsk must pass this traffic. However, the revenue sharing is between the Moscow Electrosviaz and the Moscow Rostelekom office. The other regional Rostelekom offices receive no money directly from the Moscow Electrosviaz.

In practice, the money Rostelekom receives from Krasnoyarsk's Electrosviaz appears more a matter of negotiation than any revenue-sharing formula. Two main issues affect the negotiations:

- Electrosviaz' revenue includes 25-30 per cent bad debt, so they do not receive all the revenue associated with the inter-region and international calls; and

- Electrosviaz does not agree with Rostelekom's cost argument.

According to Rostelekom, Electrosviaz insists that the accounting rate is much higher than Rostelekom's costs. Furthermore, Electrosviaz wants only to pay for costs that support its network, not for transit traffic and costs in other northern regions. Unfortunately, it is difficult for Rostelekom to break out its costs in this way. Rostelekom estimates that it receives 16-20 per cent of the tariff revenue collected by Electrosviaz.

The two problems that the regional office has raised -- the size of their zone and carrying transit traffic -- are internal Rostelekom issues. The critical issue is how the entire organisation of Rostelekom allocates money. Under the current system, every region makes calculations to determine how much Rostelekom is owed. The calculations and revenue are collected by the Moscow head office. With this centralised approach, Rostelekom can calculate how many calls originated and terminated in each region of the country. Based on this call mix and an agreed revenue sharing matrix, revenue is allocated to the different regions and Rostelekom administrative centres.

If Zone 17 is not satisfied with its allocation, this issue could be resolved by the head office, in agreement with the other Rostelekom administrative zones, and incorporated in the matrix. Apparently, Rostelekom already allocates some money to Zone 17 to subsidise their extra costs and contribution to the long distance network.

50x50 Programme

The 50x50 programme was unveiled in the summer of 1993. The plan involves overlaying Russia's long distance network with 50,000 kilometres of fibre optic cable between 50 digitalised switching centres by the year 2005. Rostelekom is managing the project. Foreign operators, Deutsche Telekom, France Telecom and US West have signed memoranda of understanding to cooperate with Rostelekom.

The regional Rostelekom office has started participating in the 50x50 programme. According to the office, NEC and Siemens have started plans to construct the network across Krasnoyarsk. Both companies have offices in Krasnoyarsk city with personnel to execute the plan. The exact nature of the construction (e.g. switching, transmission) was not discussed.

The programme encountered problems in 1994, because the regional Electrosviazy were excluded from the plan. Electrosviazy cooperation is essential, for most of them operate the long distance exchanges in their territory, as does the Electrosviaz in Krasnoyarsk. Although some Electrosviazy are unenthusiastic about the plan, preferring to pursue their own investment objectives, both the Electrosviaz and the regional Rostelekom office in Krasnoyarsk are committed to implementing the plan.

Interconnection

Establishing proper interconnection arrangements is critically important in ensuring telecommunications policy objectives. The main policy aims affected by interconnection are (i) maintenance of universal service, (ii) flow of funds between operators, and (iii) development of competition.

In Russia, existing interconnection arrangements are applicable to the incumbent operators, Rostelekom, and the Electrosviazy. Regulations contained in licences specify which networks may interconnect with the public telephone network, but they do not govern the terms and conditions which will apply.

SibChallenge is presently negotiating interconnection terms with Electrosviaz. The Coordinating Council considers interconnection strictly a commercial issue to be negotiated between the different operators. It will only play a role if the parties cannot reach an agreement.

Experience in other countries shows that regulators must play some role in determining interconnection terms. For example, in the early 1980s in the UK, British Telecom (BT) and Mercury, the new operator, had difficulty agreeing on terms. Mercury accused BT of exaggerating interconnection costs and delaying interconnection. In 1985, OFTEL, the regulatory authority intervened in favour of Mercury. In the meantime, however, Mercury had lost valuable time and money during the critical start-up phase of its operations. In Poland, the Polish national operator and the local licensees have disagreed about revenue sharing for trunk calls. The Ministry has not intervened in the dispute. As a result of the impasse, local network development has virtually stopped and foreign participants in the local networks have pulled out.

Establishing principles

The Coordinating Council indicates that it will only play a role if the commercial negotiations fail. However, its power to enforce interconnect arrangements is unclear. There are a number of ways the Coordinating Council could ensure that interconnection negotiations function smoothly.

The Council might consider establishing interconnection principles that the parties should consider in their negotiations. The first point of principle is ensuring that interconnection terms cover costs. Ideally, the costs which are relevant are the 'incremental costs.' In Krasnoyarsk, the incremental costs are the increase in total costs which will arise on the Electrosviaz' network because it is providing interconnection services and carrying SibChallenge's traffic.

There are usually practical problems to the incremental cost approach in any country. First, a substantial proportion of total costs are overheads or joint costs, and can not be easily allocated to interconnection. The second problem is that there is usually a lack of sufficient cost information. For this reason, Australia and Canada are the only countries in the world which have attempted this approach. The relative lack of cost data in Krasnoyarsk may lead the operators to consider fully allocated historical costs.

The mission was not provided with Electrosviaz cost data. Based on our experience in other NIS, it is likely that the Electrosviaz cost information may not be adequate to determine relevant historical

costs (the new operators will probably have better cost estimates, since they are just beginning). If this is the case in Krasnoyarsk, the Council may consider two other options:

Revenue sharing arrangements

Setting interconnection payments on the basis of an agreed division of call revenues among the operators is probably the easiest option. The objective is to find a fair overall division of revenues given that the cost information Electrosviaz has will most likely be at an aggregate level. A revenue sharing approach would attempt to ensure that all the operators receive a reasonable amount of income to cover their commitments. This approach would be temporary, before better cost data is obtainable.

Tariff based charges

Linking interconnection payments to the tariffs of each call type would be another approach. For example, tariff revenues could be divided on the basis of the standard CCITT cost model. The advantages of this method is that tariffs provide a clear and public reference point for interconnection charges. Also, if operators receive interconnection revenues based on tariffs, the incentives to introduce cost based tariffs -- particularly Electrosviaz' residential tariffs -- are increased. The new operators will have digital exchanges with the ability to measure incoming and outgoing calls. Consequently, total traffic, by call type, can be determined and payments would more accurately reflect costs.

Universal service obligations

Currently, the government administration gives money to Electrosviaz to fulfill its universal service obligations (USO). Given experience in other countries and the financial demands on the government, this form of payment is unlikely to continue for much longer. In this case, Electrosviaz would have to fund its USO through its own operations.

In many countries, incumbent operators' USO is partly funded through interconnect payments from new operators who do not have similar obligations. Therefore, there are two cost components to interconnection for new operators. The costs of carrying a call and the costs of meeting USO. New operators' interconnection payments incorporate both costs.

If the Government administration stops subsidising Electrosviaz's USO commitments, the Council may have a role in deciding how the USO will be funded. At that time, the Council may consider encouraging operators to add USO-related costs to interconnection agreements.

6 - THE ROLE OF ENERGY IN THE ECONOMIC RESTRUCTURING OF THE KRASNOYARSK REGION

by Todor Balabanov

Summary and conclusions

Krasnoyarsk has abundant and cheap energy resources. Presently only the coal and electricity potential are extensively tapped. Geological surveys have discovered enormous oil and gas deposits.

The region's Kansk-Achinsk brown coals are easy to mine and enrich. Their low price and relatively high heat content make them fairly suitable for power generation. Past prices were unrelated to market realities, i.e. the brown coal for local power plants until recently sold for US$1.5 per ton (US$3.75/tce), while a price more related to costs is estimated to be as high as US$12 per ton (US$30 per tce).

In spite of the continuing economic recession and distorted prices, coal mining is a growing business. In 1994 the region's mining companies produced around 64 million tons of coal (35.84 mtce). Net coal shipments to the other Russian regions are growing rapidly, namely from 22 million tons (11 mtce) in 1990 to 30 million tons (16.12 mtce) in 1994.

That only a small part of Kansk-Achinsk coals are cleaned and enriched[40] acts as a severe constraint on further growth in shipments. Without cleaning and enriching, approximately two and a half tons of physically mined coal have to be transported (over distances between 500 to 1500 km) for every ton of coal equivalent.

The region's free thermal and hydro-power generating capacity results in a power surplus, making it one of the main Russian power centres and an important node for transferring electricity. While power demand decreased from 61 400 Gwh/y in 1991 to 56 300 Gwh/y in 1994, net power exports to the rest of Russia grew strongly -- from 11 600 Gwh/y in 1991 to 22 000 Gwh/y in 1994. In other words, while local demand dropped by 8 per cent, shipments to the rest of Russia almost doubled.

New energy prices mean significant direct and indirect financial gains for the region. The revenue from direct sales of coal and electricity could reach 700 million US$ per year, while the sale of energy intensive products (aluminium) to the world market could amount to an additional 1,500 million US$ per year. These revenues could be the basis for financing regional development programs.

The region's southern power grid is part of the Russian Unified Power Transmission Grid and connects, by the means of 500 KV and 200 KV transmission lines, the producers of Krasnoyarsk and

Irkutsk with the consumers in Russia. These connections were planned as the main power transmitter from Siberia to the rest of the Soviet Union, allowing for a large scale reduction of the needed power generating capacity for central Russia. The local part of the Unified Power Grid was recently de-capacitated by the harsh Siberian climate and bad maintenance and lost a significant part of its transfer and regulation capabilities. As a result, regional power producers now face reduced sales opportunities. The isolated Norilsk power grid transports the power produced by the local hydro- and gas fired power plants to the important local industrial complexes. Many of the region's areas still have no access to power supplies other than unreliable, local diesel generators.

Per capita energy consumption in the region is 9.8 tons of oil equivalent, i.e. almost 4 times higher than Austrian per capita consumption. Industry accounts for the greatest share of regional energy consumption (58 per cent), followed by households and services (10 per cent) and by agriculture. The region's enormous industrial energy consumption stems from a long term Soviet era strategy to allocate and develop energy intensive, basic industries in Siberia. These energy (especially electricity) intensive industries consume more than 80 per cent of electricity consumption. Households and services consume only 10 per cent (a per capita consumption of 1 353 kWh/year, or less than half the average consumption for an Austrian household).

For the region as a whole most of the boilers delivering centralised heat are small, inefficient and frequently locally assembled, installations. These coal or wood burning devices probably contribute more to the degradation of the environment than to the heating comfort of the inhabitants.

The combination of an enormous energy consumption and a scarcity of pollution control devices means that energy production and use account for almost 85 per cent of the region's atmospheric pollution. Norilsk, Krasnoyarsk and Achinsk number among the Russian places with the worst environmental conditions.

Planners have drafted an extensive list of potential energy development projects for the region. For example, after the oil crises of the seventies the feasibility of large-scale liquefaction of Kansk-Achinsk coals was extensively discussed. Many detailed feasibility studies have been made available to interested parties including those on development of (i) the Iarubchenskoe oil fields and (ii) the natural gas deposits in Sobinskoe, (iii) the rehabilitation and further development of the open-cast mines in Kansk-Achinsk and (iv) additional hydro-power schemes on the Angara or Yenisei.

Nevertheless, experience shows that the fragile Siberian environment requires thorough environmental impact assessment of any projects and that further development will require a careful analysis of both economic and ecological feasibility.

Introduction

Although Krasnoyarsk's enormous energy potential should benefit the population, its intensive exploitation has created significant environmental and industrial development problems. Many of the region's producers are large, energy-intensive conglomerates that are challenged by restructuring and finding new markets. The energy sector, too, now must restructure in an uncertain climate of falling demand, lack of investment funds and inadequate prices. The process of adjustment to these new realities, while painful, is bringing the chance to correct past mistakes and to discover new markets.

This profile of Krasnoyarsk's energy situation surveys the region's energy resources and assesses the prospects for power generation and energy exports. In addition, it examines the sources of demand for

energy, analyses the possible impact on industrial competitiveness that might follow from intended energy price changes, and briefly describes the region's environmental situation.

Energy resources: reserves and development prospects

Crude Oil and Natural Gas

Krasnoyarsk's estimated oil and gas resources are enormous, 6 854.4 10^6 tons of crude oil and 24 942 10^9 m^3 of natural gas. Because only 2 per cent of the region's territory has been geologically surveyed, additional discoveries may be expected .

Up to now 25 prospective fields have been geologically explored and their exploitable resources estimated at 681 million tons of crude oil and 1126 billion m^3 natural gas.

The recoverable resources of some of the main prospective areas are listed in table 6.1. Most of the known reservoirs contain both crude oil and natural gas.

Table 6.1. Recoverable Oil and Gas resources listed by prospective areas (January 1991)

Name of the Field	Crude Oil 10^6 tons	Natural Gas 10^9 m^3
Shrubtshenskoe	149.6	296.7
Vankorskoe	82.9	49.4
Kiumbinskoe	76.8	88.8
Tagulskoe	49.5	39.5
Suzunskoe	46.4	18.3
Sobinskoe	11.2	158.3
Severno Soleninskoe	na	78.7
Lodotchnoe	43.2	69.8
Deriabinskoe	na	54.7
Total	456.6	1010.3

One of the peculiarities of the natural gas discovered in the Koviktinskoe and Sobinskoe fields (not listed in table 6.1) is the unique inclusion of the valuable gas Helium - comprising up to 0.25 per cent from the gas volume in the former and 0.57 per cent in the latter. The high level of inclusion of other valuable elements, e.g., Ethane, Propane, Butane, Nitrogen, etc., makes the construction of gas clearing, drying and separation facilities economically justifiable .

At present "Norilskgasprom" has undertaken the only commercial extraction of natural gas from the South and North Soleninski gas fields, at a level of between 5.8 and 5.85 billion m^3/year. Around 8 000 tons of crude oil per year are produced by the coal mining enterprise "Krasnoyarskugol´ ".

The only oil refinery of the Krai is located in the city of Achinsk and has a throughput of around 6 million tons of crude oil per year. In 1991 the refinery produced 1 317 000 tons of gasoline, 1 791 700 tons of diesel fuel and 1 327 600 tons of fuel oil, hence the production structure, with its high output of heavy products, is typical for the Post-Soviet refineries. The needed crude oil is supplied via a pipeline which connects the refinery with the Western Siberian oil fields and then continues its way to other Siberian and Far East regions.

Given the substantial number of relatively small, isolated, fields, which may have local economic significance, it seems that a thorough consideration of economic feasibility of all available options for local production of petroleum products, heat or electrical power can lead to improved development prospects in the respective regions.

Coal

The region is richly endowed with brown and hard coals. The total reserves make for around 16 per cent of the known Russian coal resources. The main economically attractive deposits are located in the Kansk-Achinski and Minusinski basins (see table 6.2), but vast reserves have been discovered also in the Central Siberian Plateau and North Siberian Plain, e.g., Tungusski, Taymye and in the Lena basins. For example the total reserves of Minusinski basin are estimated at 89 billion tons of coal and those of the Tunguss basin, located in the extreme North, are considered to amount to 2 300 billion tons.

Table 6.2. Coal deposits within the Region (million tons)

	economically recoverable	**exploitable**	**total**
Kansk-Achinsk	80 600	31 900	112 500
Minussinski	5 000	400	5 400

Kansk-Achinsk brown coals are easy to mine. Due to their high-density they are also easy to enrich. Furthermore their low ash and relatively high heat content (see table 6.3) make them fairly suitable for power generation. In addition, these coals have the lowest price in the former Soviet Union. For example, up to July 1995, Kansk-Achinsk coal supplied to the local power plants had a selling price of US$1.5 per ton, or US$3.75/tce[41]. As discussed below the proposed new price setting concept considers the self-financing price for Kansk Achinsk coals to be at a level of US$12 per physical ton, or US$30 per tce.

Due to their relative proximity to the surface most of the brown coal deposits of Kansk-Achinsk basin are suitable for open cast mining -- the overburden is said to be in the vicinity of 2 m^3 of earth per m^3 of coal.

In the Minussinski basin there are 9 known deposits of hard-coal of which 6 have been extensively surveyed. Hard coal is produced from 2 of them, Kayaksky and Beiskoe, by the means of both open-cast and underground mining. The Beiskoe field is said to be the more promising development with a potential extraction of 32 million tons coal per year.

The main characteristics of the known deposits of brown and hard coals are shown in table 6.3.

Table 6.3. Characteristics of the main coal types of Krasnoyarsk region (related to the burnable mass)

	Coal type	C wt %	H wt %	N wt %	S wt %	Q. MJ/kg	Ash %	Moisture %
Kansk-Achinsk Basin:								
Itat-Barandatski	Brown	71.5	5.0	1.0	0.3	15.66	9.0	15.66
Nazharovski	Brown	70.0	4.8	0.8	0.8	13.02	12.0	13.02
Uluisko-Kemtshugski	Brown	69.5	4.9	0.7	0.8	12.81	11.5	12.81
Bogomol´ski	Brown	69.5	4.9	0.7	1.0	11.81	12.0	11.81
Berezovo - Nazarovski	Brown	71.0	4.9	0.7	0.3	15.66	7.0	15.66
Balahtinski	Brown	71.5	4.9	0.7	0.3	14.82	7.0	14.82
Abanski	Brown	71.0	4.9	0.7	0.6	14.74	12.0	14.74
Minussinski Basin:								
Kayaksky	Hard	77.5	5.5	1.4	0.5	23.9	8.0	13.0
Norilsky basin	Hard	85.5	4.8	1.7	0.7	22.65	28.0	4.0

Coal mining is a growing business, and in 1993 the mining companies of the region, including the biggest one “Krasnoyarskugol´ ”, had an output of around 65 million tons of coal, corresponding to 35.84 million tons of coal equivalent (mtce). Coal is also being mined by some of the industrial enterprises. From the produced coal 15.45 mtce were used by local thermal power plants, around 15.5 mtce were exported to the other Russian regions, and 5 mtce used for heating purposes within the region (see table 6.4).

The main consumers of Kansk-Achinsk coal are the Thermal Power Plants of Krasnoyarsk region, of Irkustsk Oblast, and of Buriat Republic. The main export destinations are Western Siberia, Amursk Region and Khabarovsk Region. The Kansk-Achinsk coals are relatively easy to enrich and in case suitable installations are made available the enriched coal, with its competitive price, can find new export opportunities.

Table 6.4. Fuels and power production/export in the Krasnoyarsk region

	units	1990	1991	1992	1993	1994	1995
Coal Produced by main mines	10^6 .t	58.75	62.06	63.02	64.83	66.94	69.24
Chakazki	10^6 .t	6.70	6.84	5.62	5.63	6.04	6.04
Kansk-Achinsk	10^6 .t	52.05	55.22	57.40	59.20	60.90	63.20
Coal imports - from Kuznetzk	10^6 .t	0.87	0.76	0.70	0.70		
Coal exports, including:	10^6 .t	**22.86**	**24.64**	**24.98**	**27.70**	**29.91**	**29.61**
Kansk Achinsk	10^6 .t	19.95	21.43	22.06	24.93	27.16	26.91
Chakazki	10^6 .t	2.92	3.21	2.92	2.77	2.75	2.70
Other fuels used in the region	10^6 .t	0.35	0.34	0.33	0.33	0.34	0.34
Natural Gas Production	10^9 m^3	5.10	5.07	5.05	5.05	5.08	5.10
Crude oil production	1000 t	7,0	8,0	8,0	8,0	8,0	8,0
Locally produced fuel oil	10^6 .t	1.34	1.35	1.40	1.55	1.70	1.90
Heat production	10^6 .Gcal	74.78	74.95	72.16	68.78	67.43	66.75
by:							
Co-generation power plants	10^6 .Gcal	45.40	45.70	46.00	46.90	47.50	48.00
Local Boilers	10^6 .Gcal	25.18	25.05	21.96	17.73	15.83	14.65
Waste heat users and electr. boilers	10^6 .Gcal	4.20	4.20	4.20	4.15	4.10	4.10

Despite the general economic recession, net coal exports to the other Russian regions are growing, namely from 23 million tons (11 mtce) in 1990 up to 30 million tons (16.12 mtce) in 1994 (see table 6.4). Although forecasts suggests that this trend will continue, a new pricing formula will increase coal prices almost tenfold and could negatively affect the interregional coal trade.

The quality differences between mined coals for different time periods are identifiable by the changed ratio of mined mass to the standard ton of coal equivalent (tce), i.e. while in 1990 one tce was made up of two tons of physical coal, by 1994 this ratio improved to 1.85 t/tce.

As mentioned above, despite their suitability, only a very small part of Kansk-Achinsk coals are currently enriched[42], so that for every ton of coal equivalent (7000 Kcal) approximately two tons of mined coal has to be transported. Given the usual transportation distances of 500 to 1500 km., and the permanent increase of prices charged by the railways it may well be expected that the new interregional coal prices may make the installation of coal purification and enrichment facilities a profitable venture.

Since the ongoing economic recession is slashing local demand, the future of Krasnoyarsk's coal mining will increasingly hinge on expanding other sales opportunities, mainly with the other Russian regions.

Electricity

An analysis of the capacity balance for electrical power (see table 6.5) shows that the installed capacity of the region (19,505 MWel in 1994) far exceeds the maximum local load of 7 550 MWel and that the net shipments to Tuva and to the Western Russian regions command a higher demand on installed

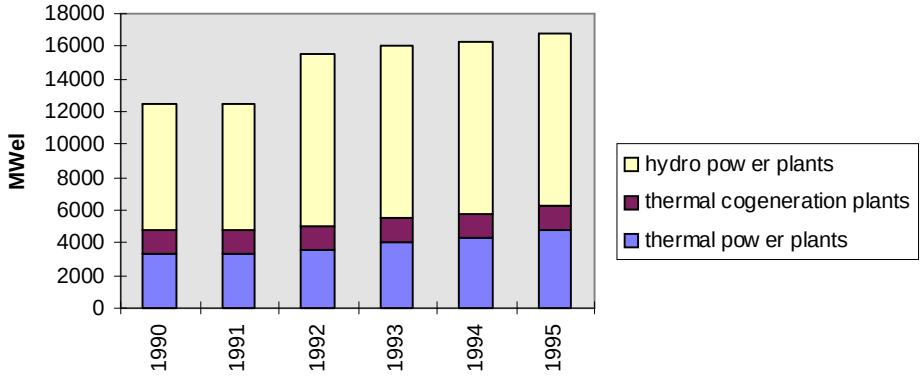
capacity than does local consumption.[43] In this respect Krasnoyarsk region is an important node for transferring electricity and one of the main Russian power houses.

Table 6.5. Krasnoyarsk region: Balance of Power Generating Capacity [MWel]

	1990	**1991**	**1992**	**1993**	**1994**	**1995**
Maximal load	**8 150**	**8 200**	**7 800**	**7 750**	**7 550**	**7 650**
Reserve capacity	1 300	1 300	1 300	1 300	1 300	1 300
Exports to:						
Tuva Region	98	100	101	97	94	89
Western Regions of Russia	4 414	4 629	7 043	7 700	8 545	9 010
Total Exports	4 512	4 729	7 144	7 797	8 639	9 099
Imports from Irkutsk	1 843	2 110	1 090	1 296	1 321	1 526
Net Exports	2 669	2 619	6 054	6 501	7 318	7 573
Required available capacity	**12 119**	**12 119**	**15 154**	**15 551**	**16 168**	**16 523**
Total Installed capacity	**18 467**	**18 467**	**18 463**	**19 423**	**19 503**	**20 493**
Hydro Power Plants:						
Installed capacity	12 721	12 721	12 721	12 721	12 721	12 721
Available capacity	7 710	7 710	10 221	10 221	10 221	10 221
Thermal Co-generation Plants:						
Installed capacity	1 596	1 596	1 592	1 592	1 672	1 852
Available capacity	1 416	1 416	1 440	1 437	1 443	1 523
Thermal Power Plants:						
Installed capacity	4 150	4 150	4 150	5 110	5 110	5 920
Available capacity	2 993	2 993	3 493	3 893	4 504	4 779

The structure of available capacity (see figure 6.1) is dominated by hydro-power plants with thermal co-generation and condensing power stations comprising around 37 per cent (1994) of the total.

Figure 6.1. Balance of the available electricity production capacity



The electricity production balance (see table 6.6) shows that the total local demand for power dropped since 1991, while net sales outside the region rose sharply. Hence, over the last 4 years the region's own electricity demand was depressed by 8 per cent while electricity exports practically doubled. Moreover, with the present electricity prices of 0.0007 US$ per kWh, the region appears poorly remunerated for these sales[44].

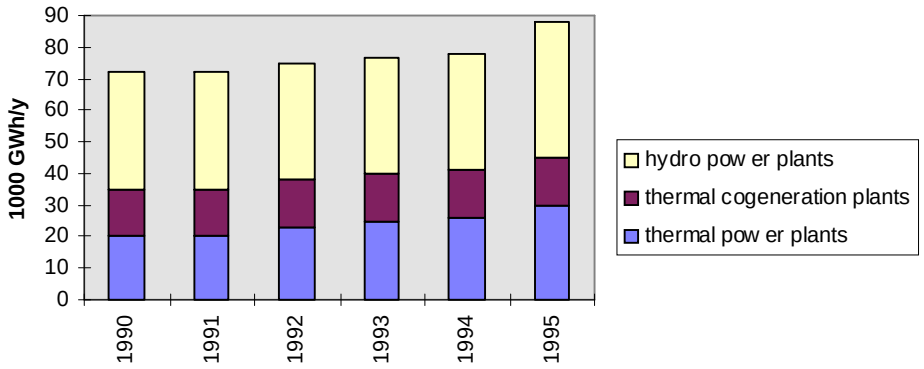
Table 6.6. Electricity production balance for Krasnoyarsk region (1000 GWh/y)

	1990	**1991**	**1992**	**1993**	**1994**	**1995**
Consumption within the region	61.00	61.40	59.00	57.40	56.30	56.40
Exports to:						
Tuva region	0.70	0.70	0.70	0.70	0.60	0.60
to Western Russia	19.30	18.70	24.70	27.40	31.80	43.10
Imports from Irkutsk	8.90	7.80	8.80	8.50	10.40	11.60
Net Exports of Electricity	**11.10**	**11.60**	**16.60**	**19.60**	**22.00**	**32.10**
Net Production (consum+exp-imp)	**72.80**	**73.00**	**75.20**	**76.30**	**78.10**	**88.50**
Power production by:						
Hydro power plants	37.20	36.50	36.10	35.80	36.20	43.70
Co-generation thermal power plants	15.50	15.70	15.90	16.10	16.20	16.30
Thermal power plants	20.10	20.80	23.20	24.40	25.60	29.00

The structure of electricity production differs from the structure of available capacity (see figure 6.2). Only 47 per cent was produced by hydro power, while the rest comes from thermal stations. Co-generation plants appear to be producing more than their share of the installed capacity: with 30 per cent share from installed thermal capacity they are contributing around 40 per cent to the electricity output.

Another striking point is the significant discrepancy between installed and available capacity, especially serious for the Hydro Power Stations and the thermal condensing units. The reason may be twofold: (i) planning mistakes in matching the available water stock and the installed capacity for the hydro power systems and specifically in designing the operations of hydro electrical cascades, and (ii) outages due to insufficient maintenance of the generally aged thermal power stations.

Figure 6.2. Electricity production structure



Thermal and co-generation power plants

Thermal power plants located in the South of the region use locally produced coals, while the northern Norilsk area uses natural gas as the main fuel input for power generation. Most of the main facilities are owned and operated by "Krasnoyarskenergo", but there are some locally owned plants in Norilsk, in the Evenki autonomous district and in several industrial complexes. The biggest Thermal Condensing Stations are Krasnoyarsk 2 with 1 230 MWel of installed capacity and Nazarovsk with 1 150 MWel.

In the southern part of Krasnoyarsk region the installed thermal power generating capacity reached 5 322 Mwel, in 1992, while output continually decreased from a peak of 27 000 GWh/yr in 1990 to 17146 GWh/yr in 1994. The district heat output, depending mostly on the thermal load of the buildings and industrial processes, recorded a much smaller decline, e.g. from 28 421,000 Gcal/yr in 1990 to 25 251 000 Gcal/yr in 1994.

The dedicated power distribution grid of the northern region of Norilsk is supplied by thermal condensing power stations and co-generation power plants with an installed power generating capacity of 1 577 Mwel (see table 6.7) which recorded a slightly diminishing output, namely from 7 480 GWh/yr in 1990 to 6 704 GWh/yr in 1994.

Table 6.7. Main Indicators of the thermal Power Plants in Krasnoyarsk

All plants except in Norilsk	**1994**
Installed capacity in MWel	5 222
Produced electricity in GWh/yr	17 146
District heat produced in 1000 Gcal/yr	25 251
Total fuel input in tce/yr	9 155
including:	
Fuel oil in tce/yr	210
Coal input:	8 945
Coal from Kansk-Achinsk mines	8 763
Other local coal	182

Plants in Norilsk		**1994**
Installed capacity in	MWel	1 577
Produced electricity	GWh/y	6 704
District heat produced	1000 Gcal/yr	17 954
Total fuel input	mtce/y	4 534
including:		
Natural gas	mtce/y	4 534

The heating demands of households and industries were covered to the extent of 80 per cent, in the best central planning tradition, by centrally delivered heat coming from co-generation and district heating boiler houses.

Despite the fact that the region has substantial coal resources there are some known deficiencies in fuel supplies to the thermal power plants:

- deliveries are quite sporadic resulting in unacceptable low inventory levels;
- delivered coal frequently has an unbearably high content of unburnable mass.

There is a predominance of commissioned co-generation facilities at the expense of purely power producing condensing power stations. This disproportional development has resulted in increased summer power demand from hydro power plants and results in weather-related bottlenecks.

Most of the thermal power stations are quite old and depreciated installations -- it is said that more than 40 per cent of them have been in operation for more than 30 years. Any programme of rehabilitation and upgrading of these facilities will have to include an ecological impact assessment.

Hydropower

The hydro power potential of the region's rivers, e.g. Yenisei, Angara and their tributaries, is said to be as high as 21.8 per cent of the Russian total.

This hydro potential is tapped mostly by run-of-the-river hydro power stations with water storing lakes that have destroyed vast areas of fruitful agricultural land and forests. In the harsh Siberian climate these artificial lakes have contributed to a climatic change in the region. The ecological impact on the local climate has resulted in increasing social resistance to development of new hydro power schemes, specifically in the Southern areas, but also to demands for closure of some hydro stations to make fertile land available for agricultural purposes.

At present the hydro potential has been tapped by two conglomerates of hydro power plants:

1. Sayano-Shushenskaia (commissioned 1985 with installed capacity 6,400 MWel and inlet water pressure 220 m.), Mainskaia (commissioned 1985 with installed capacity of 320 MWel and inlet pressure 19 meter) and Krasnoyarskaya (commissioned 1971 with installed capacity 6 000 MWel and inlet pressure 100 meter). These are located sequentially on Yenisei in the south of the region.

2. Ust´-Khantayskaia (commissioned 1985 with installed capacity 441 MWel and inlet pressure 30 m.) and Kureiskaia (commissioned 1985 with installed capacity 480 MWel and inlet pressure 67 m.) and located on the Yenisei´s tributaries Kataika and Kureika in the Norilsk region.

The southern hydro power stations are connected to the Unified Power Transmission System of the Former Soviet Union (Unified Power Grid) and are net exporters of electricity. The Northern Power Stations supply energy to the dedicated regional transmission network of Norilsk sub-region.

The three southern Hydro power stations are also used to stabilise the operation of the Unified Russian Power Grid. This is done by the allocation for exclusive use by the Russian energy system of the Base Load and Reserve Capacities (see table 6.8).

Construction works on two additional hydro power stations, Boguchanskaia and Nizhnekureiskaia, started in 1976 and 1989 respectively.

The controversial Boguchanskaia power station, located on the river Angara in the South Eastern part of the region, was designed to have installed capacity of 3 000 MWel with water pressure at the turbine inlets of 71 m. Construction has been stopped as a result of both the negative reaction of local population and of numerous design mis-conceptions such as the ecological disaster resulting from submerging large tracts of forest and agricultural land into the newly formed lake, the environmental pollution from the nearby Pulp and Paper complex, etc. In addition the economic recession has affected the level of energy demand of the region, hence making uncertain the viability of this hydro power station.

Although the expert's opinion is that in the future electricity demand will recover and that ecological damages may be repaired, public sentiment is against any further construction. An ecological audit done by a respected international body may be helpful in deciding the fate of this project.

Certainly the central planners have drafted an extensive list of additional hydro-power schemes, e.g. Sterl´kovskaia and Nizhneangarskaia on Angara, Osinovskaia and Tuvinskaia on Yenisei, etc., but any

further development will have to be subjected to careful analysis of both the economical and the ecological feasibility.

Table 6.8. Main production related indicators of the hydro-power stations

		Krasnoyarsk	Sayano-Shushensk and Mainsk	Ust'-Khantaysk	Kureisk
		1994	1994	1994	1994
Installed Capacity	10^6 kW	6.0	6.72	0.441	0.62
Available Capacity	10^6 kW	5.17	5.4	0.441	0.48
Power Production	**10^9 kWh**	**18.09**	**27.01**	**1.49**	**1.47**
Capacity reserved for Base Load	10^6 kW	1.3	1.14	na	na
System reserve capacity	10^6 kW	0.3	0.76	na	na

Main power transportation lines: the grids

The region's southern power grid is part of the Russian Unified Power Transmission Network and connects, by the means of 500 KV and 200 KV transmission lines, power producers of Krasnoyarsk and Irkutsk with the consumers in Russia. These connections were conceived as the main power transmitter from Siberia to the rest of the Soviet Union so as to reduce greatly central Russia's need to install power generating capacity. After the Soviet Union disappeared, the Unified Power Grid lost much of its transfer and regulation capabilities.

Furthermore, the ambitious 1150 KV transmission system, which was supposed to double the power transmitted toward Barnaul-Itat-Kansk-Bratsk, has been de-capacitated by the harsh Siberian climate, theft and lack of maintenance. Hence, the reduced transfer capacity has aggravated the past mistakes and has diminished the sales opportunities, leaving regional power supply with unused free capacity which is being de-capitalised due to its aged structure and the lack of maintenance.

Substantial distances between the region's rural demand centres and the location of the energy generating capacities, combined with underdevelopment of South-North power transmission capabilities, results in acute power scarcities in the remote regions and in long lasting black outs for the customers. Frequent outages of the high tension transmission lines also occur from the harsh Siberian weather conditions. There is a practical isolation of hundreds of villages and so called low density demand areas from the centralised power supplies. These customers are forced to rely on old, unreliable diesel generators or small hydro power stations, which freeze during the winter. The isolated Norilsk grid has achieved a relatively stable operation.

Additional demand on the overloaded transmission lines comes from increased electrification of the railways. Although the Transiberian railways have their own power grid, the power inputs to it are supplied via local connections to the Unified Power Grid, hence burdening their operational stability.

Investment projects related to the improvement of power transmission capabilities will undoubtedly bear respectable returns, especially as electricity prices are adjusted in a direction towards the marginal cost of power production.

Investment opportunities in energy resources development

The region's huge potential for hydro and coal development was recognised by the former Soviet Union's central planners. This recognition resulted in the extensive allocation of energy-intensive, export-oriented production lines and in a disproportional exploration of this potential for power exports. These "think-big" projects were usually conceived with no concern for environmental impact. New investments will certainly need to consider the fragile Siberian eco-system.

Leading Russian energy institutions consider the following three investment projects to be promising:

1. The development of the Iarubchenskoe oil deposits. Located in Evenki autonomous district, the deposits were discovered in 1984 and are being surveyed. The oil bearing layers are located 2 230 meters below the surface. The total area of interest is around 220 km^2. The main characteristics of this local crude oil are: density 0.82 grams/cm^3; Sulphur content 0.19 per cent; and asphalts 6.07 per cent. In 1992 the exploitable oil deposits were estimated to be 205 million tons, and the natural gas deposits, 250 billion m^3.

The project requires numerous infrastructure investments. The local transportation infrastructure is poor and needs roads. A 650 km oil pipeline is needed to connect the fields with Achinsk Refinery. The power supply requires transmission lines with total length of 240 km. Housing and other buildings will be needed.

Drilling about 630 wells should, 12 years after the project's start, allow the extraction of 2.3 to 3 million tons of crude oil. A feasibility study done by the Siberian Energy Institute concludes that, assuming no cost overruns, the delivered crude oil would cost around US$73 per ton, or US$10 /bbl.

A striking feature of this and other feasibility studies is the implicit "think-big" approach. Instead of considering different up-to-date options, e.g. stepwise development of the fields, use of natural gas for local heat and power generation, installation of a movable refinery to ensure early income, etc., the approach is tilted to large scale, longer term plans with the corresponding financing risk.

2. The development of natural gas deposits in Sobinskoe. The field in the Evenki Autonomous District, was discovered in 1982, the geological surveys were completed by 1987 and some commercial production has begun (21 wells were drilled). Gas bearing layers are 2 511-2 596 meters below the surface. This field's reservoir is under substantial pressure, making the extraction easier. Recoverable reserves are estimated at 160 billion m^3. The gas composition is: Methane 64.8 per cent; Ethane 5.12 per cent; Propane 1.93 per cent; Butane 0.78 per cent; Pentanes and Hextanes 0.81 per cent; Nitrogen 25.8 per cent; Helium 0.57 per cent; and Sulphur 0.36 per cent.

As usual for Siberia, the infrastructure is completely lacking. Roads must be laid on frozen ground. Although the natural gas can be used locally for heat and power production, the project envisages constructing 900 km of gas pipelines. The feasibility study is based on a project length of over 14 years, assuming gas prices of around US$ 18 /1000 m^3 and gas output of 6 10^9 m^3/year. The outcome is that under these assumptions the expected internal rates of return are between 6 per cent and 11 per cent. The project document also states that if taxation rates can be reduced and the gas selling prices increased, the internal rate of return may exceed 20 per cent.

3. The rehabilitation and further development of open-cast coal mines in Kansk-Ashinsk. At present, coal is being mined at three places: Borodinskoe, Berezovskoe-1 and Nazarovskoe (see table 6.9).

Table 6.9. Main indicators of the three open-cast mines in Kansk-Achinsk

	unit	Borodinskoe	Berezovskoel	Nazarovskoe
Maximal output	10^6 t/yr	29.08	20.7	10.8
Operating period	years	74	67	31
Average daily output	1000 t	81.14	34.7	24.46
Overburden	m^3/t	0.94	0.43	2.23
On situe coal layers	No.	4	1	1
Layer's average thickness	m.	43	27	9.7
Max. depth of the layers	m	107	55	52

Note: For the present maximal level of output

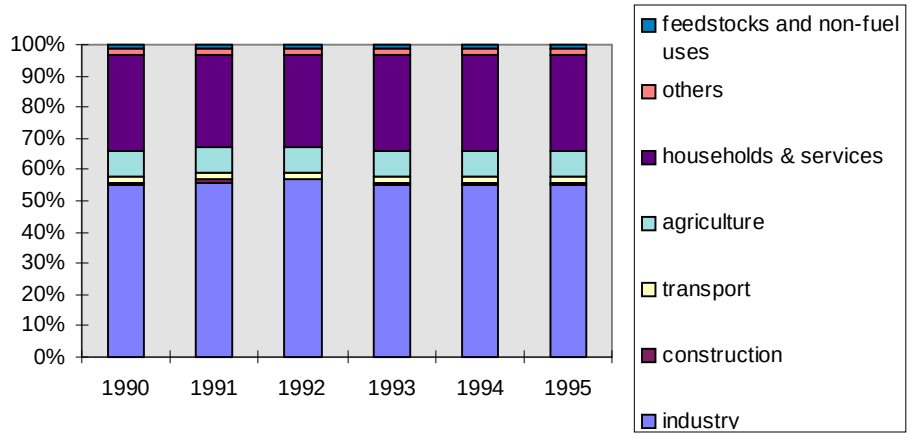
The result of this feasibility study is that, even with coal prices as low as US$1.5 per ton, the invested capital for rehabilitation of these fields will bring an internal rate of return of around 15 per cent. Among the main uncertainties are the demand for coal and the related evaluation of income and expenditure.

Energy demand: geographic and sectoral distribution

More than 72 per cent of the region's population is concentrated in the industrialised urban conglomerates, while the rest lives in broadly dispersed villages and settlements, frequently without any supporting infrastructure. Energy demand is concentrated in the region's industrialised south and in the Norilsk industrial complex.

Industry consumes most of the region's energy (58 per cent of total), followed by households and services (10 per cent) and by agriculture (see figure 6.3). This enormous industrial consumption results from central planners' long-term strategy to develop energy-intensive, basic industries in Siberia. The production of non-ferrous metals, chemicals, forestry products, paper and pulp and construction materials far exceeds regional demand. These industries, as well as coal and electricity production, were planned for shipment to the rest of the Soviet Union.

Figure 6.3. Structure of energy demand for Krasnoyarsk Krai



The collapse of the huge Soviet market has led to reduced output by most of the region's industries, which in turn has reduced energy demand (see figure 6.4). Even with an absolute energy demand reduction (from 45 million tce in 1990 to 40 million tce by 1994), the region's per capita consumption of 9.8 tons of oil equivalent (toe) remains high. (Austrian per capita consumption is around 2.7 toe per year.) However, households and services account for only 10 per cent of total consumption, or a per capita consumption of 1 353 kWh/year, i.e., less than half the average per capita consumption of Austrian households.

Figure 6.4. Energy demand within the Krasnoyarsk Krai

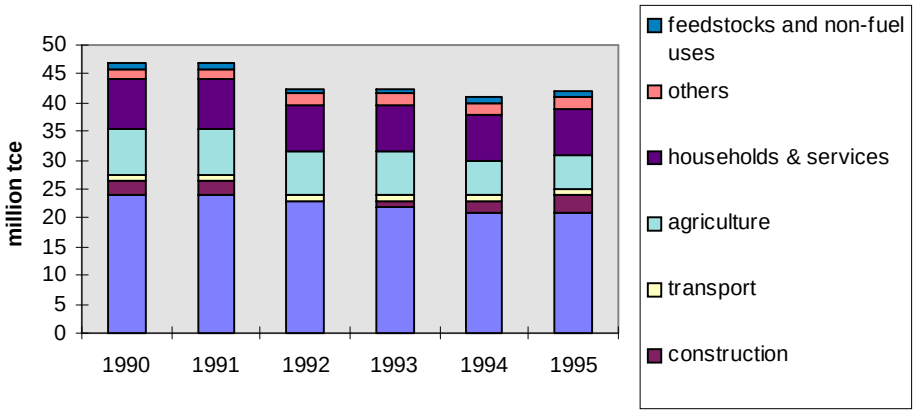
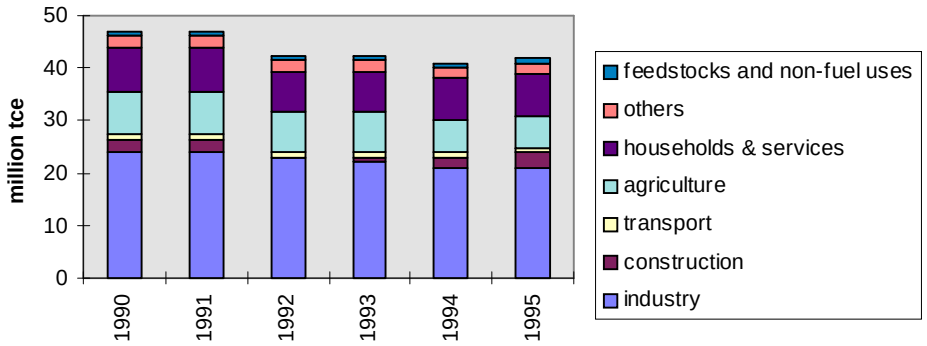
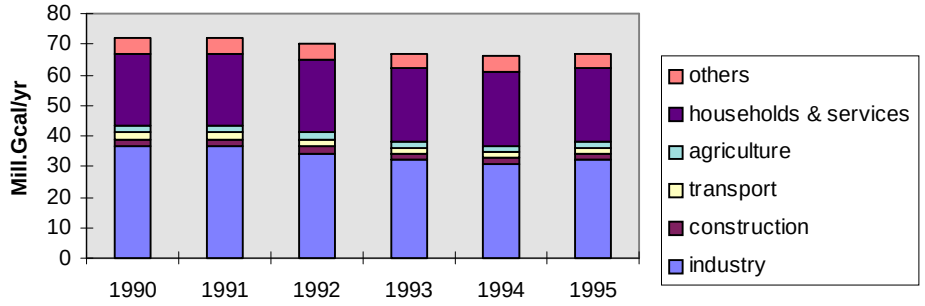


Figure 6.5. Electricity consumption by sector



The region's households and services and its industry each consume about half of the heat supplied centrally from co-generation and district heating plants (30 mill-Gcal/yr). While the recession slowed industrial heat consumption, the household consumption has remained constant (see figure 6.6). A relatively constant consumption level does not indicate that household satisfaction has also remained constant. The decaying heat generating installations and transportation networks, the absence of regulation and control of heating within houses, the lack of buildings maintenance - all may be contributing to increased energy consumption while the energy services delivered to the inhabitants of the cities may be worsening.

Figure 6.6. Consumption of centrally supplied heat



For the region as a whole most of the boilers delivering centralised heat (see table 6.10) are small, inefficient and frequently locally assembled installations. These coal or wood burning devices probably contribute more to the degradation of the environment than to the heating comfort of the inhabitants.

Table 6.10. Regional boiler houses according to their capacity

	Boiler houses	Boilers	Heat capacity (Gcal/h)	Boilers	Heat capacity (Gcal/h)	delivered heat 1000 Gcal/yr	Fuel use 1000 tce
		steam		hot water			
< 20 Gcal/h	2241	1625	3653	3805	6207	16785	3282
20 to 50 Gcal/h	60	148	2243	34	333	3503	738
50 to 100 Gcal/h	29	99	1918	22	440	3207	677
> 100 Gcal/h	14	50	2512	35	1120	4939	1036

The fuel used by people living outside the main cities can be estimated from the data on direct use of coal and wood by households (see table 6.11). Assuming that 40 per cent of directly used fuel is consumed within the cities, the per capita use of conventional fuels for heating and cooking in the villages will be 2.7 tons of coal equivalent -- quite a substantial quantity-- which could reflect both the long heating period in the polar regions and the inefficiencies of the installations used by villagers.

Table 6.11. Direct use of conventional fuels by households & services (m tce)

	1990	1991	1992	1993	1994
Direct use of coal	1.38	1.41	1.42	1.44	1.49
Wood and local fuels	1.041	1.05	1.05	1.05	1.02
Use of coal for heating	3.031	3.06	3.08	3.09	3.10
Total	5.452	5.52	5.55	5.58	5.61

Energy pricing and industrial competitiveness

The prices for energy produced within the Krasnoyarsk region were historically the lowest in Russia**.** For example, in 1993 the region's electricity was priced at 0.51 rubles per kWh, while neighbouring region Irkutsk charged 1.6 rubles/kWh and Far-Eastern producers, 3.82 rubles/kWh, and those from the Zabaikal region, 6.1 rubles/kWh**.** Past energy prices were unconnected to costs, i.e., the Kansk-Achinsk brown coals were supplied to the power plants for 1.5 US$/ton while their self-financing price was estimated at 9 to 10 US$/ton**.** A new, more rational price structure for interregionally traded energy is scheduled for 1996.

There are two principal price strategies (see table 6.12):

1. Self-financing**.** This scenario is based on the marginal cost of production for a group of Russian regions, e.g. the European part, the Urals, Siberia, and the Far-East**.** It attempts to reflect the comparative advantages in the energy endowment by introducing marginal regional prices**.** Such regional price differences should stimulate the efficient producers, and the

enhanced energy trade should help capital accumulation and more efficient investment allocation.

2. International prices**.** Pegging regional prices to world market prices would raise regional energy prices about 20 to 30 per cent more than would a self-financing strategy**.** This scenario seems a popular way to introduce the public to the idea of flexible price formation, which might have to be implemented later.

Table 6.12. Two proposals for restructuring the pricing of interregionally traded energy forms in Russia as of 1996

I. Self-Financing					
	Nat.gas [$/t.m^3]	Crude oil [$/toe]	Coal [US$/tce]	District heat [$/Gcal]	Electr. [$/th.kWh]
Central, North-West	51.5	75-80	43	11,5-12	33-34
North Caucasus	55	75-80	50	11,5-12	33-34
Povolozhski Ec.Region	48	75-80	37	11,5-12	33-34
Ural	42.5	75-80	29	11,5-12	33-34
North Tyumen Region	26.5	75-80	na	5,6-5,8	18-19
West Siberia	45.5	75-80	16	5,6-5,8	18-19
East Siberia	na	75-80	19/**12**(1)	5,6-5,8	18-19
Far East	63	75-80	35	13,5-14	41-42

II: Based on World Market Prices					
	Nat.gas [$/t.m^3]	Crude oil [$/toe]	Coal [$/tce]	District heat [$/Gcal]	Electr. [$/th.kWh]
Central, North-West	63	110-120	48	13-15	40-41
North Caucasus	70	110-120	55	13-15	40-41
Povolozhski Ec.Region	57	110-120	42	13-15	40-41
Ural	50	110-120	34	13-15	40-41
North Tyumen Region	26	110-120	na	7-7,5	20-22
West Siberia	46	110-120	18	7-7,5	20-22
East Siberia	na	110-120	18/**13**(1)	7-7,5	20-22
Far East	60	110-120	38	13,5-14	43-45

Note: (1) The prices for the Kansk-Achinsk coal are given in the denominator.

Both scenarios propose multiple price increases across the spectrum of energy forms**.** While single crude oil prices are foreseen, the other energy forms will be priced according to their regional availability.

Any price hikes will present serious challenges and risks**.** While the region's energy will remain the cheapest in Russia, major price changes will still happen**.** For example, the price of local coal shipped to other Russian regions will rise by a factor of eight[45] [12 $/ton (30 $/tce), instead of 1.5 $/ton (3.75 $/tce)]**.** Electricity, by a factor of twenty five (18-19 US$ per 1000 kWh, instead of 0.7 $/1000 kWh).

How these price hikes will affect the sales volumes is unknown, but assuming inelastic demand or price elasticity in the range $-1<\varepsilon_p<0$, then the energy exports could realise up to 700 Million US$ annually for the region. (This estimate uses 1994 shipments, namely 30 million tons of coal and 22,000 Gwh/y of electricity, and the new prices of 9 US$/ton of coal[46] and 18 US$/1000 kWh of electricity**.** It results in about 400 million US$ from electricity exports and 270 million US$ from coal sales.)

New prices may render economically viable some of the region's previously neglected oil and gas deposits**.** On the other hand, the crude oil needed for the region's refinery will cost more and render the refinery economically unviable.

One of the advantages of the new price shaping formula is its flexibility for setting energy prices for local industries**.** According to the present proposal, energy prices for local industrial enterprises will be negotiated at the local level between representatives of the region's Energy Commission and the industries**.** The results of these negotiations will have a direct impact on industrial competitiveness, especially for the energy intensive industrial branches.

The Energy Commission may have many reasons to be interested in higher energy prices -- environmental consciousness, social considerations, capital accumulation for industrial restructuring, etc**.** Nevertheless, it will also be interested in keeping the local budget in balance**.** As experience shows, a set of direct and cross-subsidies may come into existence, e.g**.** industries subsidising households, electricity producers and industries subsidising coal suppliers, etc. Energy price negotiations will probably be a source of future tensions and conflict of interests. Sound external assistance and expertise will undoubtedly be needed.

The forthcoming energy price increases are causing a widespread fear of plant closings. Many of these fears seem unfounded because, as mentioned above, (i) the local prices will be subject to local decisions, (ii) changed energy prices go together with changed output prices. A region with significant production of goods sellable at world market prices has much less to fear from closures than, say those without exportable surpluses. A major real source of fear comes from the lack of knowledge on price elasticities and the size of the drop-off in sales. (A recovering Russian economy should, however, demand more of the region's basic goods.)

Environmental consequences of energy production and use

Recent surveys show that more than 70 000 km^2 (about 3 per cent) of the region's territory suffer from pollution levels that are at least two times higher than accepted Russian norms, and while 25 000 km^2 have pollution at levels permanently above 10 times Maximally Allowed Concentrations (MAC). Specifics of the local climate exacerbate the region's pollution. While Norilsk suffers from exceptionally severe pollution levels, pollution is a severe problem in other cities in the region (see table 6.13). These serious pollution levels cause numerous health problems for the inhabitants and have destroyed a number of forested areas.

Table 6.13. Yearly concentration levels of the main polluters averaged over the period 1987-1988 (actual pollution level/ MAC)

	Dust	SO_2	NO_x	CO_x
Krasnoyarsk	9.8 (2.0)	1.2 (0.2)	13.8 (1.0)	4.4 (0.3)
Norilsk	8.0 (1.3)	45.0 (8.2)	15.0 (0.5)	na (0.3)
Achinsk	9.2 (4.0)	1.3 (0.8)	5.9 (0.5)	0.6 (0.3)

Notes: The first digit represents the maximal concentration over the MAC and in the brackets is the average yearly concentration as compared to MAC.

Energy production and use are said to contribute up to 85 per cent of the total emission of atmospheric pollutants. The reasons for this are:

- many energy intensive and polluting industries with no pollution reduction equipment;
- old, neglected power producing installations without dust precipitators that have sufficient ash trapping capability -- power plants emit 69 per cent of the SO_2, 68 per cent of NO_x and 42 per cent of the dust;
- habitual use of coals with a higher ash content than required by the design norms of the installations;
- a long heating period during which the numerous small, faulty boilers, lacking any kind of dust trap, burn anything they can get -- these small boilers emit up to 84 per cent of all cancerous substances, 80 per cent of CO_x and 54 per cent of particles, but use only 23 per cent of the fuel.

The energy sector also contributes to the thermal pollution of the waters. In particular, water consumption for power production is a multiple of the accepted amount, e.g. the region's thermal power plants use around 55 m^3 of water to produce one MWh, a quantity which is ten times higher than that for the rest of Russia.

The sensitive Siberian nature has a very low regeneration capability. The Siberian Energy Institute has estimated that in order to only stabilise the eco-system, dust emissions will have to be reduced by at least 78 per cent, SO_2 emissions by at least 11 per cent and those of NO_x by 23 per cent.

Measures for alleviation of environmental degradation

Environmental measures, which add to costs, do not make economic sense under the present price structure. The forthcoming price changes should make some measures possible. Among the least expensive measures would be purification, sorting and enrichment of the local coals used as the main boiler fuel. Energy efficiency improvements may even reduce the burden of price increases to the recipients of heat.

More efficient measures will need capital investment. These are a relatively standard set of actions related to energy conservation and efficiency improvements, such as:

- installation of flue gas cleaning equipment, e.g. scrubbers and other filters;
- introduction of automation and control equipment to improve boiler efficiency and the quality of heat supply while simultaneously reducing emissions;
- option for diversification of fuel inputs that are site specific and depend on local conditions, e.g. from coal to natural gas or fuel wood;
- rehabilitation of heat transportation and distribution networks and of home heating by introducing simple heat measuring and regulating devices -- the latter will improve the collection of payments and relate them to the consumed energy.

One successful method used elsewhere is to impose regulations that carry stiff penalties for polluters. This step will open a new market for efficient and non polluting heating devices, possibly arising from the technical ingenuity of local under-employed engineering workshops.

Table 6.14. Energy Consumption in the Krasnoyarsk region

I. Electricity consumption ('1000 Gwh)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Industry	43.73	43.42	41.74	40.53	39.8	39.91
Construction	1.17	0.87	0.83	0.75	0.68	0.77
Transport	3.05	3.01	2.77	2.65	2.60	2.76
Agriculture	1.79	1.87	1.83	1.77	1.67	1.77
Households & Services	3.73	4.09	4.03	4.06	4.09	4.18
Net Electricity Consumption	53.47	53.25	51.20	49.76	48.84	49.39
Power Plants Own consumption	3.43	3.83	3.68	3.58	3.50	3.55
Transportation Losses	4.08	4.34	4.17	4.06	3.98	4.03
Total Electricity Supply	**60.97**	**61.42**	**59.05**	**57.39**	**56.33**	**56.97**

II. Centrally supplied heat (million Gcal)						
Industry	36.312	36.04	33.57	31.09	30.47	31.28
Construction	2.824	2.82	2.72	2.60	2.50	2.60
Transport	1.047	1.00	0.89	0.80	0.75	0.80
Agriculture	1.957	1.93	1.91	1.89	1.87	1.90
Households & Services	24.727	25.09	25.28	25.21	25.25	25.27
Others	5.675	5.82	5.62	5.39	5.11	5.11
Non heat consumption	72.542	72.685	69.99	66.98	65.95	66.96
Transportation Losses	2.261	2.27	2.18	2.09	2.06	2.09
Total Heat Supply	**74.803**	**74.951**	**72.17**	**69.07**	**68.01**	**69.05**

III: Fuel used by Local Heating Devices (mtce)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Industry	4.958	4.83	4.63	4.45	4.40	4.50
Construction	0.039	0.04	0.04	0.04	0.03	0.04
Transport	0.054	0.05	0.05	0.05	0.05	0.05
Agriculture	0.557	0.55	0.54	0.53	0.52	0.53
Households & Services	3.031	3.06	3.08	3.09	3.10	3.13
Others	0.983	1.01	0.99	0.93	0.89	0.89
Feedstocks and non fuel uses	0.168	0.16	0.12	0.10	0.08	0.10
Non fuel consumption	9.79	9.693	9.451	9.19	9.06	9.218
Losses	0.06	0.06	0.06	0.06	0.06	0.06
Total Fuel Supply	**9.85**	**9.75**	**9.51**	**9.25**	**9.12**	**9.28**

(table 6.14. continued)

IV. Direct Uses of COAL (mtce)						
Industry	0.83	0.78	0.69	0.63	0.62	0.65
Construction	0.03	0.03	0.03	0.03	0.03	0.03
Transport	0.01	0.01	0.01	0.01	0.01	0.01
Agriculture	0.20	0.19	0.19	0.19	0.19	0.19
Households & Services	1.38	1.41	1.42	1.44	1.49	1.51
Others	0.78	0.79	0.77	0.74	0.70	0.70
Feedstocks and non fuel uses	0.10	0.09	0.07	0.06	0.05	0.04
Non fuel consumption	3.33	3.31	3.18	3.09	3.08	3.13
Losses	0.01	0.01	0.01	0.01	0.01	0.01
Total Supply of Coal	**3.34**	**3.32**	**3.19**	**3.10**	**3.09**	**3.13**

V. Direct Uses of NATURAL GAS (mtce)						
Industry	1.04	1.04	1.00	0.937	0.863	0.825
Transport	0.03	0.03	0.03	0.03	0.03	0.03
Households & Services	0.01	0.01	0.02	0.019	0.022	0.372
Others	0.01	0.01	0.01	0.01	0.01	0.01
Non fuel consumption	1.08	1.09	1.05	0.99	0.92	1.23
Losses	0.02	0.02	0.02	0.02	0.02	0.02
Total Supply of NATURAL GAS	**1.10**	**1.11**	**1.07**	**1.01**	**0.94**	**1.25**

VI. Direct Uses of FUEL OIL (mtce)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Industry	0.84	0.81	0.76	0.722	0.702	0.704
Agriculture	0.02	0.02	0.02	0.02	0.02	0.02
Households & Services	0.60	0.59	0.59	0.58	0.57	0.56
Others	0.20	0.20	0.19	0.185	0.176	0.176
Feedstocks and non fuel uses	0.005	0.004	0.004	0.003	0.003	0.004
Non fuel consumption	1.66	1.62	1.57	1.51	1.47	1.46
Losses	0.003	0.003	0.003	0.003	0.003	0.003
Total Supply of FUEL OIL	**1.66**	**1.63**	**1.57**	**1.51**	**1.47**	**1.46**

(table 6.14. continued)

VII. Other fuels (mtce)						
Industry	2.24	2.20	2.17	2.166	2.207	2.317
Construction	0.007	0.01	0.01	0.01	0.01	0.01
Transport	0.013	0.01	0.01	0.01	0.01	0.01
Agriculture	0.344	0.34	0.33	0.32	0.32	0.32
Households & Services	1.041	1.05	1.05	1.05	1.02	0.68
Others	0.006	0.006	0.006	0.006	0.006	0.006
Feedstocks and non fuel uses	0.068	0.06	0.05	0.04	0.03	0.06
Losses	0.03	0.03	0.03	0.03	0.03	0.03
Total Fuel Supply	**3.75**	**3.70**	**3.66**	**3.64**	**3.62**	**3.43**

VIII. Motor Fuels [mtce]						
	5.50	5.23	4.79	4.53	4.42	4.63

TOTAL ENERGY USED (mill. tce)	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**
Industry	25.42	25.41	23.97	22.97	22.57	22.85
Construction	1.357	1.24	1.126.	1.05	1.01	1.06
Transport	1.228	1.21	1.11	1.05	1.02	1.09
Agriculture	6.968	6.72	6.25	5.96	5.80	6.06
Households & Services	8.497	8.70	8.74	8.75	8.78	8.83
Others	1.959	2.008	1.94	1.861	1.763	1.763
Feedstocks and non fuel uses	0.17	0.16	0.13	0.10	0.09	0.10
Total Demand	**45.60**	**45.44**	**42.13**	**41.75**	**41.03**	**41.75**
Losses	1.78	1.86	1.79	1.74	1.71	1.73
Own uses of the Power Plants	1.115	1.244	1.196	1.162	1.141	1.154
Delivered Energy	**48.49**	**48.54**	**43.92**	**44.65**	**43.88**	**44.63**

Table 6.15. Regional fuel balance for all boiler types (mtce)

	1990	1991	1992	1993	1994	1995
Production	44.546	46.251	46.5	47.63	49.08	50.58
including:						
Coal	31.813	33.53	33.74	34.66	35.84	37.02
Natural Gas	5.85	5.815	5.792	5.792	5.827	5.85
Fuel oil	1.843	1.856	1.925	2.131	2.337	2.612
Other fuels	5.04	5.05	5.05	5.05	5.07	5.1
Regional Demand	33.47	33.698	33.61	33.02	32.96	33.82
Coal	20.5	20.848	20.9	20.45	20.42	21.56
Natural Gas	5.85	5.816	5.793	5.792	5.827	5.85
Fuel oil	2.531	2.491	2.437	2.378	2.343	2.338
Other fuels	4.589	4.543	4.478	4.394	4.364	4.075
Including:						
A. Thermal Power Plants	18.348	18.701	19.52	20.09	20.57	21.67
Coal	13.381	13.766	14.57	15.07	15.45	16.83
Natural Gas	4.542	4.51	4.519	4.582	4.688	4.404
Fuel oil	0.385	0.385	0.39	0.39	0.395	0.4
Other fuels	0.04	0.04	0.04	0.04	0.04	0.04
B. Boilers	5.271	5.243	4.596	3.711	3.313	3.065
Coal	3.782	3.763	3.136	2.281	1.883	1.635
Natural Gas	0.204	0.2	0.2	0.2	0.2	0.2
Fuel oil	0.485	0.48	0.48	0.48	0.48	0.48
Other fuels	0.8	0.8	0.78	0.75	0.75	0.75
C. Direct Use	9.851	9.754	9.492	9.219	9.071	9.089
Coal	3.337	3.319	3.193	3.097	3.09	3.1
Natural Gas	1.104	1.106	1.074	1.01	0.939	1.246
Fuel oil	1.661	1.626	1.567	1.508	1.468	1.458
Other fuels	3.749	3.703	3.658	3.604	3.574	3.285
Regional Balance (+ export; - import) **including**:	11.076	12.553	12.9	14.61	16.12	16.75
Coal	11.313	12.682	12.84	14.21	15.42	15.46
Natural Gas	0	0	0	0	0	0
Fuel oil	-0.688	-0.635	-0.512	-0.247	-0.006	0.274
Other fuels	0.451	0.507	0.572	0.656	0.706	1.025

List of main energy specific abbreviations

coal equivalent (ce): - relating different coal types to a standard accounting unit with calorific value of 7 000 Kcal per kilogram

mtce: - million tons of coal equivalent

MJ/kg: - calorific content of the fuel measured in million of Joules per kilogram

Mwel: - million Watts (1000 Kilowatts) of installed power generating capacity

GWh/y: - power production in billion (10^9) Watt hours (million kWh) per year

Gcal/yr: - heat production in billion (10^9) calories (million Kcal) per year

oil equivalent (oe): - relating different crude oil types to a standard accounting unit with calorific value of 10,000 Kcal per kilogram

toe: - ton of oil equivalent

bbl: - British barrel of oil equal to 157 dm^3

7 - KRASNOYARSK: TRANSPORT REPORT

by Dr. Gerhard Metschies

Executive summary of findings and recommendations

The economic reform's replacement of subsidies with requirements to cover costs has greatly shaped the current situation of the Krasnoyarsk region's transport and communication sectors. The sectors have moved from more socially-oriented to more capital-oriented policies. At the same time, Siberia's unfavourable location (4000 km from Moscow) and the new unfavourable relation between costs for transport and production costs for raw materials are increasingly playing a decisive role in shaping policies.

The present general characteristics of the transition for the transport sector are:

- rising transport prices, often several times above the inflation rate, caused mainly by reduced government subsidies;
- declining transport volumes, caused mainly by a general break-down of industrial production (often to less than half its earlier volume), a general reduction of demand for transport within the emerging market economy due to rising prices, and an oversupply in the fleet of trucks, planes, ships etc. , whose owners are inclined to calculate their services at operational costs only (below the fully cost-covering price); and
- diminishing quality, reliability and speed of transport, mainly within the state-owned part of the sector (such as air, rail and post services) and often caused by irregular and poor payment of employees.

The major changes and trends within different subsectors of Krasnoyarsk's transport and communications sectors may be summarised as follows:

– Privatised taxis and truck transport introduced competitive and cost covering prices with immediate effect and they may continue to be organised under private ownership as in Western countries. Private, fixed-route (marshrutnyy) taxis are finding an increased demand (as fares for individual taxis are often too expensive).

– Public buses and trams continue to raise fares (generally in a co-ordinated approach all over the Russian cities). For the western Russian cities the target for the next 5 years --as specified

by a World Bank loan-- is to cover costs by at least 50 per cent, which might also be a realistic goal for Krasnoyarsk.

- The road sector deserves special attention, if the existing central and regional road funds are to continue to finance the maintenance of the existing road network (at a tax rate of approximately *5 US cents* per litre fuel earmarked exclusively for this purpose).

- Urban roads and the public transport in cities requires the creation of an Urban Road and Transport Fund, (which may be financed --as in Western Europe and Canada-- by an additional fuel tax of up to *4 US cents* per litre plus the annual vehicle license fees).

- The air transport sector, which shrank to less than a quarter of its former volume, may continue to be fully privatised (with a majority of shares in private ownership) and forced to apply non-subsidised prices.

- With an ageing fleet of Soviet planes and rising prices for jet-fuel, which eventually may reach the level of world market prices, new types of more economical aeroplanes are necessary; also foreign capital for the airlines may be needed (e.g., the present privatisation process of Krasnoyarsk Airlines is seeking foreign capital involvement).

- The shipping sector --suffering from the immobilisation of ships during the long frozen period-- must charge relatively high prices. On the Yenissei river, which is navigable only 5 months a year, the local fleet's seasonal shipping costs may be twice those encountered elsewhere in Russia. On the Polar Route Dudinka --Murmansk, which is navigable only 3 to 4 months a year-- considerable savings in transport costs (especially for iron ore and timber) may be achieved if this route is opened to international shipping, especially tramp shipping and time charter shipping (in the same way as is being discussed for the western Russian shipping connection Yaroslavl-Archangelsk). Finally, surplus units of the Yenissei fleet may be sold or used, as is presently done in the Baltic or Black Sea shipping market.

- Rail transport is still the most important mode of transport. Therefore continued federal subsidies for rail tariffs are crucial for a landlocked, Central Siberia (presently only 26 per cent of costs are covered).

- Postal transport continues to deteriorate. With transportation periods of 3 to 4 weeks for a normal letter from Krasnoyarsk to Western Europe, this service is irrelevant for communication with foreign business partners. Modern telecommunications such as satellite and E-mail connections are being installed.

Comparing the transition process of Russia and the Krasnoyarsk region with the transition of other East European countries (such as Poland and Hungary) the following future developments may be expected:

1. An almost world-wide technological change from rail to road transport has occurred over the past 30 years, reducing rail transport's market share from 75 per cent to about 25 per cent or less. Therefore, long-distance truck transport on well-maintained roads may be expected to grow.

2. Prices for road construction are already reaching West European levels in the Moscow region, as are prices for buses, trucks and cars.

3. Despite the presently falling standard of living, the number of private passenger cars will continue to rise --a phenomenon known from other East European countries also.

4. Air transport prices will continue to rise as subsidies are phased out. Airport user charges (in the range of US$10 per departure as in other CIS countries) may become unavoidable to cover the maintenance costs of the extensive public airport network in the Krasnoyarsk region.

5. Rail transport subsidies might be maintained for longer periods, as in Western Europe (Germany, France, Great Britain, Netherlands etc.) the cost-covering rate of the railways reached only approximately 50 per cent. In former transition countries (Poland and Czech Republic), subsidies for the railway subsector are also the last ones to be cut within the whole transport sector.

6. As railway deficits generally are covered by other transport subsectors, there will probably be an increased taxation of private vehicles, mainly in the form of fuel taxes and of annual registration taxes.

7. Gasoline and diesel prices, which are still very low compared to international standards, may rise considerably, perhaps doubling or tripling.

8. The capital for the overdue renovation of the telephone system may only be raised if the present system of free local calls is abolished in favour of a cost-covering system of user charges like in Western countries.

9. As long as the state-owned postal and rail delivery services remain unreliable, the promotion of private parcel services (as already introduced in Moscow on a large scale) should be encouraged.

To better understand what steps to take in restructuring Krasnoyarsk's transportation and communication sectors, analytical work on the following subjects needs to be pursued:

a) the economic possibilities of making the Krasnoyarsk region independent of transport-intensive, imported goods (such as food, vegetables etc., which might use cheap local heating energy);

b) the future transport and marketing of the Krasnoyarsk iron ore and timber production, taking into account their general low world market prices;

c) the feasibility of opening a Polar Shipping Route (Rotterdam-Murmansk -Dudinka/Yenissei) to international shipping lines to provide cheap transport for exporting Krasnoyarsk raw materials;

d) the further commercialisation of public passenger transport in Krasnoyarsk city (and participation in a possible World Bank credit scheme);

e) the internal taxation possibilities (to be introduced by the regional administration) on road transport and specifically on the Achinsk refinery products;

f) the feasibility of introducing an Urban Road and Transport Fund for Krasnoyarsk city, financing it by road user charges (as the annual vehicle registration tax is raised to international levels);

g) the feasibility of improving Krasnoyarsk's airport (including landing rights for foreign companies); and

h) an increased co-operation with the transport centre in Novosibirsk, (780 km west of Krasnoyarsk) which has already introduced many transport measures still missing in Central Siberia (e.g., co-operation with foreign airlines, a Siberian-West European Transport Joint Venture, Special Customs Depot [for short-term import and export], airline transit facilities to all parts of Siberia, the organisation of trade fairs, the residence of European consulates for visas, etc.).

Krasnoyarsk's influence on the Russian Federation may be improved through a mechanism for co-ordinating special Siberian interests with its neighbouring provinces. Such co-ordination might be especially fruitful in the following areas:

- maintenance of the special subsidised railway fares;
- improving Siberia's unfavourable geographic position by opening the region to international air and shipping lines;
- establishment of a common tourist strategy (the promotion of international tourism is considered a good means to initiate improvements in the general infrastructure that are also needed for the further development of trade and industry);
- preparation of regional and local revenue and taxation policies on: provision of fuel taxes for regional road maintenance, additional fuel taxes and annual vehicle license fees for an urban transport fund, and the general permission to raise local fuel taxes (as in Canada) to improving the region's budget.

Local initiatives play an ever increasing role in economic development policy. A body independent from the centralised bureaucracies may be useful in promoting the region's trade, transport and tourism.

The transport system of the Krasnoyarsk region

The Krasnoyarsk region's vast territory, harsh climate, and population distribution have a profound impact on the region's transport. The region's geographical situation makes transport a key element in its economic development.

The region's immense dimensions (600 km from East to West within the Transsiberian railroad belt and a 1500 km flight between Krasnoyarsk in the South and Norilsk in the North) are unfavourable for any internal economic development. The export relations from Krasnoyarsk are very unfavourable (4656 km by rail to St. Petersburg and 5293 km by rail to Vladivostok). The shortest export distance therefore is by ship: 4000 km from Krasnoyarsk to Murmansk at the Finnish border, of which 2000 km are on the Yenissei River.

The large transport distances place the region in a particularly unfavourable economic position, due to the very nature of the economic transition process. Past investments were calculated with heavy subsidies for transport and with fixed prices for products. The introduction of world market prices for raw materials such as oil, wheat, timber and coal and the increasing removal of subsidies for transport (and all other infrastructure) have defined a completely new scenario for the Siberian economy.

The *New Price Scenario* shows that under these new economic conditions, the traditional long distance rail (and truck) transport for oil, wheat, timber and coal will be uneconomical. Moreover, in addition to pipeline transport for oil products, other modes of transport such as cheap international ocean shipping and radar controlled river shipping must be developed.

The *New Price Scenario* and the move to international prices show that long distance air travel may be increasingly beyond the means of private persons. While people continue to spend their private transport budget on increasing numbers of private cars, prices for urban public transport --also to working places-- will rise and may, depending on the distance to work, reach 5 to 10 per cent of the individual monthly salary, as in other countries.

The regional administration's primary task should be to improve the general framework conditions for a privately-owned, cost covering transport industry. It should bargain with the central government to maintain subsidies, especially for the rail sector, as long as possible and to improve vigorously the quality and maintenance of infrastructure connections such as post, telecommunications and road relations.

The basic structure of the region's transportation system

Railway transport has traditionally been dominant in Krasnoyarsk Region, and its leading market position has recently grown (see table 7.1).

Table 7.1. Relative shares of regional transport (%)

	Russia		**Krasnoyarsk Region**	
Year	1990	1993	1990	1993
Rail Transport	37,2	49,3	46,7	61.3
Road Transport	51.5	40,7	40,5	28,4
Water Transport	9,7	7,9	11.6	9,2

The economic recession has reduced considerably local road vehicle transport; whereas, the important transit transport along the Transsiberian Railroad has continued. Air transport of goods counted for only 0.2 per cent of total transport in the Krasnoyarsk Region in 1993.

In 1993 the share of total goods transported within the region according to the distance shipped was as follows: local transport (starting and ending within the region) 43.4 per cent; transit transport (crossing the region) 33.1 per cent; and interregional transport (starting or ending in the region, with destinations in other regions) 23.6 per cent.

The total volume of transported goods dropped significantly in 1993 and in 1994. The declines in transport volume (1993 compared to 1992) were as follows: rail transport -20.2 per cent; road transport, -40.4 per cent; river transport, -31.2 per cent; and air transport, -45.5 per cent.

The declining volumes relate to conditions affecting each of the different transport modes: 1) the reduced goods transport volume is approximately related to the reduced industrial output; 2) the reduced passenger transport is approximately related to the reduction in Gross National Product; and 3) additional reductions in the number of transported passengers is related to the considerable net transport price increases (by reduction of former subsidies, mainly in the field of transport by air and public buses).

Rail transport

The railroad is the backbone of goods transport in the southern part of the region, while river transport is the basic mode of goods transport in the northern part. There is no rail or road connection between the southern and northern part of the region. The railroad is centrally administered from Moscow, where timetables and tariffs are fixed. All ownership rights of the entire railroad system are executed by the Moscow Ministry of Railways. The Krasnoyarsk region is an important transit region for the Transsiberian Railroad.

According to the Technical Director of Railways in Krasnoyarsk, the entire railway system covers about 26,5 per cent of its costs. In spite of a 60 per cent fare increase (as of 15 February 1995) and in spite of low pay for railway workers, the railroad tariffs for passengers and for goods (calculated in constant foreign currency prices) would have to increase four-fold to cover the railway system's costs. About three-quarters of railway costs are subsidised by the federal budget. (The amounts may be considerably higher, as it is not certain if depreciation and investments are included in the above figures. Western European railways cover from 25 per cent to 75 per cent or their costs).

The total length of the railroad in the Krasnoyarsk region is 3 200 km. The only railroad in the north is the connection from Norilsk to the Dudinka port at the Yenissei River. The region's total passenger traffic for 1994 was 4 544 million passenger/kilometres, or 2.2 per cent of Russia's total. The region's total freight turnover was 61.2 million tons for 1994, or 55 per cent of the 1991 level, a drop corresponding roughly to the size of the general Russian economic breakdown.

As for the rolling stock, there are insufficient investments in the repair and rehabilitation of railcars and locomotives. The locomotives on the branch lines belong to local industry, which also loads the railcars. There appears to be no intention to transfer the ownership of branch lines to local authorities or local industry, although the branch lines are often subsidised by the clients.

The transport situation is extremely difficult for the timber and coal industry, which is very sensitive to transport prices (see table 11). According to the Krasnoyarsk Railway Administration, existing tariffs are often applied with a 60 per cent discount. The present official rail tariffs (already specifically lowered for timber and coal and indicated without VAT-tax) are approximately *1.2* US cents per ton-kilometre for a 1 000 km distance (see tariff table II annexed), which is less than a tenth of the West European price level.

Nevertheless, local industry considers the present general railway tariffs to be very high, as they are double the costs for truck transport. As noted above, rail tariffs are relatively low when compared with international transport prices. Average prices for normal non-preferential goods at a 500 km distance are approximately 2.5 US cents per ton -kilometre (tkm) and at a 1 000 km distance, approximately 0.2 US cents per tkm including VAT.

Railway tariffs show three main structural features: (1) a reduction for long-distance transport (of over 1 000 km) and a supplement for short distance transport (under 1 000 km), which are normally justified as reflecting economies of scale; (2) distinctions by the type of goods (a holdover of the era when officially fixed rates were part of industrial policy): "normal prices" are charged for cereals, salt, cement, and tank cars of petrol and liquids; whereas, transport-sensitive, low-price goods such as iron ore, coal and timber get reductions of up to 45 per cent; and (3) a general application (as recently instituted in West European countries) of the full value added tax VAT of 21.5 per cent, reflecting a government policy that considers transport a normal economic good or service. The application of past "social" and client-oriented tariffs may not last.

Passenger railway tariffs are low at 1.1 US cents per person/kilometre for a 4000 km ride. Prices to neighbouring CIS countries are relatively higher than those within Russia, for each country calculates the tariff according to the distance within its own territory and then adds individual country prices to form the final fare.

Road transport

The road network

The Krasnoyarsk region's road system totals 10 010 km, of which 9 100 km are under regional jurisdiction. There are 908 km of paved highways (motorway M53 and M54) which are under federal jurisdiction, thus there are only 30 km of unpaved federal roads. About half of the roads under regional jurisdiction are paved (see table 7.2).

The road system lies exclusively in the southern part of the region. No roads connect with the north. The road along the Yenissei bank which ends 500 km north of Krasnoyarsk at Yartsevo, is still 1100 km from Norilsk. There is a highway connecting Krasnoyarsk to Western Europe.

Table 7.2. Classification and length of road systems in Russia and the Krasnoyarsk region (km)

	Russia (km)	**Krasnoyarsk region (km)**	
I. All Public Roads	489 059	10 008	2.1%
of which paved	274 609	5 428	2.0%
I. a. Federal Roads	40 622	908	2.2%
of which paved	36 316	878	2.4%
I. b. Regional Roads	448 437	9 100	2.0%
of which paved	238 293	4 550	1.9%
II. Unclassified Enterprise Roads	450 000		
III. Access Roads	700 000		
IV. Urban Roads	not available		

The Federal Road Agency (UPRDOR) maintains the federal road network. The Regional Highway Administration (Avtodors) maintains federal highways under contract and regional roads. Maintenance costs are estimated at US$1 000 per km for federal roads and US$500 per year for regional roads.

Financing of Road Maintenance by Road Funds

In October 1991, the Russian Government eliminated all budgetary funding of roads and introduced an expanded road user taxation system. The Federal Road Fund (FRF) and 87 Regional Road Funds (RRF) were established by Law No. 4226-I, dated 25 December 1992, to fund construction, maintenance and rehabilitation of public federal and regional roads. The combined budget is approved annually (by the Supreme Soviet in 1992 and by Presidential Decrees in 1993 and 1994). The first full year of operations for both FRF and RRF was 1993.

Federal Road Fund (FRF)

The Federal Road Fund is fed by: (a) a nation-wide fuel and lubricant tax, (b) a vehicle production tax, and c) enterprise, vehicle sales, and vehicle registration taxes (see table 7.3). The detailed sources for the FRF are:

a) a fuel and lubricant tax: There is a 25 per cent tax on gasoline, diesel fuel, lubricant oil, and compressed and liquefied gas. The tax is levied on 32 Russian refineries (located in 20 oblasts) and on all their resellers (including co-operatives and small plants). When reselling oil or lubricants, corporations, enterprises, organisations and entrepreneurs must pay on the difference between their price of sale (less VAT) and their purchasing price (less VAT).

However, Decree No. 1008 (May 23, 1994) specifies that "in assessing the tax on fuel and lubricant sales, the tax base shall exclude the turnover of producing enterprises and of other economic entities involved in selling products to non-CIS countries at prices close to world levels". Therefore, no tax on exported fuels or lubricants should be paid to the FRF. This decision supposedly reduced FRF resources by about 8 per cent.

b) a vehicle production tax (formerly levied up to June 30, 1994): The six Russian vehicle manufacturing firms, NAZ, AZLK, GAZ, YAZ, IXE, OKA are taxed (the tax rate was 35 per cent).

c) enterprise, vehicle sales, and vehicle registration taxes in the cities of Moscow and St Petersburg. Enterprise, vehicle registration, and vehicle sales taxes generally go to regional road funds. The cities of Moscow and St. Petersburg, however, collect these taxes for the FRF. These contributions are significant, representing rubles 54.9 billion in 1993 (January 1993 prices).

Regional Road Funds

Taxes for the Regional Road Funds are levied as follows:

a) enterprise tax: most enterprises are taxed a minimum of 0.4 per cent on sales, except commercial firms, for which the tax rate is 0.03 per cent or higher. In most regions, rates are now between 1.5 per cent and 3.5 per cent . All enterprises, organisations and individuals considered a "legal entity" in the Russian Federation pay the tax.

b) vehicle sales tax: enterprises or organisations that purchase, exchange, or lease vehicles pay this tax, which is a percentage of the sales price (less VAT) -- i.e. 20 per cent for trucks, vans, mini-vans, buses and cars and 10 per cent for trailers and semi-trailers.

c) vehicle registration tax: levied on both firms and individuals, this tax ranges from 30 kopecks per Horsepower (HP) to 7.15 rubles per HP per year. The regions have adjusted the rates for inflation. Tax enforcement mainly comes from the road police (GAI). Tax collection dates are fixed by Republic

parliaments and corresponding authorities of the autonomous okrugs, krais, regions, and cities of Moscow and St. Petersburg.

Annual registration taxes (also called vignette) are minimal, amounting to approximately US$75 per normal passenger car per year (as recommended by the World Bank for developing countries). With an existing regional fleet of 255 000 private cars and assuming international tax levels, the annual registration tax may equal up to US$19 million per year.

The State Duma annually votes on the global amount of subventions and grants for each oblast. In 1993, the corresponding total amount was 537.8 billion rubles (current prices) and should be approximately 1540 billion rubles (January 1994 Prices) in 1994.

Current Problems in Road Financing

Tax collections were problematical when the new Road Fund system was introduced in 1992, because most of the taxes, including the fuel tax, were collected at the regional and local level. Many of them were never collected, in part because: (a) the system of tax collection was inadequate; (b) some regions were reluctant to remit taxes to Moscow; and (c) many enterprises were in poor financial condition, as inter-enterprise debts grew rapidly. To meet the shortfall in funds for federal roads during the construction season, the FHD borrowed from the Central Bank. Most of these loans have been repaid.

Fuel taxes are mainly collected at the refinery level. Fuel and vehicle excise taxes are allocated to the FRF, and taxes described as "road user" (enterprise) taxes, vehicle sales taxes and registration taxes are allocated to Regional Road Funds. Therefore the FHD doesn’t rely on local authorities to remit taxes owed, while regional governments pressure enterprises located within their regions to pay their taxes.

As of 1993, the regions were also given authority to raise the levels of the road user tax, vehicle sales tax and registration tax. These various measures improved the 1993 collection of taxes for the Federal and Regional Road Funds.

Other remaining obstacles affecting the FRF include the withholding of fuel taxes by refineries located in one or two autonomous republics which assert a relatively large degree of independence from central government. Opposition to the energy tax originates mainly with the energy lobby and other interests which want to see fuel taxes reduced or eliminated altogether. The Road Fund is not audited or monitored by any independent agencies.

Table 7.3. An overview of the Federal and Regional Road Funds (billion rubles)

	Russia	Krasnoyarsk Region		
	1993	1994	1994	1995
I. Federal Road Fund	311.0	ca. 2500	48	86
of which				
a) fuel + lubricants tax	204.0		(allocation	voted for
b) vehicle production tax	52.0		by the State	Duma as a
c) enterprises + vehicle sales, + registration	54.9		global	amount)
II. All Regional Road Funds	417.9		233 (collected	570 locally)
a) enterprise tax (0.4%), but not for farms (also called "road user tax")	304.1			
b) vehicle sales tax 20% of sales price (without VAT)	90.3			
c) vehicle registration tax for car owners 418 Rubles per 1 HP	23.5			

Urban Road Funds

Urban road funds generally do not exist. Individual cities and communities may establish them, using additional local fuel taxes or increasing the annual vehicle tax (e.g. the Annual Car Taxes or Vignettes levied by the communities).

Public Buses and Private Cars

The Krasnoyarsk Region has about 3 100 buses. Krasnoyarsk city has about 500-600 big passenger buses (fare: 500 rubles) plus “fixed-route” taxis or shuttle buses (fare: 1 500 rubles). The subsidies for urban passenger transport were budgeted at 123 billion rubles in 1995. According to the City Council 153 billion was needed and the city of Krasnoyarsk is already overloaded with subsidies for the local infrastructure due to the presently insufficient local tax base.

The number of private cars is increasing - despite the economic crisis - as in most other East European transition countries (see table 7.4).

Table 7.4. Private cars per 1 000 inhabitants

year	Russia	Krasnoyarsk Region
1980	30.2	36.7
1990	58.6	66.6
1992	68.5	75.6
1993	75.7	82.3

There are approximately 255 000 private cars in the region, and private car ownership is expected to increase further. The average car usage, 7 000 to 8 000 km per year, appears limited. (West European car ownership is six times higher, often reaching 500 cars per 1 000 inhabitants). The prices for vehicles in Krasnoyarsk (22 June 1995) were: US$7 830 for a GAZ-4 301 four-ton truck and US$10 470 for a Volga passenger car.

There are 360 taxis in the city of Krasnoyarsk, all of them privatised, i.e. a joint stock company was formed with 30 per cent state capital and 70 per cent private capital.

Fuel prices

Russian fuel prices are centrally fixed at 1300 rubles per litre for diesel and low octane gasoline (June 1995, or 29.1 US cents/litre including VAT), which includes the transport, a 25 per cent tax and a distribution fee. (The Rotterdam World market price -- fob, without taxes -- on 21 June 1995 was 19.3 US cents/l for Super 98 octane with 0.4Pb). In contrast, sales prices at the pump in Western Europe stood at 80 to 110 US cents/l. Energy prices in Russia are expected to keep to rising.

Fuel taxes are a major source of state revenues in all West European countries -- in Germany fuel tax revenues total US$40 billion yearly -- covering all road sector expenses and railroad deficits. Additional local financing laws earmark funds from fuel taxes for urban transport, thereby covering urban deficits.

Russian cities and regions should closely follow any changes in fuel prices to secure their own share from them. An additional tax of 200 rubles per litre applied to all the 3 billion litres used yearly in the Krasnoyarsk region would generate an additional revenue of 600 billion rubles or US$13.4 million.

There are 2 main fuel taxation systems in the OECD area. In Europe all fuel taxes pass through the central government before being redistributed, whereas in the USA and Canada regional authorities have the right to levy additional fuel taxes on their own. It may be worthwhile for the West, Central, and East Siberian Regions to formulate a common position on the energy taxation issue towards the central government.

Ship transport

Ships on the Yenissei provide for most bulk transport from Krasnoyarsk to the north (3 000 tons/day). The main shipping route is from Krasnoyarsk to Dudinka Port (2 000 km) and takes 4-5 days downstream and 6-7 days upstream (at full 24 hour ship operation due to the newly installed Radar system). The route is open 156-185 days per year and ships depart twice daily. Normal barge loads are up to 1500 tons, i.e. equal to West European standards.

Tourist hydrofoils (at 60 km/h) make a 2-day trip to Podkamena at the mouth of the Podkamena Tunguska with an overnight stay in Yenisseisk.

There are 582 self-propelled ships on the Yenissei River, of which 45 per cent are operational. With local transport volumes falling, some of the river/ocean-going ships are being leased for operation in the Baltic Sea, the Mediterranean and the Black Sea. Additionally there are 1 200 towed barges.

Another upstream shipping route is Krasnoyarsk-Abachan, which starts 35 km south of Krasnoyarsk, at the dam site. Ships of up to 2 000 tons are pulled on rollers overland into the upstream lake. Total transport volume (mostly grain and coal) is rather small and limited to approximately 50 000 t of grain per season.

The affluent of the Angara is navigable by hydrofoil up to Ketschma, an area rich in minerals and currently a large timber production centre. About 1 million cubic meters of wood are rafted per year along the Angara River. The lower Tunguska River is navigable 30-40 days per year up to Tura (and 10-12 days per year up to Vanavara).

Dudinka, in the northern Yenissei, has a connection by ocean vessels and ice breakers to Murmansk at the Kolsk peninsula (a five-day journey of 2 500 km at 13 knots speed), where there is an oil refinery. Icebreakers keep the passage open from 15 June to 10 October. Murmansk has a direct rail connection to Finland. Ocean-going ships may even reach the Igarka port on the Yenessei, 250 km south of Dudinka.

Ship transport prices are lower than those for rail transport. The export route to Finland by ship (also for fuel from the Tyumen oil fields by pipe to Achinsk and with storage at Lesosibirsk/Riverport on the Yenissei to Dudinka and Murmansk) seems profitable: 115 000 tons/year are transported (at fuel prices of 700 000-1 million rubles per ton).

The polar export route used by ocean-going bulk carriers from Dudinka/Yenissei via Murmansk to Rotterdam is the only economic transport route for coal, iron ore and crude oil exports (i.e., raw materials with a world market price of less than US$100 per ton). Transport prices are US$5-10/ton for the Dudinka-Rotterdam route. The international Tramp and Time-Charter Transport market for ships has relatively low rates. The general opening up of this route to international competitive transport might improve the export position of the Krasnoyarsk region. Due to the short summer period in the north, loading and unloading times of vessels are becoming increasingly important and modern bulk carriers, which can be loaded within a 12 hour shift, may be appropriate.

Coal's relatively low world market price of US$50 per ton means that the world-wide transport of coal almost exclusively uses ships. According to the "Verein Deutscher Kohlenimporteure/Hamburg", in 1994 out of the total 402 million tons of coal trading world wide, a volume of 373 million tons was transported by ship. International coal shipping is even expected to double by the year 2010. The biggest importer of coal is the European Union (117 million tons, some of which came from as far as Australia). Expensive rail transport limited Russian coal exports to 10 million tons. A figure in the Deutsche Verkehrszeitung (15 August 1995) describes 1994 world coal shipping without taking into account the polar route. It indirectly shows the possibilities for Russian coal.

Air transport

The region has 193 airports, 5 of which (Krasnoyarsk, Norilsk, Igarka, Yenisseisk and Abarka) have direct non-stop connections to Moscow. The air transport network is rather dense. The main carrier

is the stock company Krasnoyarsk Airlines (51 per cent state ownership) operating from Emolyekovo Airport (20 km west of Krasnoyarsk). In July 1995 there was a public tender for Krasnoyarsk Airlines (in to sell at least 25 per cent of the assets including all the planes, the airport and the airport hotel. A fully state-owned local airline operates from the Choremshanka Airport (16 km west of Krasnoyarsk). As throughout the NIS, regional air transport volumes decreased continuously during the last years (see table 7.5).

Table 7.5. Volume of air transport in Krasnoyarsk region

Year	**1994**	**1993**
Passenger/km	3321.9	4386,2
´000 Passengers	1322,2	1864,2
Post Freight ´000 tons	2,8	3,8
Freight ´000 tons	34,4	65,2

The average flight distance per passenger was 2 500 km. Reduced flight operations reflect the economic downturn and is aggravated by diminished punctuality. According to the Statistical Committee in January to March 1995, 65 per cent of the planned international flights, 21.5 per cent of the national flights and 20 per cent of the local flights were cancelled.

Prices of air transport in Russia are still relatively low, about 1/5 of Western prices. The present price level may be maintained as long the existing Soviet aeroplanes are still available. With Aeroflot already using some Airbus planes, transport prices will inevitably increase. (In Western Europe flight tickets cost 2.5 to 3 times the price of rail tickets). The national price level of Krasnoyarsk Airlines is about 11 US cents cents/mile (or 7 US cents/km), about 4 to 5 times the rail tariff (see table 7.6). International IATA tariffs are about 40 to 80 US cents cents/mile, with an average of 60 US cents/mile.

Table 7.6. Air transport tariffs as of June 1995

Flight prices from Krasnoyarsk within the Russian Federation (one way)					
From Krasnoyarsk to	distance in miles[2]	Tariff ('000 rubles)	Tariff US$	Price level US cents/mile/person	Airline
Abakan	185	160	33,3	18,0	7B[1]
Moscow	2113	1267	263,0	12,4	7B
Irkutsk	489	240	50,0	10,2	7B
Tura	625	310	64,8	10,3	7B
Novosibirsk	378	200	41.7	11.0	7B
Norilsk	923	510	108,0	11,7	7B
Vladivostock	1944	710	148,0	7,6	7B

Flight prices from Moscow (one way by Russian and Foreign Airlines)					
From Moscow to	distance in miles[2]	Tariff ('000 rubles)	Tariff US$	Price level US cents/mile/person	Airline
Norilsk	1773	828	172.0	9.7	local
(if purchased abroad)			375.0	21.2	special
Volgograd	554	260	54.5	9;8	local
(if purchased abroad)			109.0	19.6	special
Irkutsk	2613	1180	246.0	9,4	local
Samarkand	1735	735	153.0	8.8	local
Vladivostock	3989	1218	271.0	6.8	local
Seoul	4107		1960.0	47.7	IATA
Madrid	2131		1285.0	60;0	IATA
Helsinki	566		462.0	81;6	IATA
Istanbul	1091		881.0	80.8	IATA
Warsaw	720		435.0	60.4	IATA
London	1556		1065.0	68.4	IATA

Flight prices IATA-Fares (Lufthansa) (one way)				
	distance in miles[2]	Tariff US$	Price level US cents/mile/ person	Airline
Novosibirsk Frankfurt/Main	2984	1937	64.9	LH
Moscow Frankfurt/Main	1264	723	57.2	LH

Notes: (1) 7B= Krasnoyarsk Airlines
(2) 1 mile = 1.6 km

If the flight prices are calculated on a per kilometre basis, the generalised summary of passenger transport prices looks as shown in table 7.7.

Table 7.7. Passenger fares in US cents per kilometre in Russia and Western Europe

	Russia	**Western Europe**
	existing tariff (1995)	normal tariff (IATA)
Air Transport	6-7	38
Rail Transport	1.1-1.4	16
Bus Transport	1	8-16

The West European prices shown in table 7.7 are market prices, which on principle do not take into consideration any social aspects. The Russian prices are transition prices. They also reflect social considerations, as long as the balance can be paid by the government, which in most cases may no longer be able to consider the purchasing power of the passengers.

Pipeline transport

Pipelines carry oil from the Tyumen and Tomsk oil fields in West Siberia to the Achinsk refinery and further to Irkutsk in East Siberia. Two pipelines cross the Krasnoyarsk region and parallel the Transsiberian Railway. They belong to the state organisation, the "Transsiberian Pipeline Association", whose territory reaches from Tomsk in West Siberia to Irkutsk in East Siberia. There is an "isolated" pipeline, not connected with the common Russian network, north of Kaimonovo at the Angara River.

The Achinsk refinery has a capacity of 6 000 tons per day and will reach a capacity of 12000 tons/day (approximately 4 billion litres fuel per year) after renovations. The pipelines are owned by the Central Siberian Pipeline Association, which is one of the 17 major state pipeline companies existing in Russia.

Pipeline transport in the permanent frost regions of the north is difficult. New fibreglass technology, different heating systems for the pipes, and alternative construction techniques for pipe-laying deep under the frozen soil are used or being tested. The necessary investments of up to US$1 million per km of pipeline require experienced commercial management.

Postal transport and communication

High standards for communication and information are prerequisites for modern economic development. Lags in general communication and information infrastructure will retard efforts to reach Western development levels.

Postal services have deteriorated, especially the delivery times for international items (which often amount to several weeks). The postal price list as of end of 1994 is shown in table 7.8.

Table 7.8. International postal service

Weight	**Price**	
(grams)	**rubles**	**US$**[(1)]
postcards	600	0.20
letters		
20	900	0.30
100	2 500	0.83
250	5 430	1.80
500	10 670	3.56
1000	20 270	6.75
2000	33 290	11.97
books		
500	5 750	1.92
1000	10 560	3.52

International Air Mail Packages			
	weight (kg)	rubles	US$ [(1)]
to Germany	1	41 100	13.7
	10	76 800	25.6
to the USA	1	34 300	11.4
	10	170 800	56.9

Note: (1) 30. Dec. 1994
Registered packages are twice the price.

Private express mail

With the declining quality of the State Postal Service, new private express services (like DHL, EMS, UPS, TNT etc. with head offices in Moscow) are replacing the traditional state-owned post transport, especially for the business community. Prices (see table 7.9) are often only 50 per cent above the registered Air Mail Packages of the Post Office, and delivery is within a few days world-wide. For example, a 30 kg package to be shipped Krasnoyarsk-Moscow costs US$231 and Moscow- Frankfurt/M, US$223. Other cost comparisons for private Express Mail may be calculated according to table 7.9.

Table 7.9. Prices for package transport in US$, payment in rubles

Domestic Zones Zone 1-Central European Russia Zone 2-Far North, South Russia, Urals Zone 3-West Siberia Zone 4-East Siberia Zone 5-Russia Far East						International Express Zone 1-Europe, USA, Far East Zone 2-Near East, Central America Zone 3-S. America, S. Africa, Australia, New Zealand Zone 4 & 5-Where irregular Air service				
Zone	1	2	3	4	5	1	2	3	4	5
Up to 100g	12	15	17	20	22	31	34	39	64	74
Up to 1 kg	18	22	25	27	31	44	49	55	84	89
Up to 2 kg	22	27	30	33	78	51	61	72	106	136
Up to 3 kg	26	32	35	39	84	58	73	89	128	183
Up to 4 kg	30	37	40	45	90	65	85	106	150	230
Up to 5 kg	34	42	45	51	96	72	97	123	172	277
Each additional kg	4	5	5	6	6	7	12	17	22	47

Main features of a regional transport policy for the Krasnoyarsk region

General planning aspects of the economic transition

Russia's recent move toward world price application for commodities (e.g. metals, coal, and grain), consumer goods, and the whole transport and communication sector (which in the past was heavily subsidised by the Russian Central Government) has had major consequences for the very basis of Siberian industry. Some basic problems with the new price system are specific for Siberia and arise in addition to the dissolution of the former Soviet Union. The economic principles of commercialisation and privatisation -- although steps in the right direction -- only mitigate the problem.

International experience with transport privatisation (e.g. bus services in Indonesia, etc.) show that cost reductions of up to half may be achieved. The present main Siberian problem, being 4000 km from Moscow, is that world market prices for transport and communications (e.g. flight tickets, telephone tariffs, and gasoline prices) are still considerably higher than those in Russia (ratio 5:1 or 10:1, if calculated in US$). Thus, the cessation of state subventions will probably have a greater impact than the question of public or private ownership.

Cost-based location of industry

Transport costs as part of wholesale and world commodity prices

The Krasnoyarsk *Prognos Rastsifiya* (Forecast of the Social-Economic Development for 1995) shows how transportation costs have increasingly influenced recent wholesale prices of products (see table 7.10). The same rising shares for transportation are even truer for prices of raw materials and commodities like coal, timber and wheat. World market prices will therefore limit the possible budget for transport, exposing a major Siberian development problem.

Table 7.10. Transportation costs as percentage of the wholesale price

	1992	1993	1994
TV-Sets	1.2	1.8	2.3
Washing machines	7.0	9.6	13.0
Leather shoes	1.2	4.0	12.0

Raw materials and transport costs

The maximum transport ranges for rail or truck transport are crucial. (The costs for land transport already cover 25 per cent or 50 per cent of the world market sales price of a commodity.) Four different scenarios under constant world market prices exist:

- present rail transport prices of 2.5 US cents per tkm and a maximum 25 per cent transport share;
- a transport price possibly increased to 5.0 US cents/tkm and a maximum transport share of 50 per cent of the sales price;
- a transport price of also 5 US cents /km, but with a maximum transport share of 25 per cent of the sales price; and
- a West European situation, with a transport price of 10 US cents/tkm and a maximum transport share of 50 per cent of the world market commodity price.

Table 7.11. Raw materials, transport costs and maximum economic transport distances

Kind of Raw Material	World Market Sales Price (US$ / ton)	Maximum Transport Range of rail or truck transport in km for 1 ton of commodity with assumed rising transport tariffs and assumed maximum percentages of transport costs within the world market sales price : { scenario of the near future}: far future { case a: }{ case b: } (Europe) (1) (2) (3) (4)			
		(at 2.5 US cents per ton-km; present situation) 25% of sales price is transport	(at 5 US cents per km). 50% of sales price is transport	(at 5 US cents per km). 25% of sales price is transport	(10 US at cents per km. 50% of sales price is transport
	US$ per ton	up to..... km	up to km	up to km	up to ....km
Cobalt	67 800	*not very*			
Nickel	8 300	*sensitive*			
Tin	6 870	*to land*			
Copper	3 035	*transport*			
Manganese	2 800	*prices*			
Aluminium	1 800	18 000	18 000	9 000	4 500
Zinc	1 010	10 100	10 100	5 050	2 025
Lead	610	6 100	6 100	3 050	1 525
Gasoline	160	1 600	1 600	800	400
Scrap Steel	140	1 400	1 400	700	350
Raw Oil	100	1 000	1 000	500	250
Wheat	160	1 600	1 600	800	400
Timber Board (per m3, for Construction)	120	1 000	1 000	500	250
Barley/Fodder	100	1 000	1 000	500	250
Cattle	140	1 400	1 400	700	350
Coal	50	500	500	250	125

Conclusion for raw materials and transport costs

Table 7.11 leads to the following conclusions:

1. Food, wheat, and vegetables (with world market sales prices of less than US$160 per ton) have a maximum transport distance of 500-1 500 km and less. Therefore the first political

priority for the Krasnoyarsk region is self-sufficiency in food. (With adverse climatic conditions but cheap electricity, even heated greenhouses for a variety of vegetables may be worth considering.)

2. Coal, timber and iron ore prices (world market prices at US$50 to US$100 per ton) allow for a maximum land transport distance of 1 000 km and less. Therefore, the export of coal and timber by rail may become impossible. (An exception may be cheap transport on ocean vessels via Dudinka-Murmansk on this 2 500 km ocean route and further or directly from the Yenissei to Hamburg/Rotterdam.)

3. Crude oil and gasoline (world market prices at US$100 to US$160 per ton) are transport-sensitive for rail and truck transport (maximum distance between 400 and 1 600 km). They may be transported long distances only by pipelines or ships/ocean vessel. Therefore, the export of crude oil from the Lower Angara/Evenky Complex may only be worthwhile via the Polar Ocean route. (Note: the present prices for goods transport by truck are reported to be lower than the rail tariffs, but it is expected that these low truck tariffs will not last. They are a consequence poor demand from the economic crisis and are not cost-covering.)

4. Metals like lead, zinc and aluminium have decreasing export chances with rising transport costs, but may continue to be exported by rail transport.

5. Metals like copper, tin and nickel (with world market prices between US$3 000 and US$8 300 per ton) may be less affected by rising transport prices. Thus especially the Norilsk Nickel mine may constitute one of the best assets of the region.

Recommended plan of action

During the seminar in Krasnoyarsk on 9-12 October 1995 the following issues on the transport sector may benefit from discussion:

1. Improvement of general information on technical and cost aspects of transport logistics in the region. (Use of the Privatisation Centre as general Information Centre for private enterprises as well as for regional officials; use of the Privatisation Centre as general contact address to foreign institutions.)

2. Improvement of the tax basis of the transport sector in the region and Krasnoyarsk City by appropriate local tax laws. (Preparation for the planned fuel price discussion with the central government in 1996; creation of a common commission of west- , central- and east-Siberian officials to formulate a common road transport and vehicle taxation policy.)

3. Improvement of Krasnoyarsk's public bus system: import of spare parts and spare motors with World Bank Credit (as in other West Russian Cities).

4. Improvement of food supply by cost-based agricultural location and privatised food transport.

5. Improvement of shipping services on the Yenissei (including coal and ore export) on the Dudinka-Murmansk -Rotterdam Ocean route. Improvement of loading facilities in Ibarka and Dudinka following the example of other Russian ports like Yaroslavl with financial help from the European Bank for Reconstruction and Development EBRD in London.

6. Improvement of coal marketing (study on modern coal washing techniques reducing transport costs).

7. Improvement of airport connections to foreign business partners (granting landing rights also to foreign companies and securing credits for runway improvements)

8. Improvement of the highway network (participation in World Bank Credit Scheme being implemented for the strengthening of the major highways in Western Russia)

9. Improvement of rail services of goods transport by utilisation of user-owned locomotives.

10. Improvement of local manpower for the transport logistics (Co-operation with the Transport Institute of the University).

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NOTES

[1] The average concentration of pollutants in Shychia river, which is a tributary of the Yenisei, was, Cu - 115 MPCs (115 mg/l), Zn - 23 MPCs (0,23 mg/l), Ni - 29 MPCs (2,9 mg/l), ammonia - 8 MPCs (3,2 mg/l), organic matter - 4 MPCs (12 mg/l).

[2] This is reflected in the inactivity of 50% of the local fleet.

[3] Unfortunately, these figures exclude information about the military telephone connections in the region, which could add substantially to the total number of phones.

[4] The disagreement between the sources in the estimates for the numbers employed in industry, transport and communication is relatively small in absolute numbers: 470,000 versus 444,000 and 128,000 versus 148,000 respectively.

[5] The estimates for those who do not register are developed on the basis of the labor force statistics.

[6] Again, it should be stressed that vacancy data in Russia is as unreliable as unemployment data due to substantial grey and black activities in the economy.

[7] The sample data includes 583 enterprises. The total population in 1994 was about 1660 according to the Regional Statistical Committee. The sample includes the bulk of the best known and large enterprises and those enterprises for which managers answered the questionnaire, i.e., who were active in the market. Unfortunately, not all of them give their figures on personnel, output volume, and the data on depreciation of real assets. Hence, in the analysis the number of total enterprises ranges from 430 to 520 depending on the topic.

[8] Recent literature on endogenous growth stress the importance of external effects on education, innovation and technology of one industry on the other. This suggests that an analysis of the potential for endogenous development should take into account the interactions of firms and industries.

[9] The top five enterprises in terms of production volume in Krasnoyarsk in 1993 are: "Norilsk Integrated Mining And Metallurgical Works Named After A.P.Zavenyagin"; "Krasnoyarsk Non-Ferrous Metals Plant"; "Krasnoyarsk Aluminium Works"; "Krasnoyarsk Synthetic Rubber Plant"; "Joint-Stock Company 'Krasnoyarskenergo'".

[10] The four top employers Krasnoyarsk in 1993 are: "Norilsk Integrated Mining And Metallurgical Works Named After A.P.Zavenyagin"; "Joint-Stock Company 'Krasnoyarskenergo'"; "Krasnoyarsk Grain Combine Harvester Production Amalgamation"; "Achinsk Integrated Aluminum Mill".

[11] This is defined as the present value (net of depreciation plus inflation adjustment) of the capital stock.

[12] This conclusion applies only for comparisons that are to the “north east” of each other, since comparisons between two firms that are producing with different capital intensities are problematic due to scaling problems (labor efficiency is measured per worker, capital efficiency in terms of monetary value of the capital stock). A very short distance between a point and the origin must be considered less efficient than a very long distance, even when the comparability does not strictly hold.

[13] It should be noted that this argument is applicable to the long run only. Of course in the short run, Krasnoyarsk will remain a region with excess labor supply. However, the migration data suggests that when people do not find attractive employment in the north of the territory they emigrate.

[14] Estimates vary greatly according to the assumed marginal productivity of capital (a), to the assumptions of how far the economy is operating below its potential labour productivity due to waste inherited from the communist system (g) and to the exchange rates used (purchasing power parity - PPP or nominal exchange rates - NOM).

[15] One of the measures discussed in this field is the "emission" of the "Golden Siberian Ruble" (a gold coin without official character) in order to stress the close tie of Krasnoyarsk with the metal industry and its extreme wealth in natural resources.

[16] Data on registration is unreliable because of substantial black and grey activities and comparisons are difficult. In other transition economies these figures have been larger by a factor of ten.

[17] Unfortunately, this indicator has problems related to non-reporting and false reporting. Of the 583 firms surveyed, only 336 (or just under 60%) actually reported their founding date. Furthermore, in the course of transition, many enterprises undergo reorganisations -- such as breaking up of large enterprises into smaller ones and the creation of new legal forms. These reorganisations may be counted as founding a new enterprise; yet, in economic (not legal) terms this is just an organisational change, not a "start-up". If managers were to register their firms' founding dates from a legal point of view, then most managers would register their firms as "start-ups."

[18] While the previous estimates can be considered an upper bound of new enterprise formation these figures must be considered a lower bound.

[19] Forest fund areas are made up of forested areas and areas useable for multiple forestry purposes. Unforested forest fund area is usually land of low productivity.

[20] Harvest and production data are mostly for 1989 in this report. The year 1989 represents a highpoint for the technical and managerial capacity of production.

[21] Backman (1995) noted that only about 85 per cent to 90 per cent of East Siberian harvest flows were monitored by the Forest Service's data collection system, making possible serious differences between the real production levels and the production reported by GOSKOMSTAT.

[22] Many timber harvesting enterprises still employ convicts, for productivity analysis reveals that many employees work with very low-productivity equipment and are paid almost nothing.

[23] An important pulp mill planned to be built in the neighboring town of Yeniseisk. However, the co-located fiber board capacities, especially in Novoyeniseisk, can only process wood chips produced by the huge saw mills.

[24] A small fee is charged for calculating the tariff, and there are additional expenses to cover the shipment's security. Insurance companies exist for covering the risk of lost or delayed freight, but they are of questionable reliability.

[25] This list is to some extend incomplete, however can be considered to be representative for the forest industry.

[26] For this calculation one kg of mushrooms was considered to be worth 10$, the retail price in September 1995 in Austria. Fresh forest mushrooms cost about 20-50$ in Western Europe.

[27] 221.6 trillion rubles calculated with the exchange rate from the 16th of September 1994 of 2317 rubles for 1 dollar.

[28] Multiple-output enterprises report only for the entire range of output. It is difficult to separate the enterprises' contributions for infrastructure and social activities, and there are major inconsistencies of financial data and even engineering data.

[29] These prices were not necessarily the prices of the actual product, but of the product of a certain quality that should be produced at the enterprise.

[30] There are three production phases which have to be considered: i) logging operation at the site and tree skidding to the upper landing, ii.) hauling to the lower landing, iii). crosscutting, grading, piling and /or loading on railway wagons or floating site.

[31] ÖBF-Sortimentstabelle (Nadelholz, Laubholz); ÖBF-Forstschleppertabelle (Nadelholz, Laubholz) in Leistungszahlen, Kosten: Herausgeber Kooperationsabkommen Forst Platte Papier.

[32] Data problems prevent any calculation of the actual tax burden. The taxes included for the model calculation seem, however, plausible.

[33] This estimate is based on a survey of Krasnoyarsk enterprises using the model referred to above and assuming that every worker works 2160h (40h x 54 weeks) per year.

[34] Huber *et al*. (1995). This number was confirmed in private conversations with Siberian managers.

[35] The production output of the year 1989 is thought to represent the actual technical capacity installed in the region.

[36] The large differences between the ratio of forested area to growing stock for Canada and Russia stem mainly from different definitions of forested area and different productivity measures.

[37] This list is somewhat incomplete, but can be considered representative. Here it is assumed that the output of 1989 can be used as a proxy for the practical capacity of the wood-working industry.

[38] The Central Siberia Privatisation Centre was extremely helpful in organising meetings that were useful in preparing this report.

[39] Every region in Russia is allowed to certify two equipment manufacturers. Krasnoyarsk has certified Tesla Ericsson and Siemens.

[40] Coal enrichment includes separation of burnable substance from the amorphous mass

[41] The world market prices for internationally traded coal are between 30 and 40 US$ / tce

[42] Coal enrichment normally includes separation of the burnable substance from the amorphous mass

[43] The statistics on capacity allocation and electricity production reflect only the power produced by the big, centralised, installations. The numerous small diesel driven generating units, dispersed around the countryside, have not been accounted for by production statistics.

[44] The wholesale electricity prices in Austria are 0.07 US$/kWh, i.e., 100 times higher

[45] Including the cost of transportation by train

[46] Excluding transportation costs