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CHAPTER 1
THE JOINT RUSSIAN-AMERICAN PROJECT ON PRIVATIZATION OF THE ELECTRIC POWER SECTOR

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Electric Power Sector Restructuring and Privatization

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Prepared for

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CHAPTER I

THE JOINT RUSSIAN-AMERICAN PROJECT ON PRIVATIZATION OF THE ELECTRIC POWER SECTOR

1 1 Background On The Organization Of The Project

Russia is privatizing and restructuring its electric power sector The objective of this program is to increase the industry's economic efficiency by injecting elements of competition and diversity into what had heretofore been a large State monopoly

The privatization and restructuring of the electric power sector is as a joint effort between the United States Agency For International Development (USAID) and the Ministry of Fuel and Energy and RAO EES Rossi, Russia's integrated power system joint stock company

The Joint Russian-American Project On The Privatization Of The Electric Power Sector was organized into five distinct working groups

(1) *Structure and pricing* — in which the development of an appropriate structure and pricing methodology has been designed,

(2) *Legal and regulatory* — in which the design of a regulatory structure to support the recommended industry structure is outlined and the legal system to support the structure is set forth,

(3) *Securities and finance* — in which the financial management requirements for operating enterprises under market reform are defined and critical financial management tools are introduced,

(4) *Investment promotion* — in which the process of identifying viable projects of interest to investors is taught and the process of attracting investors is developed

(5) *Education and training* — in which the training needs of the above groups is supported

Each group was Co-Chaired by a Russian electric power expert and an American expert The names of all of the participants of this project are listed in Appendix A The work in groups was done on the basis of consensus decision-making, recognizing that ultimately decisions about the future direction of Russia's electric power sector must be Russian decisions

1 2 Development Of The Recommended Structure

The working group on structure and pricing began its work by examining various structural models of electric power sectors The merits of various choices were examined and a framework for the future structure of Russia's electric power sector was derived from these discussions

Certain objectives that were set forth in the working group were used to help clarify and select the best structural model for Russia

The design of the future structure of the electric power sector was based on several specific objectives important to Russia

- Power supply reliability must be maintained at a high level as change occurs
- The economic rights of customers must be protected
- Electric power must remain affordable
- The structure that is established must help maximize the ability to attract capital for the electric power sector
- Economic efficiency must be improved as a result of these changes

By comparing options and operating within the predetermined definitions as defined by Presidential Decrees 923 and 924 a structure was selected This structure involved separating generation, transmission and distribution into distinct enterprises These features were prescribed in the Presidential Decrees

The structure developed by the joint Russian-American working group involves

1) Separation of generation, transmission and distribution into separate sets of entities no one of which exercises control over another

2) Horizontal disaggregation of the generation sector into many independent, competing entities with new independent generators, built with private funds at risk, entering the sector and adding to the competition

3) Existing generators will be paid a price for their output that will allow full recovery of their costs plus a modest profit New generators (built with private funds and risk) will be paid a price that reflects marginal costs of the entire generation sector

4) Initially pricing electricity to customers at the wholesale and retail levels will be on the basis of average costs, a process that fully recovers all costs but generates no "surplus profits "

5) Wholesale and retail prices to the industrial sector will be on a "time of day" basis When electricity demand is high, production costs are high and prices therefore also should be high to recognize these costs and to encourage more efficient use of this valuable product

6) RAO EES Rossii will retain full and sole responsibility for the national transmission grid, for regional dispatch and for the dispatch of inter-regional energy flows

7) Economic dispatch procedures will be strengthened and enhanced Dispatch algorithms will be migrated to an intermediate "variable production cost" basis and eventually to an "hourly bid" basis

8) The 72 AO-Energos will buy electric power through the national transmission grid, and distribute and sell it to the retail customer They will also bear primary responsibility for customer-based energy efficiency investments

9) Federal regulatory oversight will be established Although the transitional process has been designed to reduce the need for regulation, it cannot replace the need entirely A Federal regulatory commission will oversee the operation and pricing policies of the national grid to ensure fairness

As this model of market reform was defined it became clear that the steps required to move Russia's electric power sector from its traditional command-based approach to one driven by market forces would require a managed transition The need for transitional structure and transitional programs in all aspects of the electric power sector became an important focus of work

As the second phase of this project begins, and the process of transition is initiated these issues will become priorities for future work Chapter 3 will provide an outline of these issues and Chapter 7 will describe how they must be addressed in the transitional period

1 3 The Importance Of The Electric Power Sector To Russia

One of the distinctive features of the privatization and restructuring process in Russia is how important the electric power sector is to the nation It is perceived as playing an essential role in the development of the Russian economy as well as its redevelopment By continuing to provide affordable and reliable heat and power supply, industry and commerce are able to become more competitive

Russia's electric power sector is considered to be of vital national security interest as well The integrated power system of Russia is considered to be the backbone of national economic integration Without its continuation many believe the stability of the social, political and economic foundations of the nation would be compromised

These kinds of concerns make considerations of privatization and restructuring perhaps more sensitive and vital than elsewhere in the world where similar initiatives are underway The electric power sector has a culturally significant place in Russian society For the roughly 70 years of Communist rule Lenin's words reigned supreme socialism plus electricity equals communism

Although compelling logic would suggest that the kinds of market reforms being recommended by this project could be implemented within a few years certain cultural preconditions must be addressed first For example

(1) Becoming comfortable with the principles and actions of a market economy (achievable through training and through setting up relatively low risk practical experiments)

(2) Addressing certain lingering socio-political concerns among important constituencies of the nation over balancing goals of equity and efficiency This is most often expressed as a concern with regard to matters of the distribution of profits from generating companies

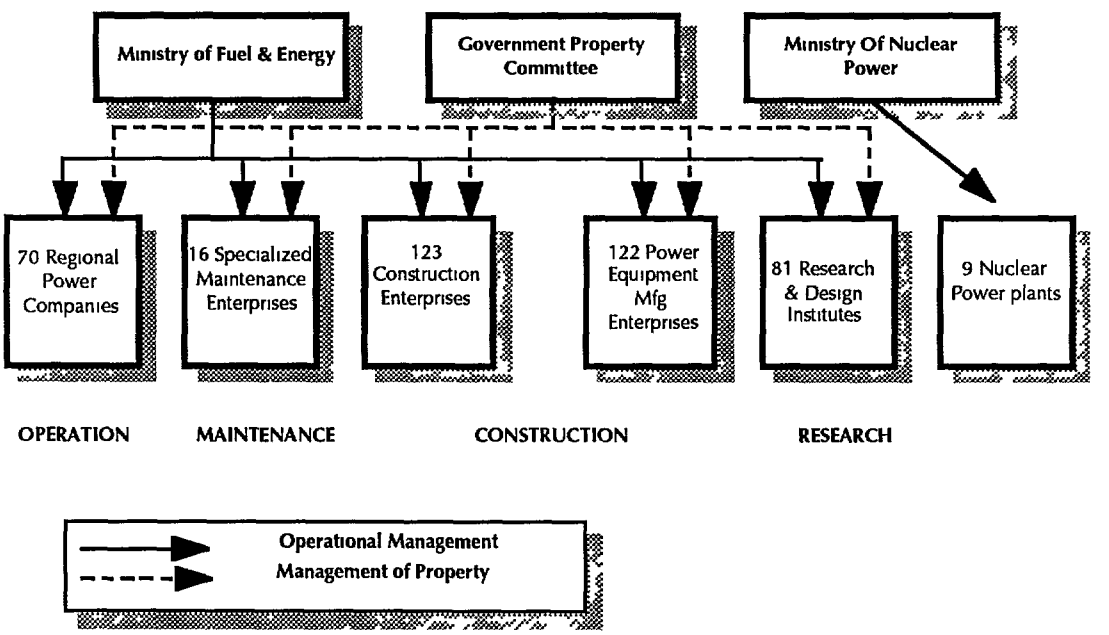
(3) Broadening the understanding of the people concerning the role of the electric power sector in the economy Many feel that reform can move more rapidly once public awareness of the need for it is established The process of building public awareness is only now beginning

1 4 A Brief History Of The Market Reform Process

Before the beginning of market reforms management of the Russian electric power sector occurred through the Ministry of Fuel and Energy, the Government Property Committee and the Ministry of Nuclear Power, as depicted in Chart 1 1 below

Chart 1 1

Management Of The Russian Power Sector Prior To Market Reform



In 1991 the Unified Power System (UPS) of the former Soviet Union was broken apart as several newly independent states emerged, taking with them in their formation the power systems that were once part of the Soviet Union

Following this dis-integration a process of decentralization also began in Russia Local authorities began to claim sovereignty over their power systems These initiatives were

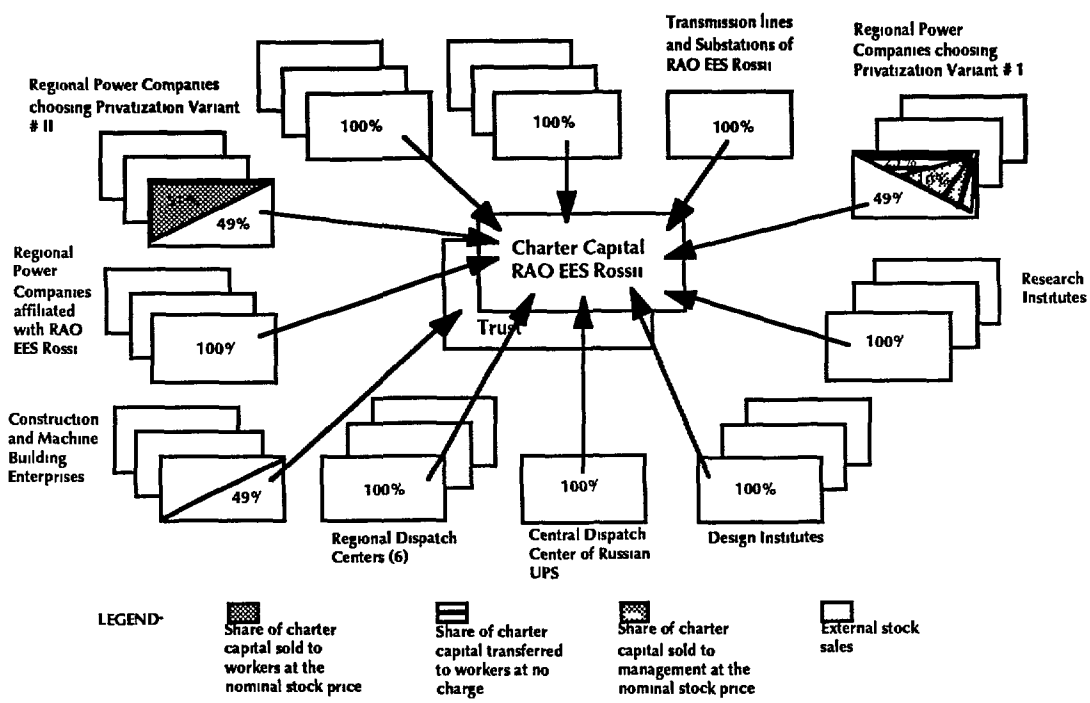
possible due to the traditional linkages between most local power systems and the administrative structures of the country

These developments represented a potentially serious threat to the nation As this decentralization trend developed a concern emerged that a collapse of the electric power system in those regions that did not have enough generating capacity could occur

In 1992 the Ministry of Fuel and Energy took actions to counter these decentralization trends and ensure the integrity of the *national* electric power system The steps involved, among other things, the formation of the joint-stock company, RAO EES Rossii whose broad mission included ensuring that the Unified Power System (UPS) of Russia be maintained Chart 1 2 below depicts the restructuring that occurred

Chart 1 2

The Initial Restructuring Of The Russian Electric Power Sector For Market Reform



The creation of RAO lead to a redefinition of the roles of other institutions involved in the electric power sector Thus, new managerial relations were established through the formation of joint-stock companies

1 5 The Phasing Of Market Reform

The initial market reforms steps have been positive The task now is to step forward from the design of the future electric power sector of Russia and begin its implementation The "transition stage" that has been referred to in this chapter shall have three general phases

(1) **The *Preparatory* Phase** Even as the design for the power sector of the future is being completed the implementation process is in its prepartory phase This phase includes the development of the legislative basis and major normative decrees regulating the operation of the power sector under market conditions

(2) **The *Intermediate* Phase** This phase will provide the opportunity to practically test and if necessary correct and improve in all details the model of the competitive electricity market, the legislative and normative basis being correspondingly perfected During this phase it will be necessary to complete the transformation of property, the state role as the major owner of power utilities being gradually decreased to a minimum Selling out the state packages of shares of power companies will be an important sign of the end of the transitional phase In addition

- The wholesale market will gradually shift from average cost pricing to marginal cost pricing
- Competition will be created for reconstruction of existing and new construction of power projects and facilities involving the use of international bidding systems
- Competition for investing will be created through capital markets
- The functions of state regulation of the power sector on the federal level will be lessened as market forces begin to work

(3) **The *Final Phase* of Mature Market Relations** As the transition is completed the Russian power sector will be characterized by a developed wholesale market with the overwhelming majority of power plants selling to it and major customers buying from it, with long-term contracts between the energy consumers and producers prevailing and a spot market operating on the basis of marginal cost pricing

While the final phase will be marked by a system that is consistent with current world thinking and experience which assures the lowest cost of power, i e , a vertically disintegrated system, the central task of the power sector for the next several years is managing a careful transition to it

1 6 Concluding Points

The design of the electric power sector under market reform has been and will continue to be a very dynamic process There are inherent and permanent tensions that will persist as market reform evolves

Practitioners in the power sector will resist the politicizing of decision-making, but political forces will always be at work Theoreticians and academicians will continue to advance their views contributing both to the problem solving needed by practitioners and to the decision-making needs of political forces Through these ongoing tensions a distinctively Russian system will evolve

While the path may be filled with twists and turns the focus on a final stage involving a competitive structure where diverse generating entities compete will be an important beacon to keep all efforts on track toward achieving stated objectives

The following report summarizes the results of the joint work done by five working groups leading to a comprehensive design for the future market-reformed electric power sector of Russia

- Chapter 2 will provide a more comprehensive profile of the system as it exists
- Chapter 3 will discuss the challenges that necessitate restructuring and that complicate its implementation
- Chapter 4 will outline the recommended structure
- Chapter 5 will discuss the legal and regulatory requirements of the recommended structure
- Chapter 6 will outline an investment strategy for the electric power sector
- Chapter 7 will discuss the transition details required for implementation
- Chapter 8 will summarize the education and training agenda
- Chapter 9 will provide a summary of the report

A comprehensive set of appendices is included in this report giving the details that an overview cannot possibly address The roadmaps for legislation and regulatory reform, wholesale market management, investment strategy, financial management and much more are included in the appendices

CHAPTER 2

PROFILE OF THE ELECTRIC POWER SECTOR OF RUSSIA

2 1 Introduction

The Unified Power System of Russia is the largest unified power system in the world It links hundreds of electricity producers to millions of consumers through a network of transmission and distribution lines over a million kilometers long This chapter provides a profile of the electric power sector of Russia It provides a review of installed capacity and generation patterns, fuel utilization, transmission, and dispatch, and management responsibilities

2 2 Capacity Mix

The power sector of Russia is based on a range of diverse technologies Fossil-fired plants provide the bulk of electricity capacity in Russia A large share of fossil-fired units are cogeneration plants which provide heat to an extensive distribution system Russia has significant hydroelectric resources which have been developed, particularly on the Volga river and along the Angara and Yenesei rivers of Siberia Nuclear power also contributes to the capacity mix

2 2 1 Capacity Mix

Installed capacity for Russia as a whole (including capacity held outside of the power sector) is shown in Table 2 1 It can be seen that 70% of installed capacity is in fossil-fired units, with half of this capacity in cogeneration units producing both heat and

power The remaining capacity is in hydroelectric (20%) and nuclear (10%) units A small share of capacity (approximately 10 MW) is held by industrial and municipal enterprises

Table 2 1

Installed Capacity In Russia
(including capacity outside the power sector)

	1980	1985	1990	1993
Total	165	196	213	212
Hydro	35	42	43	43
Nuclear			20	
Fossil-Fired			150	
Condensing Units				
Cogeneration Units				

Source Rossiiskaya Federatsiia (Moscow Goskomstat Rossii)

Fossil-fired Capacity

As with the case of electric power sectors around the world, the capacity of new fossil-fired units have grown to take advantage of increasing economies of scale Steam

temperature and pressure have increased as well, resulting in improved fuel performance From average steam pressures of 35 atmospheres before World War II to 90 atmospheres after the war, then to 130 atmospheres, and in the 1980s to 240 atmospheres Temperatures have risen correspondingly, and the standard temperature is now 540 C Most of the new units thus operate at supercritical steam conditions

Most of the recent additions to capacity have typically been of 500 MW units (coal-fired) and 800 MW units (gas-oil fired) However, because of the number of older units that remain in operation, units of 300 MW (constructed in the 1960s and 1970s) still comprise the largest number of generating units stations (35% of installed capacity of condensing units), followed by units of 180-210 MW (20% of installed capacity of condensing units)

There are over 400 power plants of total capacity greater than 5 MW in Russia, but capacity is concentrated at large power plants with multiple units At the beginning of 1993, 36 fossil-fired power plants had a total installed capacity of 1 GW or greater (52% of fossil-fired capacity), 13 of these plants had installed capacity of 2 GW or greater (28% of fossil-fired capacity) [1]

A high share (50%) of fossil-fired capacity in Russia is comprised of cogeneration units These plants, together with regional boilers, send waste heat through a centralized distribution system to industrial, residential, and other consumers These cogeneration units send out almost 1000 million gigacalories a year, which provide a significant share of

[1]CDU93 9

final energy consumption The use of cogeneration plants has resulted in a significant reduction in the overall heat rate at power plants

There is very little fossil-fired peaking capacity in Russia just over 1 GW in gas turbines have been installed While combined-cycle gas turbines are expected to play a major role in new capacity additions in the coming years, there are no units of this type operating at present

Nuclear Capacity

The first nuclear power reactor in the world for electricity generation was commissioned in 1954 at the Obinsk nuclear power plant The nuclear power program was developed on the basis of two different reactor types the VVER and the RBMK The RBMK reactor is a graphite-moderated boiling-water reactor, while the VVER reactor is a pressurized water reactor The VVER units were first to be commercially utilized a 220 MW unit was installed at the Novovorenezh station in 1964, while the first RBMK (1000 MW) was commissioned at the Leningrad station (Sosnovy Bor) in 1973

Nuclear capacity expanded rapidly in the 1970s and 1980s Just over 50% of installed nuclear capacity in Russia is in RBMK units Nuclear power plants play a major role in the North West region of Russia, where units at St Petersburg (Sosnovy Bor) and Murmansk (Kola) account for almost 40% of installed capacity in the region In the Center region, there are four nuclear power plants Kursk, Smolensk, Tver (formerly Kalinin), and Novovorenezh Together these plants account for 20% of installed capacity in the region

While significant additions to nuclear capacity had been planned, commissioning of nuclear reactors slowed after the accident at the Chernobyl' nuclear power plant in Ukraine in 1986 Construction of several plants, including nuclear heat (AST) and nuclear heat and power stations (ATETs), were canceled Several new nuclear units have come on line since the Chernobyl' accident, but no new construction has started The most recent nuclear unit to be commissioned was Balakova-4 (VVER), which came on line in 1993 Construction at several other units has continued and are close to completion (Kalinin-3 and Kursk-5), but it is unclear if and when the additional investment required to complete these units will be available

Hydroelectric Capacity

Hydroelectric capacity plays a key role in several regions of Russia, particularly those built along the Volga river in European Russia and the Yenesei and Angara rivers of Siberia In the mid-1950s, development of the tremendous hydro potential in Siberia started with the construction of the Bratsk and Krasnoyarsk hydroelectric plants In the Siberian Power Region, hydroelectric facilities account for 50% of total installed capacity There are a number of extremely large hydroelectric power plants in Siberia, such as the Sayan Sushenskaya (6 4 GW), Krasnodar (6 0 GW), and Bratsk (4 5 GW) In the Volga Region, hydroelectric plants account for 25% of installed electric capacity The largest plant on the Volga river system is the 2 GW facility at Samara (formerly Kuibyshev), there are a series of smaller plants up and down the Volga

2 2 2 Electricity Generation Mix

Electricity generation increased an average of 3 6% per year in the first half of the 1980s, in the second half of the 1980s, increases in electricity production slowed to an annual average of 2 4% per year Generation declined for the first time in the post-war period in 1991, this trend continues today In 1993, electricity generation was 12% below 1990 levels As can be seen in Table 2 2, all of this decline in electricity generation has occurred at fossil-fired plants, where 1993 generation was 17% lower than 1990 generation

Table 2 2

Electricity Generation in Russia

	1980	1985	1990	1991	1992	1993
Total	805	962	1082	1068	1009	957
Hydro	129	160	167	168	173	175
Nuclear	54	99	118	120	120	119
Fossil-Fired	622	703	797	780	716	662

Source *Rossiiskaya Federatsiia v 1992 Godu* (Moscow Goskomstat, 1993), 392 1993 data from *Al'bom Toplivo i energetika Rossii i ee regionov* (Moscow Inkotek, 1994), 54

With the addition of nuclear and hydroelectric power plants during the 1980s, the relative role of fossil-fired units fell from 77% of generation in 1980 to 74% in 1990 In 1993,

with the decline in generation from fossil-fired facilities, their share in generation reached 70% In recent years, nuclear power plants have provided 12% of total generation

There are seasonal trends in generation in Russia owing to climate conditions and seasonal demand requirements Because of seasonal fluctuations in heat demand, cogeneration units typically run under cogeneration regime for 60 to 70% of yearly generation, the remainder of the time they generation electricity under a condensing regime

Hydroelectric plants are faced with reservoir constraints seasonally While hydroelectric plants account for 20% of installed capacity, they provide a smaller share of generation because of seasonal water constraints and the limits to transmission from the Siberian energy system Also, they are used primarily for load following rather than baseload generation In 1990, hydroelectric plants provided 15% of electricity generated in Russia, with the recent decline in generation from fossil-fired units, the relative importance of hydroelectric generation has increased to 18%

2 3 Fuel Utilization

The average heat rate of power plants in Russia fell from __ gst/kWh in 1980 to 306 gst/kWh in 1993 [2] This is a very high efficiency (40%) for electricity generation This is due primarily to the use of cogeneration units which "charge" a certain amount of fuel use to heat generation, rather than electricity generation Another factor is the wide use of natural gas in the power sector

[2]Net of inplant electricity use The standard fuel used by Russians give heat rates defined in terms of "lower heating value," while US methods use "higher heating value" for fuel Adjustment of the Russian rate for 1993 to the American standard would raise it to 326 instead of 306

Power plants are the largest consumers of fuel in the Russian economy Hence, the fuel balance at power plants has closely mirrored the overall trends in fuel production in the country While only 20 years ago, coal played a major role in fuel use at power plants, its role has diminished in recent years as Russia's large gas reserves have been exploited Many of Russia's fossil-fired power plants are designed to burn either natural gas or residual fuel oil During the 1980s, a gas-for-oil substitution program was implemented Many power plants that had used residual fuel oil switched to gas use, as did several coal-fired power plants and several plants that had been using locally-produced peat

While the absolute volume of residual fuel oil use has fallen, it still plays an important role as a backup fuel during the winter when gas demand peaks Because of a lack of gas storage facilities, many power plants using natural gas have had to switch back to residual fuel oil during winter months as there not enough gas was available to meet the needs of both power plants and municipal boilers for heat production The drop in industrial gas consumption in recent years has meant that more gas is available for power plants, and the amount of time residual fuel oil must be used has fallen

Plants in the electric power sector (not including units held by industrial or municipal organizations) consumed 300 million tons coal equivalent in 1993 Natural gas plays a significant role in the fuel balance at power plants, providing 65% of fuel requirements, followed by coal (25%) and residual fuel oil (10%)

2 4 Dispatch, Transmission & Distribution

The coordination of production and consumption occurs in dispatch, transmission and distribution

2 4 1 Dispatch

The hierarchy of the dispatch management system of the Unified Power System of the USSR was comprised of three principal office the Central Dispatch Office, Unified Dispatch Offices, and Unified Dispatch Services Below in the chain of command were power plant management offices and local distribution offices

The Central Dispatch Office of the Unified Power System of the USSR was established in the early 1970s in Moscow It controlled the parallel operation of the unified power systems and was responsible for controlling the conditions of the Unified Power System, and to provide a reliable and economical electricity supply Central Dispatch Office dispatchers controlled the operational capacity of the unified power systems, their reserve capacity, electrical couplings between the unified power systems, as well as the most important couplings within the unified power systems They controlled the operation of generating units that played an important role in the UPS regime The dispatch offices (Central Dispatch Office, Unified Dispatch Offices, and Unified Dispatch Services) played important roles in both long and short-term planning of the power system, including making projections of energy consumption patterns and daily load diagrams, management of fuel resources, and scheduling of repairs and maintenance

The Unified Dispatch Offices were based in each of the unified power systems (9 for the USSR as a whole), while the Unified Dispatch Services operated at the local energy system level Dispatchers from these offices were also charged with responsibility to maintain a given frequency within their system

Even though the unified system, with the ability to shift power between regions was supposed to be able to manage peak loads, the lack of sufficient peaking capacity meant that there were times when load had to be shed In the case of a temporary energy or capacity shortage in the United Power System of the USSR, the need for load shedding was determined by the Central Dispatch Office, in conjunction with Minenergo (the Ministry of Power and Electrification) During the mid-1980s, there were significant problems with maintaining frequency in 1985, the Unified System operated at frequencies between 49 8 hz and 50 2 hz for only 33% of the year, while the frequency was below 49 5 hz for almost 40% of the year The situation has improved dramatically, and in 1993, the frequency along the Unified Power System was between 49 8 and 50 2 hz for 97% of the year

The dispatch of fossil-fired generating units were made on the basis of the amount of fuel used to generate electricity (udelnie raskhodi topliva) Nuclear capacity was operated as baseload Hydroelectric plants were typically operated at baseload only to provide for the minimum run-of-river requirements, the rest of the time they operated as peaking capacity

Since the breakup of the Soviet Union, the power systems management has undergone several changes There have been some problems with parallel operation of Russia's and Ukraine's power systems because of Ukraine's inability to maintain the requisite frequency because of fuel shortages The former dispatch center for the North West unified system had been located in Riga (Latvia), it is now being created at St Petersburg Additional challenges facing the dispatch organizations are the required coordination of local energy systems dependent on transfer of power through other countries (the North Caucasus unified system, Kaliningrad and Pskov oblast), and the calculation of revenues

of inter-regional electricity transfers In the future, dispatch functions will increase further as the dispatch of units must shift to minimize the cost of fuel used The reliable management of the Unified Power System faces the additional challenge of equipment constraints It has been said that the hardware and software of the main computer system is outdated and unable to perform complex management tasks

2 4 2 Transmission & Distribution

The Unified Power System (not including Far East, which is only weakly linked to the Unified System) spans 9,000 km (west to east) and 6 time zones It is comprised of 6 big regional power systems North West, Center, Middle Volga, North Caucasus, Urals, and Siberia Before the breakup of the USSR, interconnected regions included the power systems of Kazakhstan, Ukraine, Transcaucasus, Central Asia, and the Baltic States (which were included as part of the North West system) In Russia, 65 local electricity administrations work in parallel in the Unified System, the remaining 7 local electricity administrations are in remote regions (such as Kamchatka, Magadan, and Sakhalin) and are not connected by transmission lines to the Unified Power System

The Russian transmission system is comprised of 432,000 km of high voltage lines (110 kV and above) and 950 transformer stations with a total capacity of 535 MVA The bulk of transmission lines (65% of the total length) is in 110-kV lines, followed by 220-kV (22%), 550-kV (8%), with the remaining length in lines of 330-kV, 750-kV, and 1150-kV (one line of 500 km inside of Russia) Interties between the Regional Power Systems are generally of at least 500-kV lines, although there are several interties that still use 330-kV lines for all or part of the inter-regional transmission

2 4 3 Inter-Regional Ties

As noted above, the Unified electricity system was developed during the Soviet period, and the breakup of the USSR has some direct implications for the transmission system of Russia Several regions of Russia are interconnected only through the power pools of other regions the North Caucasus regional power pool is linked to the Center power pool through an intertie with the power pool of Ukraine, and, Kaliningrad and the Pskov oblast are no longer directly linked to the North West regional power pool and must transfer power through the Baltic states

The regional power systems operate largely to supply power to their own consumers Although inter-regional transmissions typically represent only a small share of generation, it has been important in managing peak demand, and as such has allowed for a system reserve margin of just 13% Inter-regional transmission has also been important for providing power to capacity-deficit regions, such as the North Caucasus

Russia can export limited amounts of power to countries outside of the former Unified System of the Soviet Union Finland has been receiving approximately 5 bkWh a year, primarily through a 500-kV link Norway has a small AC link that is connected with the Murmansk local energy system (8 mkWh per year), and there is a small, isolated ink between the Siberia and Mongolia (84 mkWh per year)

2 5 Electricity Consumption Patterns

A comparison of electricity consumption per capita for Russia and several OECD countries show that final electricity consumption in Russia in 1990 (5,360 kWh per

capita) lagged significantly behind Canada and the United States, but was very similar in magnitude to the figures of Japan (6,140), the FRG (6,020), and France (5,350) Perhaps most striking in this comparison is the role the industrial sector plays in consumption patterns In most OECD countries, the residential/commercial sphere plays a more important role in consumption patterns than the industrial sector This is not the case with Russia, where the industrial sector plays a very significant role in electricity consumption, electricity consumption by the industrial sector of Russia (per capita) in 1990 was close to U S levels

Final electricity consumption patterns are shown in Table 2 3 The sectors showing the largest drops in electricity consumption during this period were industry (including construction activities) and transport (which in Russia is based heavily on electrified rail) Even with this recent decline in electricity consumption, the industrial sector still plays a major role in electricity consumption patterns The industrial sector (including construction activities) accounted for 56% of final electricity consumption in Russia in 1993, compared to 63% in 1990, and 67% in 1980

It is difficult to analyze the dynamics of sectoral electricity consumption in recent years because of inconsistencies among data sources, and the unclear role the defense sector plays within different data collection agencies Within industry, it can be said that the largest electricity-consuming branches has been nonferrous metals (which accounted for approximately 20% of industrial electricity consumption in the early 1990s), followed by manufacturing and ferrous metals This dominance of heavy industry in consumption figures, coupled with the lack of management of electricity use within industry and the lack of economic mechanisms (prices and bills) to change consumption patterns, has led to high electricity intensities

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On the other hand, there are sectors of the economy that can be said to be "underelectrified " In the past, the commercial and residential sectors have played very minor roles in final electricity consumption With the increase of commercial sector activities, electricity consumption in this sector should grow with the addition of stores and other service-sector activities In the residential sector, the expansion of electricity use will be closely linked with new home construction (to overcome the severe housing shortage) and the subsequential increase in the stock of appliances There is some potential for increased electricity use in existing home stock Although most Russian homes have refrigerators, there are few automatic washing machines or advanced consumer electronics

Table 2 3

Electricity Balance, Russia
(billion kilo-Watt hours)

	1980	1985	1990	1991	1992	1993
Generation	805	962	1082	1068	1009	957
Imports (+)	33	32	35	35	28	26
Exports (-)	22	30	43	47	44	43
Line losses (-)	64	81	84	84	84	80
In-Plant Use (-)	53	61	70	70	66	67

Final Consumption	699	822	920	902	843	793
Industry & Construction	467	536	575	552	505	445
Agriculture	56	74	96	103	103	104
Transport	77	91	104	97	87	76
Other Branches	99	122	145	150	148	149

2 5 Organizational Structure (Functions & Responsibilities)

There has been a tremendous shift if the organizational structure of the power sector in recent years The power sector has been in transition from a highly-centralized structure towards a more decentralized structure, with weaker government control

2 5 1 Past Structure

The State Planning Committee (Gosplan) coordinated the national planning efforts in all fields Within Gosplan, there were departments responsible for various aspects of the fuel and energy complex, including a department for power and electrification This departments made long and short-range plans for the industries under their jurisdiction, and tried to ensure that their plans were coordinated and that there were sufficient resources available to fulfill these plans

The Council of Ministers exercised operational control over the entire energy system, including the ministries, state committees, and their production facilities Much of the long-term planning was developed in the Council of Ministers and the Central Committee of the Communist Party, which in 1983, adopted a long-range energy program that provided the groundwork for energy policy through the year 2000

The Ministry of Power and Electrification (Minenergo) and the Ministry of Nuclear Power (Minatomenergo) were responsible for the design, construction, operation, and maintenance of power plants in the Former USSR Together, Minatomenergo and Minenergo supplied just over 90% of the electricity generation in the Soviet Union The remaining electricity generation came from power plants held by enterprises outside the central electricity ministries (primarily at large factories) Minenergo also operated the Unified Power Grid, which connected the Soviet Union's 11 regional power networks six in Russia and five covering one or more of the former republics These regional power networks were comprised of local electricity systems, which largely followed the borders of economic regions (Oblast, Krai, Autonomous Republic, etc) In Russia, there were 72 local electricity systems

The Ministry of Power and Electrification also coordinated equipment needs with two specialized support ministries the Ministry of Power Machine Building provided heavy equipment for all types of power plants, and the Ministry of the Electric Equipment Industry was responsible for the production of electric generators, transformers, and high voltage transmission apparatus

2 5 1 Present Structure

During the second half of 1992, privatization activities in the Russian power sector accelerated Under Decree Numbers 922 and 923, the Russian State Property Committee was instructed to create a new Russian joint stock company "RAO-EES" as a holding organization for certain power sector enterprises The assets of the Unified Power System were spilt between various administrative units RAO-EES maintained ownership of transmission lines larger than 330 kV, thermal plants over 1000 MW, and hydroelectric power plants greater than 300 MW Each of these stations had previously been managed by one of the local electricity administrations These plants total approximately 50 GW (25% of installed capacity) RAO-EES holds 46 fossil-fired plants, and 37 hydroelectric plants These plants represent just over 40% of fossil-fired capacity, and 60% of hydroelectric capacity, but not all of the plants that would qualify (owing to size) for RAO ownership have been transferred In 1993, plants held directly by RAO-EES generated 155 bkWh, which represented 16% of country-wide generation [3] Presently, all of the length of the 1150-kV and 750-kV lines, 80% of the 500-kV lines, and 70% of the 330-kV lines are held by RAO

The Central Dispatch Office in Moscow and the six regional dispatch offices, as well as some of the research and design institutes, are also wholly owned by RAO-EES Other enterprises including various non-core businesses, such as construction enterprises, other research and development institutes and manufacturing enterprises are partially held by RAO-EES The remaining capacity are owned by joint stock companies (72) that were formed from the former local electricity administrations (now referred to as "AO

[3]CDU93 28

Energos") All commercial nuclear power plants remain under the control of the Ministry of Atomic Energy (Minatomenergo)

Other important changes that have occurred recently involve the regulation of the electricity sector The Council of Ministers established independent regulatory bodies to handle wholesale and retail ratemaking These include a Federal Energy Commission located in Moscow and a Regional Energy Commission located in each of the 72 separate energy regions, plus specific RECs for the cities of Moscow and St Petersburg The Federal Energy Commission was established in 1992 pursuant to the Act of the Council of Ministers No 493 of March 14, 1992 The Commission currently comprises twenty members, including representatives from the government and the private electric power sector Members are appointed by the Russian Prime Minister and serve unlimited terms Currently, the Federal Energy Commission has two official functions regulating wholesale electric power rates and acting as final arbitrator at the regional level In principle, the RECs are rate making organizations whose members include representatives of local governments, power supplying organizations, and retail consumers Pursuant to the Act of the Council of Ministers No 737 of July 1993, the RECs approve three categories of retail sales sales by AO Energos to customers and resellers, sales by resellers to customers, and, sales from industrial retail sellers to AO Energos or to other customers

2 6 Future Issues

The Russian power sector faces many challenges in the years to come Many of these challenges will require changes from past planning practices The criteria for making decisions on new capacity, rehabilitation of older units, fuel choice, dispatch (hence

generation), and inter-regional transfers of power will be based on a new set of market-oriented principals, and the increasing role that conservation can play This is set against a backdrop of changes in how the output of the electric power sector (electricity and heat) is used As electricity use in the commercial and residential sector is likely to rise, at the same time that industrial baseload is falling, the power sector will have to meet a different load shape This will require more flexible capacity, and greater levels of coordination on dispatch and transmission The opportunity for low-cost efficiency measures to reduce heat losses in the distribution system and increase heat loss in building could affect the utilization (and efficiency) of cogeneration units

CHAPTER 3

CHALLENGES FACING THE ELECTRIC POWER SYSTEM OF RUSSIA

3 1 Introduction

Russia has gone through unprecedented changes in the last few years It has moved from socialism toward market reforms that will bring the nation into the fold of free market economies This process has involved the privatization of state enterprises across all sectors of the economy

The electric power sector is in the process of privatization along with the rest of the economy But privatization per se does not necessitate a restructuring of the power sector in any particular direction There are many models that could be applied — from a state corporation that functions as an integrated monopoly serving the whole nation to a basket of independently operating companies providing generation services, transmission services, and distribution services, respectively

On the one hand the restructuring design process of this joint project began with an examination of various structural options On the other hand, the same design process was informed by an understanding of the critical challenges or problems that the electric power sector faces

Russia's electric power sector faces many challenges that must be addressed through the restructuring process or restructuring will be an unsuccessful effort These include

a) working within the constraints of political realities within Russia,

b) recognizing the impact that the state of the Russian economy is having on the power sector,

c) addressing problems in the organization of the fuel supply and heat systems,

d) adapting institutional realities to the characteristics of the Russian legal system, and

e) understanding the constraints and opportunities in the operations of the electric power system itself

This chapter will summarize some of the most important of these challenges which must be dealt with in order to achieve an efficient and competitive electric power system Specifically, political, economic, fuel and heat, legal, and operating challenges will be considered below The chapter will conclude by discussing how these challenges will have to be resolved

3 2 Political Challenges

The electric power sector is being privatized and restructured in a complex political environment involving many forces that push and pull the process in several possible directions The political strains involve several viewpoints from a return to the socialist past to a very rapid movement to a market-based future No single position appears to have sufficient strength to impose its will on the others Therefore, political compromise is the ruler of the day

What this means for electric power sector reform is that an ideal competitive system will be adapted to accomodate the relative influence of various interests In turn, the restructuring of the Russian electric power system must be understood as a dynamic, "dialectical process" which is driven by a clear vision about the desired outcome a competitive electric power system

These political strains are manifested through the types of power sector issues that are the focus of policy decision-making They are also evident from the processes and procedures that Russia is using to affect privatization and restructuring

The key policy issues that are being considered include

- Whether to enact a single comprehensive law defining the electric power system or several small and specific laws that add up to something comprehensive,
- How to deal with the problem of allocating surplus profits on existing plant (note that this is discussed thoroughly in Chapter 4),
- Whether the focus of market-reform should be done at the national level, where a single wholesale electric power market is established to serve the entire nation, or at the regional level where more decentralized management of the power system is realized

3 2 1 The Legislative Challenge

A reasonable argument can be made that it would be appropriate to enact comprehensive and sweeping legislation that mandates an immediate transition to a highly competitive

industry structure for the electric power system By this argument, little stands to be gained by delay and many opportunities stand to be lost

The creation of such a sweeping change, however, must involve the Duma — Presidential decrees will not suffice The legislative strength and stability necessary to enact rapid restructuring requires the firm, long-term control of the Duma by pro-economic-reform forces This control has not occurred Furthermore, the will and the degree of unanimity necessary to support sweeping change for an entire economic sector does not seem to exist in Russia today nor anytime in the near future

3 2 2 The Challenge Of Allocating Surplus Profits

A major cause of political instability is the issue of wealth distribution both existing wealth and new wealth created by the healthy operation of competition in a market economy This issue generates debate, even in countries with long-established market economies In Russia may threaten political fragmentation

The electric power system is a vital part of the national economy Many Russians feel that resolution of the wealth-distribution issue for the electric power system will produce a powerful precedent for other industries and therefore a precedent for the political structure of the nation itself They argue that if some regions are able to capture the electric power system's wealth for themselves and their inhabitants, then the forces of disunity will prevail and the "commonwealth" of the nation as a whole will suffer This is a difficult issue to resolve because there are several different, potentially-valid, interpretations of what an "equitable distribution" of this wealth involves

3 2 3 National Vs Regional Market Reform

The process of reform has brought with it a strong new interest in regional decision-making involving relative autonomy and minimal influence from the center What is contradictory about this desire is that from an operating perspective national integration of the electric power system ensures certain benefits that cannot be realized through regionalization, e g , greater efficiencies in the use of electric power capacity through improved operations of the transmission system

Decisions about which is emphasized — nation vs region — will have significant impacts on the restructuring of the electric power sector The timing, the scale and the scope of change is fundamentally different if restructuring is done at the national level compared to regional level efforts

3 3 Economic Challenges

The notion that electric power systems should be governed by competition is relatively new Many initiatives are underway throughout the world to implement this new approach While each nation faces its own distinctive problems, the general principles of a competitive electric power system are applicable in all cases

Russia's application of these general principles is even more challenging because of the distinctive economic circumstances in which the effort is taking place To illustrate by comparison, the United States has only recently begun to experiment with competition in the electric power industry after about 100 years of being heavily regulated

By contrast Russia, which is still taking its first steps into the arena of market-based systems, must deal with economic instability and a set of inherited dislocations that make the implementation of reforms especially challenging — most likely leading to the requirement of more time to affect changes and greater caution in the process of reform than might be assumed as justified if experience from other nations were to be assumed as perfectly applicable

3 3 1 Instability

The Russian economy is in a state of depression and faces the threat of hyper-inflation This complicates the electric power system's process of transition to a competitive structure Hundreds of major state-owned heavy-industry and manufacturing entities have lost their traditional markets and seem unable to find sufficiently large roles in the new competitive markets to survive intact The electric power system's traditional customer base is therefore wobbling on the brink of collapse and is either unable or unwilling to pay its electricity bills The new manufacturing and commercial entities that are growing to replace the old ones generally produce less energy-intensive products

The economy also suffers from a level of public and private corruption that is inconsistent with Western experience, a major cause of which is the desire to avoid the uncertainty of highly-volatile tax laws and unstable monetary policies (and the consequent unpredictable inflation), and the need for businesses to survive in the face of rapid changes in public policy This situation discourages long-term fixed investments (particularly investments by foreign investors) and encourages a short-term "trading" approach to business The electric power system is one of the most long-term, capital-

intensive industries in the economy It suffers disproportionally from this economic situation

3.3.2 Inherited Dislocations

The electric power system must learn to survive and prosper in the environment in which it lives This environment abounds with dislocations and contradictions The greatest dislocations involve the mismatch between the existing base of capital equipment which produces goods that no one wants to buy (e g , armaments), and the desperate need for new capital equipment to produce goods that people actually do want to buy (e g , consumer goods) This mismatch of capital equipment is mirrored by a mismatch in operating and management skills Many have the skills necessary to operate on the old, command-based economic foundation, but few understand, much less possess, the skills necessary to build businesses on the new, competition-based economic foundation

These mismatches produce a justifiable hesitancy by Russian electric power sector executive management There is a valid view that few within the electric power sector fully comprehend the requirements of restructuring This acts as a constraint on the ability to take action The risk is perceived as extreme when what is being "left to market forces" is something believed to be a form of national life blood and the management talent to make it happen is limited in number An emphasis on more training more quickly is something that has been of rising interest over the course of the design work in Phase 1 of the joint project to privatize the electric power sector

These mismatches also produce contradictions between the plans for a competitive economic future and the means necessary to accomplish these plans This report

discusses steps to acquire these means (automated dispatch equipment, accounting and financial reporting systems, management and operator training programs, capital investment analysis, etc) for the electric power system But the system's customers will also need to take similar steps Otherwise, the electric power system may outrun the rest of the economy and therefore run the risk of becoming isolated from its customers For competition to succeed, a vigorous dialogue between suppliers and customers must be created and maintained

3 4 Fuel Supply And Heat Challenges

Economic theory and common sense indicate that the benefits of a competitive structure in the electric power system depend in part on whether related sectors of the economy are also based on a competitive structure The electric power system depends greatly on the fuel and heat sectors Neither is competitive or even effectively regulated

As yet, no fossil fuel for power generation is sold at prices that are determined by free markets Oil and gas are dominated by vertically-integrated (and expanding) monopolies GAZPROM, in particular, not only supplies an essential power production fuel but also directly competes with electric power Furthermore, it may undertake electric power generation ventures of its own

The market power of GAZPROM should be a significant consideration in restructuring the electric power system Excessive fragmentation of the electric power system would hand many competitive advantages to an integrated monopoly gas system If gas prices for power generation can be controlled by command, then the gas industry has (by setting gas prices at different levels for different electricity customers) the opportunity to place

the power system in a vice, squeezing its costs of generation up on the one hand, and squeezing its revenue potential down on the other

Coal presents a different (but equally challenging) set of problems The price of coal (and the price of coal transport) is as much a political as an economic issue Power generation is the only customer for many coals and the only source of livelihood for the miners The electric power system is therefore obliged to buy these coals at a price determined by the need to keep the miners employed Since many of these coals are of poor quality, and since productivity at many mines is also low, the coal price that the electric power system must pay may exceed the market price (real or estimated) in order to provide miners with a living wage The United Kingdom, under much more stable political conditions, has wrestled with this political problem for decades

Fuel is an important electric power input, heat is an important output Russia's current dependence on district heating, produced by combined-heat-and-power plants and sold at command-based prices, has the ability to hold hostage the success of the electric sector restructuring program Artificially-low heat prices act as a hidden and arbitrarily-determined "tax" on the electric power system, siphoning-off revenues to subsidize the inefficient use of thermal energy by the system's customers The larger this "tax", the fewer financial resources available to build a more efficient electric power system A possible resolution of the heat-pricing problem will be discussed in Chapter 4 Resolution of the fuels problem will be more difficult

3 5 Legal System Challenges

3 5 1 Inadequate Commercial Laws

Unlike nations whose market-based economies are well established and run relatively smoothly, Russia has no commercial law tradition and no reliable civil judicial mechanism for the enforcement of commercial contracts Russia also has no administrative law tradition, no history of impartial regulatory bodies, and little trust of administrative bureaucracy Instead, there is a widespread, and perhaps justifiable, fear of governmental power being exercised arbitrarily, or in a manner that leads to more corruption

These gaps in Russian legal experience and practice combine to create a policy dilemma On the one hand, the commercial law foundation for a competitive market (and particularly for market-based investments) does not yet exist On the other hand, even if such a legal foundation were put in place, there will be great resistance to the establishment of western-style regulatory bodies to administer the laws because of a fear of corruption

There may be no tidy or particularly satisfying solution to this policy dilemma Realistically, competition sufficient to allow Russia to forgo regulation will take time to affect Significant market power will unavoidably be retained by some entities each of the stages of the industry value chain (generation, transmission and distribution), at least initially

In the real world, where "the best" can be an enemy of "the good", the challenge is to do two things (albeit incompletely) at once

a) Enhance competition by creating more initial competitors, and building forces into the system that will tend to create even more competition in the future The recommended structure for both the transitional and final stages of the restructuring process do just that

b) Improve regulation by legally formalizing the responsibilities of existing regulatory bodies, expanding those responsibilities, and seeking other methods to raise the standards of independence, impartiality, and professionalism of the members of the regulatory bodies This too is a central component of the recommended structure for both the transitional and final stages of the restructuring process

3 6 Electric Power System Internal Challenges

Until recently, the electric power system was a horizontally- and vertically-integrated state monopoly, operated under a command system of central planning This old structure has undergone, and will continue to undergo, enormous and rapid changes But the system's current financial, management, economic, and structural problems will require even larger and more rapid changes In tackling these problems, Russia should deal first and most decisively with those that it considers to be the most critical

Problems that are external to the electric power system (those that affect other sectors of the economy, or perhaps the society as a whole) will not be resolved by a restructuring of just the electric power system, even though such a restructuring may well offer a useful template for other sectors It is worth noting, however, that many of the system's most

important problems are not external, they are quite specific to the electric power system itself These problems may not have yet received all the attention that they deserve

3.6.1 Financial Challenges

Customers are not paying their bills and the electric power system is suffering a serious shortage of funds As a consequence, existing plant and equipment is deteriorating and new generation and transmission assets cannot be installed While this problem plagues many, if not most, businesses in Russia, its resolution almost certainly will involve actions taken principally by the system itself, rather than by the nation as a whole The State budget appears unable to supply the needed resources to solve this problem for everyone Foreign investors will not provide a substantial source of funds for the electric power system until kinds of financial accounts with which they are familiar have been installed

3 6 2 Operations and Management Challenges

The potential benefits of competition (as opposed to command-based administration) in the electric power system are undeniably large and attractive Generation of these benefits, however, depends on the ability to use some practical tools and management systems These are so common and familiar in the West that there is a tendency to take them for granted If these tools and management systems (such as standardized cost and financial accounting systems that are openly visible to all, computer-based communications and control systems, access to efficient markets for fuels and investment funds, and so forth) and the trained personnel to use them are not generally available, then competition is unlikely to produce the full economic benefits that are possible Thus the

focus in the immediate future must include the development and installation of these tools and management systems as well as the creation of the structure itself These challenges and their solution fall into ten broad categories

1 Accounting

A uniform system of cost and financial accounts must be installed in and used by every entity in the electric power system This step should be one of the very first that the electric power system takes Government should require by law the use of a Uniform System of Accounts, and regulators should audit these accounts at least yearly

2 Economic Dispatch

New automated data communications and control systems that are unbiased and "transparent" (the operation can be seen and understood by all entities in the system) must be acquired and installed Manual dispatch cannot satisfy these criteria The electric power system's chosen methodology for dispatch should be published for all entities to see and confirmed as appropriate by law

3 Capital Investment

The economic signals and incentives that the market provides, not the traditional command-based approach, must form the basis for capital investment decisions Transmission and end-use energy efficiency should receive particular emphasis since investments here may well be the most effective way to increase the economic efficiency and reliability of the electric power system Furthermore, these investment alternatives have not received sufficient attention in the past No additional law seems to be required

4 Tariffs

Tariffs should be based on production costs This basis should progress from an average-cost to a marginal-cost structure in order to provide appropriate economic

signals and incentives for customers Regulators must be responsible for insuring that the cost-base used by each entity is fair, accurate, and transparent to all entities in the electric power system

5 Competitive Strategy

As Russia progresses towards a market-based economy, customers will increasingly have a variety of choices for satisfying their energy supply needs Electricity will be only one of these The electric power system should begin to adapt its product offerings to this new environment of customer choice

6 Marketing

Marketing programs that identify specific customer needs and create products and services to satisfy them are an important element of competitive strategy As the Russian economy advances, these "demand-based" programs will supplant the traditional "supply-based" approach of the old command system of economics

7 Investment Promotion

Investment promotion programs, like marketing programs tailored for its energy customers, attempt to tailor the electric power system's investment offerings to the specific needs of its capital "customers" Competition in the capital markets gives choices to these "customers", and electric power system securities (stocks, bonds, loans, etc) are only one of their many alternatives Government should ensure that its laws encourage foreign investment and that volatility in its tax and monetary policies doesn't frighten them away

8 Corporate Governance

An entity that competes in the marketplace for customers must focus and direct its organization according to these individual customers' needs The measures of success of this approach to corporate governance are quite different from those of the old economic foundation, which simply measured "quantity" of production, regardless of its salability The management and corporate board of each entity

must understand and foster this focus on customers, not the old focus on Government measures of total production

9 Licensing / Permitting

Licenses and permits entitle entities in the electric power system to compete in the marketplace, subject to the rules of the market These rules should be few in number, require honest and open commercial transactions, and be strictly enforced Government should ensure that these licenses and permits have a firm legal foundation on which to stand

10 Contracting

Entities in the electric power system should be able to contract for products and services from a variety of competing suppliers No entity should be obliged to be the captive customer of a single supplier (engineering, repair, maintenance supplier, power generator, etc) Note, however, the important and difficult problem of fuel supply that is discussed above Government should ensure that these contracts have a firm foundation of commercial law on which to stand

In all of the above matters, the role of the national government is to support the industry's transformation, and to match the industry's progress, stride for stride, by resolving those issues that only government can

3 7 Resolution Of These Challenges

It is not reasonable to ask electric power system managers to answer political questions Equally, it is unwise to excuse political leaders from doing so The matters listed here are those that political leaders must resolve It is also not possible to implement any ultimate structure for the Russian electric power system until these political decisions have been made It is, however, possible to design the structure and to begin (and to continue)

making progress towards it so long as a reasonable sequence of political decisions is established

3 7 1 Government, Legal, and Policy Responses

Those challenges to the electric power system that require government response for their resolution include the following

a) How will the benefits and costs of the existing system be allocated among the people of the different regions in the Russian Federation?

b) How will conflict between national and regional interests be resolved in matters of efficiency, autonomy, and equity?

c) How should issues of national security and international competitiveness affect the structure and pricing policies of the electric power system?

d) What are the appropriate roles for the national and regional governments in matters of ownership and regulation of entities in the electric power system?

e) What constraints and costs should be placed on the electric power system in matters of public health and of environmental preservation and clean-up?

f) How should customers' rights be best preserved?

g) What should be done about corrupt economic practices and how should responsibility be allocated for implementing appropriate remedies?

h) How will members of the regulatory bodies be selected, and what powers will they have?

In these areas, the Government's role is to enact new laws The electric power system's role is to recommend the substance of such laws, and to adhere to them when they are enacted In other areas, the Government must also enact laws that support changes that the system itself must make Examples include

a) What changes should be made to the process of dispatching power generation plants and to the method of financial settlements among all the entities in the electric power system?

b) How should wholesale and retail tariffs be structured and what should be the basis for geographical variations in these tariff levels?

3 7 2 Electric Power System Management Responses

Finally, the necessary changes internal to the industry itself can be made without the Government's action The major responses in this area will be discussed in Chapter 7 below The most immediate and severe problem of the electric power system - that of non-payment by its customers - is discussed in Appendix ___

3 8 Conclusion

The Russian electric power system in its final state will be based on a competitive structure that is even more economically-efficient than that in the United Kingdom (Chapter 4 contains the details) This structure will help to ensure that the nation is

provided with reliable and affordable power In order to implement this structure, a number of challenges need to be met challenges internal to the power system itself, and challenges related to the interface of the electric power system with the Russian economy and society

In order to meet these challenges, Government (hopefully with the assistance of the electric power system) must develop an electric power policy for the Nation based on competition, and create a set of laws to implement this policy The electric power system, however, is not yet prepared to cope fully with such laws In order to do so, the system must invest resources to foster change in management systems and equipment, and in extensive personnel training programs Complementary investments must be made by the customers as well These changes must occur before full-scale competition can become a reality and they will require extensive cooperation between Government, electric power system entities, and customers

CHAPTER 4

RECOMMENDED ELECTRIC POWER SYSTEM STRUCTURE UNDER MARKET REFORM CONDITIONS

4.1 Introduction

This chapter describes the recommended structure for the electric power sector of Russia In designing the structure it was recognized that there was a gap between the current structure and the recommended structure This gap required building a bridge, or transitional structure, that functioned as a means of getting from the existing structure to the new one In other words, the recommended structure is actually two linked structures — a transitional structure and a "final stage" structure

This chapter also highlights certain critical elements in the transitional and final stages First, the creation of a wholesale market is considered of paramount importance to successfully affecting a transition to the final stage Second, the question of maintaining system reliability while restructuring takes place is considered a critically important matter

The chapter begins with an overview of the structural analysis and recommendations that are being made Following a discussion of current, transitional, and final stages a more thorough description of the wholesale market and why it is being defined and developed as it is will be considered Then, a brief discussion of the importance of ensuring system reliability, regardless of which stage of evolution, will be presented Finally, the chapter concludes with a summary of the key issues that should be the focus of power sector management as its evolution unfolds

4 2 Overview

The recommended structure for the electric power sector of Russia was developed over a year of joint working sessions between Russian and American teams The work began by examining various structural options, defining overall objectives for the power sector and recognizing the constraints such as the Presidential decrees that have already prescribed certain steps toward unbundling the vertically integrated system

As work continued, the ownership of sector entities, and the trading arrangements between these entities was examined The role of the wholesale market emerged from this work as a particularly important dimension to the structure both in the near-term and over the long term

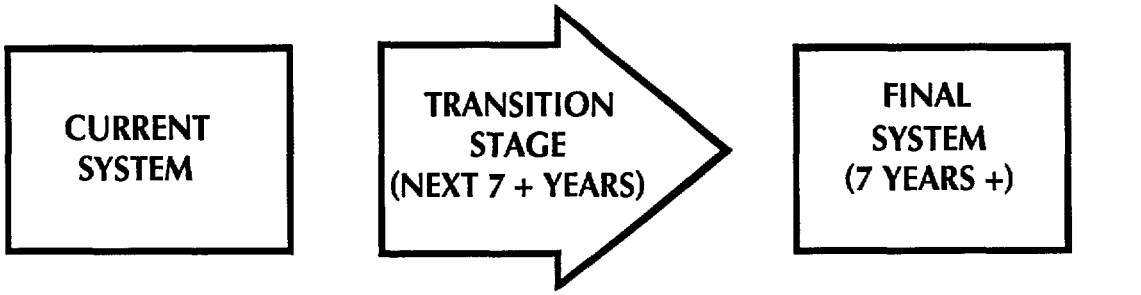
4 2 1 The Need For A Well-Designed Transitional Stage

As the joint work progressed it became clear that a well designed transitional stage would be essential to the achievement of a competitive electric power sector for Russia

Chart 4 1 illustrates the key components in each of the three stages of the structural evolution of the electric power sector in Russia

Chart 4 1

The Evolution Of The Electric Power Sector



CURRENT SYSTEM	TRANSITION STAGE (NEXT 7 + YEARS)	FINAL SYSTEM (7 YEARS +)
30 GENCOs	Competitive No of GENCOs	Competitive No of GENCOs
Generation dispatched through monthly plans	Generation dispatched on variable costs	Generation dispatched on hourly bids
Weak competition	Limited competition	Strong competition
Retail prices recover average generation costs	Retail prices reflect average generation costs	Retail prices reflect marginal generation bids
Inefficient end use assets	Investment in efficiency	Efficient end-use assets
Regulation prevents surplus profits	Regulation and/or contracts prevent surplus profits	Unregulated new generators may earn surplus profits

The following priorities are critical to the transitional stage

- Competition during the transitional stage will be developed by encouraging new, independently owned companies to build generating plants that compete with existing generators
- During the transitional stage variable cost will provide the dispatch criterion
- Moving from an average cost basis of pricing to a free market that sets prices on the basis of marginal costs In the transitional stage retail pricing will be based on average costs but will be time-differentiated to reflect cost

of service differences Retail prices will gradually shift to approximate marginal costs over a period of seven or more years

- Moving from end-use assets that are inefficient to ones that are efficient In the transitional stage a program of investment in end-use efficiency will be an important element of the resource planning process

4 2 2 The Wholesale Market Bridge To The Final Stage

The recommended structure envisions transactions occurring between generators and consumers with the transmission company providing a transportation service and a settlements function The marketplace that is defined by these transactions is considered the wholesale market and it plays an important role bridging the current system and the recommended final stage

The term "wholesale market" can be used in many ways Technically it is a term referring to a market that involves "sale for resale " However, in this project the term "wholesale market" is used as a rubric to refer to all non-retail transactions (i e , all transactions except those sold by AO Energos) that will occur from the transition stage to the final stage

During the evolution to the final stage it is assumed that several types of wholesale transactions will overlap until the final structure is implemented including but not limited to sales for resale, bilateral contracts, use of a spot market for energy, various forms of interregional exchange agreements, and other contract types, e g , peaking contracts or load shaping contracts

During the transitional stage existing generation will sell to the wholesale market at regulated prices reflecting their actual costs New generation will sell at prices reflecting the marginal costs of production In this way, price effects on customers can be controlled and minimized while, at the same time, investors will be given proper signals for considering new projects

This two tiered pricing system is discussed further in Appendix ___

4 2 3 The Retail Market

The retail market will consist of regulated distribution enterprises (AO Energos) that buy power from the wholesale market, generate some of their own , and sell power to their customers See Appendix ___ for a detailed discussion of retail pricing methodology recommended for the transitional and final stages

4 2 4 System Reliability, Regulation and Planning

Control of the industry to ensure fair pricing, and appropriate investing, will be exercised by Federal regulation (whose primary function will be oversight of the development and operation of the wholesale market and of the production of a national integrated resource planning process) and Regional regulation (where retail matters, especially pricing, will be the focus)

4 3 Current Structure And Ownership Profile

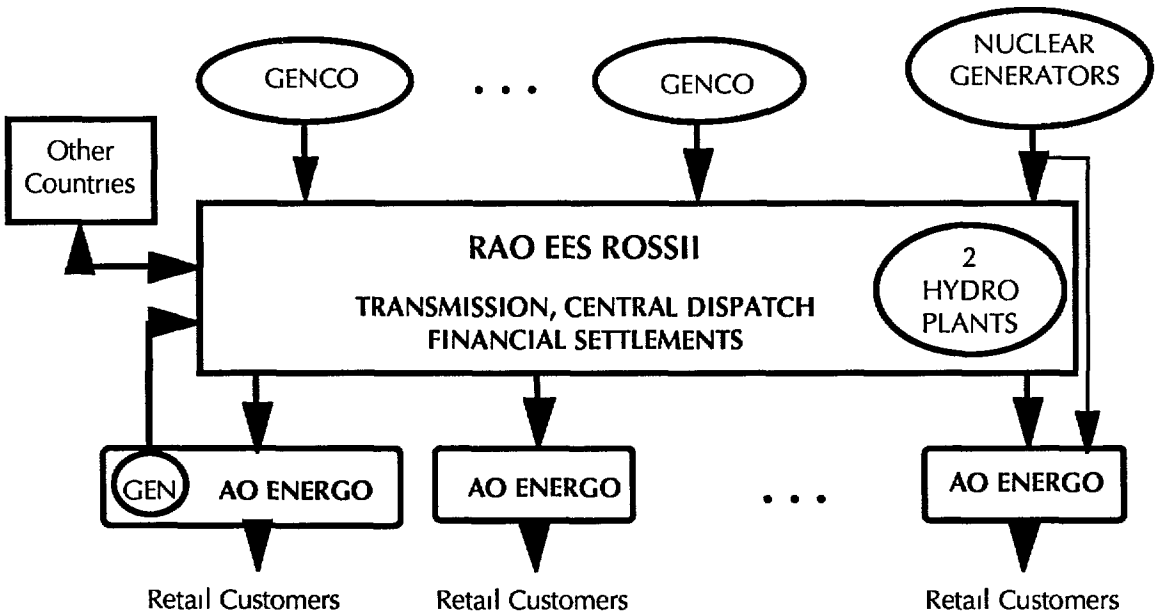
4 3.1 Partial Vertical Integration

The current structure of the electric power sector might be characterized as "partially vertically integrated"

RAO EES ROSSII, a joint-stock holding company, was created to manage the privatization of the electric power sector Chart 4 2 below depicts the structure of the sector as it currently exists

Chart 4 2

The Current Structure Of The Electric Power Sector



RAO was created from the Ministry of Fuels and Energy It was entrusted with the responsibility for reliability of power supply in Russia Regional energy systems,

comprising distribution, CHP, and small generating plants, were transformed into joint-stock companies as well

Currently, the Russian power sector is "quasi-vertically integrated" RAO owns 100% of transmission networks above 330 kv, substations and dispatch centers, 100% of larger thermal and hydro power plants, and 100% of various research and design institutes RAO holds 49% interest in the AO Energo's, to RAO also belongs a trust that ows 49% of construction and machine building enterprises

RAO's largest shareholder is the government of the Russian Federation, which must retain at least 50% interest in RAO for a three year period ending in 1995

RAO owns a diverse mix of other enterprises as well including construction companies, research institutes, engineering firms and much more These entities will be divested as part of the overall restructuring except in some cases where RAO holds the entity as a trust obligation to the state

4 3 2 Impact Of Ownership Structure On Power Sector Operations

Ownership structure impacts how the power sector operates For example, if RAO were to continue to hold percentage interests in all generators, the structure of the electric power sector would be essentially a single large generation and transmission entity The ability to affect economic competition among generators or to create a wholesale market would be compromised Such an ownership pattern would require intense regulatory scrutiny because it would be a monopoly

By creating a wholesale market and using it as a principal means of evolving from the current to the final structure the intent is to reinforce the value of vertical disaggregation i e , the value of competition

The Government of Russia intends for RAO to divest its ownership of generators and retail distributors (AO Energos) Any other ownership structure will produce a power sector that can be privatized but will be inherently less competitive

4 3 3 The Fairness Issue

The Government of Russia intends to disperse sector ownership during the Transitional Stage But certain complications associated with the way privatization took place will need to be managed

The argument is made that the distribution of shares was done without regard for the fact that "the people of Russia" built the electric power system and should share equally in its benefits Insofar as excess profits accrue to individuals who did nothing except "be in the right place at the right time" there is an inherent "unfairness" to the current situation

The debate over this concern is serious and can profoundly impact the future structure of the electric power sector It merits thorough understand in order to appreciate how the transitional and final structures attempt to accomodate these concerns while trying to ensure that the benefits of a competitive system are ultimately realized

The electric power system assets that exist in Russia today -- including power plants, transmission lines, related facilities, equipment, institutes, and others -- were built and owned by the Soviet state Many of these assets have shortcomings (and associated

potential liabilities) inefficiency, obsolescence, delapidation, pollution/ contamination, etc But these assets also have great value In particular

(1) All these assets are entirely free of debt Thus, the costs of owning and operating them do not include debt service

(2) Through the privatization process, these debt-free assets have been transferred (at no cost) to newly created joint stock companies in the power sector (An effective controlling interest in most other companies in the power sector has been retained, temporarily, by RAO EES Rossii, the State Property Committee has in turn retained temporarily an effective controlling interest in RAO)

(3) These assets include huge hydroelectric facilities, which generally have far fewer shortcomings and far greater value (per kw of installed capacity) than Russia's coal, oil, and gas-fired plants

The geographic locations of Russia's existing power system assets were dictated by a variety of factors suitable hydro conditions for dams, proximity to fuel sources for some other plants, centrally planned schemes for creating new industrial complexes or population centers But regional political or ethnic factors, and considerations of autonomy generally, were not matters to which Soviet planners gave great weight and apparently did not significantly influence location decisions for power system assets

What Is The "Fairness" Issue? The "fairness" issue concerns the appropriate allocation of benefits (both power supply and cost benefits) from Russian power plants Such benefits can in theory be allocated in virtually any combination to or among one of more of the following (1) the entire nation and/or all Russian electric power consumers, (2)

particular regions and localities, (3) particular end-use consumers or classes of consumers, ranging from major smelters to all ultimate consumers within a particular geographic area or political subdivision, (4) particular joint stock companies that own the power plants, or that supply power to consumers in particular regions or localities, or (5) other parties, such as a "trader" who has a tolling agreement with an aluminum smelter

This issue involves only power plants and their benefits Transmission facilities and other power system assets are not involved Moreover, as a practical matter, the power plants at issue are primarily hydro facilities The combination of no debt and free fuel makes Russian hydro plants particularly valuable (Nuclear plants could conceivably become involved, too, but fossil fuel plants appear much less likely to be caught up in the fairness debate)

The fairness issue reflects the tension between national and sub-national interests in Russia today It does not reflect, is not determinative of, nor is it necessarily even related to an entirely distinct issue how competitive should the Russian electric power sector become, and how quickly?

It is possible to have a competitive national wholesale power market or a monopoly national wholesale power market, one could also have competitive regional power pools or monopoly regional power pools The two variables -- the degree of national integration of the wholesale power market and the degree of competition -- can be independent, and it helps to think of them interdependently, i e , the wholesale power market structure that resolves one issue may very well resolve the other, as discussed below

RAO's Stated Position RAO's concern is that the power supply and cost benefits of all Russian power plants should be shared by the entire nation, effectively through maintenance (or creation) of a single power supply and cost pool [4]

RAO has at least three stated reasons for its position The stated reasons are

(1) All Russians paid for these power plants, so all Russians should share in the benefits of these plants

(2) National law must be obeyed, and defiance of the law cannot be rewarded, or Russian civil society will break down This issue has already been resolved by law at the national level The Government of the Russian Federation has ordered that the 51 largest such plants should (a) provide their power output to the national wholesale market, and (b) become the assets of joint stock companies whose shares are to be held by particular entities in a particular manner, all in accordance with a national privatization scheme

(3) The alternative of dividing these power plants and their benefits among sub-national entities -- and particularly of letting various A/O Energos or regional governments basically expropriate them -- would dissolve in practice into an anarchic free-for-all This could harm Russia's overall economic performance, the performance of the electric power sector,

[4]RAO officials dislike the word "pool" for several reasons Nonetheless, to Westerners the word is familiar and accurate in the context in which it is used here So in this paper "pool" will be used both as a noun and as a verb

Russian national security interests, and perhaps even the territorial integrity of the nation itself

Evaluation Of RAO's Stated Reasoning RAO's stated reasoning has its persuasive merits, but only with respect to existing power plants (not, as shown below, with respect to future power plants, and RAO is in agreement with this perspective)

Nonetheless, other points of view must be recognized, and counterarguments can be stated

(1) "All Russians paid for these plants, so all Russians should share their benefits " This logic, though simple and appealing, can be questioned For example, all Soviet citizens actually paid for these plants, yet no one proposes that all former Soviet citizens (including non-Russians) share the benefits Moreover, this particular concept of fairness has not been applied elsewhere in the former Soviet Union or in other sectors of the Russian economy Former Soviet Republics have themselves expropriated many former Soviet assets, and even within Russia it appears that little attempt is being made to retain for all Russians the benefits of State assets in sectors other than the electric power sector

(2) "The law must be obeyed " The relevant laws were not enacted by the Duma, and their Constitutional legitimacy as decrees/resolutions has been questioned This issue exists and cannot currently be resolved because the Constitutional Court is not yet functioning

(3) "Potential disintegration of the integrated national electric power system, the national economy, and perhaps even the nation itself " Within Russia,

> regional economic and even political disintegration may be positively desired by some individuals, groups, and geographic regions And there appear to be those who believe that economic or even political disintegration of Russia might prove a positive benefit to the people of various subjects of the Russian Federation (and perhaps the West) It is reasonable to believe that whether Russia remains economically and politically integrated will depend on the play of forces far greater than those affected by the choice between a single national wholesale market or several regional pools in the Russian electric power sector

Stated Reasoning Of Those Opposing The "Fairness" Issue Opponents of a single national wholesale power market include some of the Regional A/O Energos, various local and regional governments, some individuals in the Ministry of the Economy and elsewhere in Moscow, and certain Westerner observers These entities and individuals appear to favor creation of about seven regional wholesale power markets (corresponding to the seven existing regional power dispatch areas), with specific power plants being dedicated either to particular regional markets or to particular A/O Energos or other participants in such regional markets

Advocates of this viewpoint have several stated arguments Note that theseadvocates do not appear to argue in favor of "unfairness," nor do they deny that there does exist a certain fairness to RAO's proposal Instead the contention, in effect, is that fairness is not the only relevant value, and that the mere invocation of fairness cannot properly end the debate They appear instead to assert the following

(1) A single national wholesale power pool is neither necessary nor desirable Large Western nations such as the U S and Canada do not have such

pools Regional autonomy within a federal republic is a positive good, and the alternative, which opponents characterize as a centralized national power system controlled by Moscow, merely perpetuates the problems and inefficiencies of the Soviet past

(2) A single national wholesale power pool is not even feasible Things have already gone too far in the other direction (witness the nascent aluminum smelter deals and initiatives to develop independent generators for AO Energos)

(3) The wholesale electric power market should be competitive If there is a single national wholesale power pool, RAO will dominate it, and, as a practical matter, if RAO dominates the wholesale market there will be little or no competition for the foreseeable future

Evaluation Of Other Stated Positions The stated reasoning of those who oppose a single national wholesale power pool and who advocate creation of regional pools instead deserves careful evaluation

(1) "A single national wholesale power market is not feasible " Four points might be made in response First, at least until now, Russia has had a single national wholesale power market Second, there is no way to tell whether a single national wholesale power market could continue except by trying it Third, the contention that such a market is impossible is not only self-serving, but potentially self-fulfilling again, no one will ever know unless a single national wholesale power market is put to the test Finally, the "choice" between fairness and multiple wholesale markets is a false dichotomy There is a simple compromise solution (the "Two-Tier

approach in Appendix __) which shows that even if a single national wholesale market is not feasible or desirable, RAO's fairness concern can still be reconciled with the existence of other wholesale markets and wholesale competition as the design of the transitional and final stages recommends

(a) recognize the fairness principle by creating a single national wholesale power pool for the power output and costs associated with existing generators, and

(b) exclude all new generators from that pool in the future

(2) "A single national wholesale market is not desirable, either" The choice need not be that of fairness on the one hand or greater regional autonomy and wholesale competition on the other, both are possible, again, as the recommended design shows

(3) "The wholesale market should be competitive" There is no disagreement about this point The issue is how competitive, how quickly, and how best to achieve the degree of competition and speed of implementation that are ultimately selected Again, the important point is not to assume too readily that fairness and competition are necessarily inconsistent The "Two-Tier" approach serves RAO's stated fairness concern and still creates a competitive wholesale power market for the steadily-increasing portion of Russian total power demand that cannot be met by the existing capabilities of Russia's aging generators

Clearly, during the transitional stage, dealing with the problem of "unfair economic rents" accruing to some workers and not to others will be an essential challenge

The pricing system that has been designed for the transitional stage will play an important role in capturing surplus profits on the existing asset base of the electric power sector and redirecting them for the overall benefit of Russia's population

4 4 Transitional Structure

The transition of the electric power sector from its current structure to the recommended structure is considered a huge leap It will require not only significant changes in the technical operation of the power sector It will also require a management culture change of massive proportions

For these reasons the movement from the current structure to the recommended structure will take some time This interim period has been designed as a managed process — one where the building blocks essential to operating the final structure will be put in place

During the transitional stage one of the most important elements is the development of the wholesale market It is believed that properly implemented the wholesale market can play a critical role in bridging the current structure and the recommended final structure

4 4 1 The Essential Role Of Central Dispatch

For an effective wholesale power market to develop it is essential to ensure maximum capability for moving power from region to region This necessitates a national grid enterprise to manage the overall system

In both the transitional and the final structures, RAO EES Rossi will play a key role in central dispatch This function dispatches the generation resources within the regions and

effects greater interconnection and coordination among them As will be discussed later, this is one principal reason for an emphasis on a national wholesale market as opposed to several regional wholseale markets Chart 3 illustrates this function

4 4 2 Reducing Regional Cost Differences With Increased Interconnections

There are differences in regional generating costs in Russia today Through increased interregional system integration regional generating cost differences can be reduced This is achieved through interregional power exchange agreements that are ordered by the central dispatcher

4 4 3 The Transitional Structure Leverages The Wholesale Market

The current structure may not fully capture the benefits of a wholesale market Until Presidential Decree 1034 which takes effect in 1995, not all generators were selling to the wholesale market In fact of the 52 entities that should be selling to the wholesale market only about 21 were doing so This has contributed to price disparities between regions and reinforced various concerns including suboptimization of the electric power system from an operational perspective and reinforcement of the problem of allocating surplus profits

4 4 4 The Importance Of Long-Term Contracting

The transitional stage will be a somewhat amorphous period of change aspects of the current system will co-exist with aspects of the new, and aspects of the final stage will be undergoing a form of testing or trial effort One such area that will be subject to such pressures concerns the way that sellers and buyers interact and carry out transactions

During the transitional stage the transaction systems and infrastructure needed for the final stage will have to be developed, tested, refined and formalized The principal transaction tool will be power contracting There will be several types of power contracts developed for the electric power sector

- Long-term contracts with existing generators for capacity and energy
- A series of variable term contracts for a variety of services such as electricity without capacity, electricity generating capacity (and energy when needed), energy exchanges, sale of both transmission capacity and transmission service at either the wholesale or retail level, and sale of transmission service (without sale of capacity)
- Contracts that provide the buyer with the option to acquire energy or capacity at some specified future date Most often such contracts are tradable, i e , can be sold to other parties
- Futures contracts which are agreements to provide energy and/or capacity at a date certain in the future Most often such contracts will be tradable, i e, can be sold to other parties

Long-term contracting with existing generators will be particularly challenging because there are no precedents for such mechanisms in the Russian electric power sector It will be important to develop these instruments during the transitional stage They will be a useful way of ensuring an effective balance between regulatory oversight and the use of market forces to regulate the system

Specifically, if generators have long-term contracts with the wholesale market maker and manager or with direct customers, and if these contracts spell out the pricing methodology

to be used over the duration of the contract, then the need for annual regulatory review of prices will be reduced Considering the scope of the transition agenda and the need for regulators to play a facilitating role, the diminishing of the need for frequent price regulation review would free the regulator to focus on other matters, such as facilitating the transition to the recommended final structure

Development of long-term contracting is important for many reasons It will

- Reduce the need for complex regulatory systems (as just noted)
- Provide a tool for dealing with existing and new generating plants in a fair and consistent way
- Provide greater incentives for economically efficient operation of existing generators
- Provide a way to raise capital through sales of individual contracts to private investors

During the transitional stage several critical issues will have to be dealt with if power contracting is to be an effective tool Specifically,

- Russia's legal system may not be ready to accommodate the complexities that may emerge from the use of power contracts,
- Workers may resist using power contracts because such contracts could limit wealth realized from certain plants,

- Retail customers may confront increases in their electric costs in some cases unless profits from certain contract holders (i e , those from existing generators) are rebated to those customers

Nonetheless, it is important to develop and use long-term contracts during the transitional stage because contracts will be the foundation of the final system

4 4 5 Keys To Success In Navigating Through The Transitional Stage

During the transitional stage the electric power sector of Russia will evolve from its current state of "partial vertical integration" to a sector having three distinctive lines of business — generation, transmission and dispatch services, and retail distribution of electric power

For this to be successful the following must occur

- The tensions between the so-called fairness argument and the discipline of economic efficiency must be to a constructive resolution
- No single enterprise, whether generator, transmission company, or distributor, should have a controlling interest in any other segment of the industry
- While concentrated ownership, i e , few owners who control the enterprise, may be allowed in individual enterprises, concentration of an entire segment of the industry (generation, distribution) must be prohibited Such concentration allows for monopolistic or oligopolistic behavior which, in turn, diminishes the efficiency of market forces

If, during the transitional stage, regulatory control is exerted to keep anti-market forces from dominating the electric power sector then market-based benefits will have a better opportunity to develop and the final stage will be approached with better-established market principles and conditions in effect

Further, progress during the transitional stage should yield several critical benefits for the electric power sector —

- Increased competition and lower overall costs of power through the entry of independently financed , owned and operated generators
- Continued system reliability through the strong regulation of the transmission grids and through the use of economic dispatch principles
- Improved efficiency of energy use through a structure that incents the AO Energos to make profitable energy efficiency investments

4 5 The Final Stage — A Market-Based Power Sector

4 5 1 An Open Market For Customers

As the electric power sector enters its final stage one new aspect of its structure will be the ability of large industrial customers to acquire electric power resources directly from the wholesale marketplace, bypassing the distributors' retail tariffs

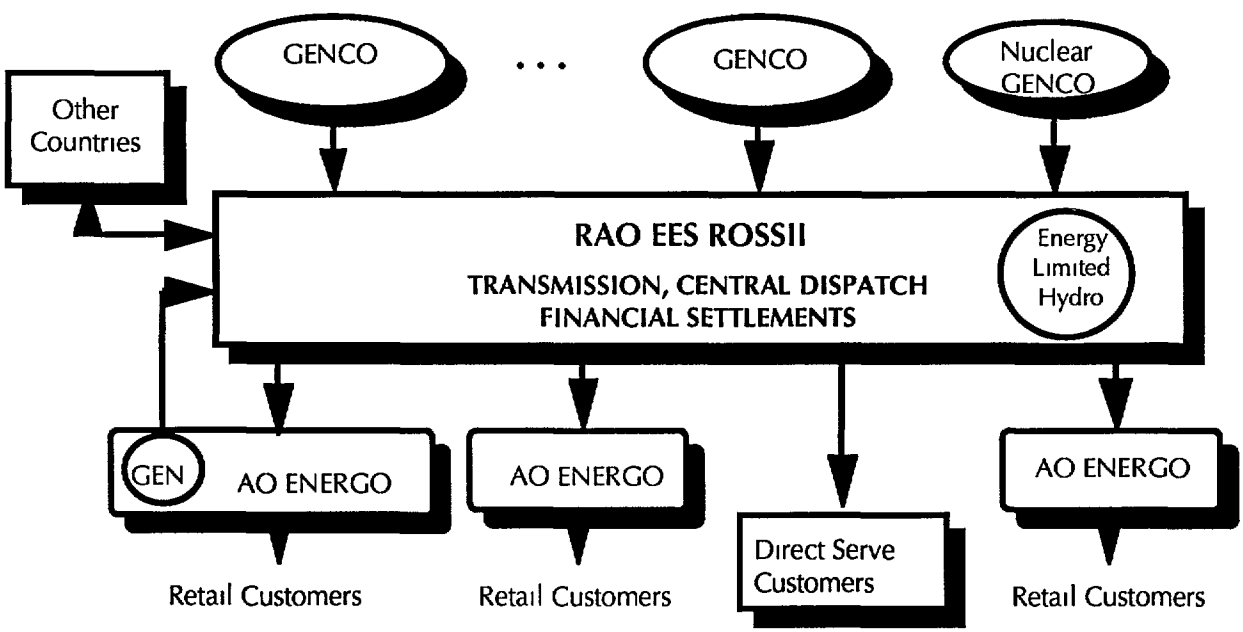
This option of paying only a "use of system" fee to the AO Energo will incent the AO Energo to set retail rates that reflect cost of service and to eliminate cross subsidies The creation of customer choices and incentives for economically-efficient behavior can help to reduce the need for central regulation and control in a market-based economic system

4 5 2 Final Stage Structure

The emergence of direct service customers does not significantly alter the structure of the electric power sector from its transitional stage providing the entry of these buyers into the market should be relatively easy Chart 4 3 depicts the slight alteration in the structure of the electric power sector at its final stage of development into a market-based system

Chart 4 3

The Final Sector Structure Is Not Vertically Integrated And Allows Direct Service Customers To Access The Wholesale Marketplace



4 5 3 Final Stage Pricing And Dispatch Principles

In the final stage of the electric power sector's transition to a market-based system, generation will be dispatched by "hourly bids" which each generating company, GENCO,

will provide to the dispatch center one day to one week ahead Pricing will be discussed further in the section on the wholesale market below

4 5 4 Ownership In The Final Stage

At the final stage all electric power production from generators must be sold directly to and dispatched by the transmission grid It may not be sold directly to an end-use customer or an AO Energo The central dispatch and transmission entity, RAO EES Rossii, should not own generation (other than peaking capacity necessary to insure transmission stability and security) These restrictions reduce the opportunity for one entity in the electric power sector to show favoritism to another or to a special customer and therefore introducing an unfair bias in the operation of the market for electric power

4 5 5 Merit Order Dispatch

All generators in a regional power pool will be dispatched in strict "merit order" the generator with the lowest bid will be dispatched first, the generator with the second lowest bid will be dispatched next, and so on up the "stack" of generators until sufficient power is being generated to meet the power demands of the customers This methodology insures that each and every level of customer demand is supplied at the lowest economic cost (the greatest economic efficiency) to the electric power sector

All generators that are dispatched in a given hour are paid a price equal to the highest bid that is actually dispatched Generators are not paid a price equal to their own bid

New generators built with private "at risk" funds will be allowed to earn and retain profits However, these generators will also be required to accept any losses that they

may incur as well Success by private funds placed at risk will earn rewards failure will incur losses

This final structure will introduce an important element of diversity and competition into the decision-making process for investment decisions in the electric power sector No one entity, public or private, would monopolize this process

4 6 The Wholesale Market Bridge To The Final Stage

In both the transitional structure and the final structure a national "wholesale market" plays an important role This market is the bridge that also carries market reform from its current stage to the desired final structure

The importance of the national wholesale market was realized through a process of examining various options The options included

(1) Conventional sale for resale involving RAO as the single buyer and reseller for the nation

(2) Conventional sale for resale involving seven regional pools

(3) National grid providing a transportation service and settlements function with the system operating with long-term capacity contracts and energy sold on a spot market

(4) Regional pools functioning as (3)

Further analysis is justified to make appropriate refinements in how the wholesale marketplace will function to best serve the market reform process Nevertheless it is

believed that the general direction discussed in this section of the chapter is the best approach

In assessing which option appeared to make the most sense the objectives of reform were used as the principal evaluation criteria These were supplemented with criteria based on the experience of Russian electric power sector experts involved in the project The objectives, again, are

- A growing electric power system and the continuing ability to efficiently and reliably provide the nation with affordable power,
- The ability to do the above social equity and economic efficiency,
- The ability to attract foreign investment on terms that are beneficial for the electric power sector

Russian experts in the electric power sector used several principles to evaluate options

(1) Contributes to solving existing legal problems and thereby helps foster competition, which will increase the system's economic efficiency

(2) Contributes to enhancing system efficiency and optimization, including preserving the electric power system from future fragmentation and decline and maintaining and enhancing an efficient dispatch order, which will minimize electric power generation costs at every level of demand

(3) Contributes to making the most efficient use of limited capital resources

(4) Provides both suppliers and buyers with tools to understand and hedge financial risks and, in turn, enhance supply reliability

(5) Plays a key role in setting market-based retail power prices

Table 4 1 summarizes the analysis

Table 4 1

Evaluating Wholesale Market Options

	National market single buyer/reseller	National market, national grid	Regional markets single buyer/reseller	Regional markets regional grids
Affordable power supply	Enables average cost pricing to work	Requires marginal cost pricing	Enables average cost pricing but provides less benefit than a national market	Ensures significant regional price disparities
Balances social equity and economic efficiency	Pricing mechanisms ensure balance	Maintains present disparities	Maintains present disparities	Maintains present disparities
Attracts investment	Investment banks support this approach	This would bring independent power producers	Less attractive to prospective investors vs a national market	Thi swould bring independent power producers
Solves existing legal problems	Ensures control of the system until there is a legal framework	Too complicated until there is a legal system	Reinforces existing problems, makes legal problems worse	Too complicated until there is a legal framework
Enhances system optimization	A national market provides the greatest optimization potential	Equal potential for system optimization to a national sale for resale market	Optimization potential at regional level but loss of value vs national optimization	Equal potential at regional level sale for resale market
Efficient use of limited capital resources	Focuses investment on transmission which offers the best cost/benefit	Focuses investment on transmission and generation	Focuses on regional generation and/or inter-regional transmission	Focuses on regional generation and/or inter-regional transmission
Risk hedging and supply reliability	Ensures adequate supply	Some risk from relying on non-regulated market forces	May ensure adequate supply at regional level only	Some risk at regional level from relying on market forces
Key role in retail pricing	Ensures a consistent basis	Ensures a consistent basis	Retail pricing may vary region	Retail pricing may vary region

(5) Plays a key role in setting market-based retail power prices

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Enhances system optimization	A national market provides the greatest optimization potential	Equal potential for system optimization to a national sale for resale market	Optimization potential at regional level but loss of value vs national optimization	Equal potential at regional level sale for resale market
Efficient use of limited capital resources	Focuses investment on transmission which offers the best cost/benefit	Focuses investment on transmission and generation	Focuses on regional generation and/or inter-regional transmission	Focuses on regional generation and/or inter-regional transmission
Risk hedging and supply reliability	Ensures adequate supply	Some risk from relying on non-regulated market forces	May ensure adequate supply at regional level only	Some risk at regional level from relying on market forces
Key role in retail pricing	Ensures a consistent basis	Ensures a consistent basis	Retail pricing may vary region	Retail pricing may vary region

	for retail pricing	for retail pricing	to region	to region

Analysis of these options indicates that a national market appears to most closely achieve the objectives of power sector restructuring

Analysis of the options indicate that the value differences between a national sale for resale market and a transaction system where the national grid provides a common carrier and settlements service are not significant Therefore the wholesale power market will be structured as soon as possible into a market where long-term contracts and a spot market for energy exist because this is consistent with the recommended structure for the final stage of market reform

Initial steps are already being taken to move the market in this direction Specifically, Presidential Decree 1034 requires all generation to be submitted for economic dispatch This has the effect of eliminating the bypass of the wholesale market

Also, a draft Presidential decree is currently circulating for comment among various ministries It would define the wholesale market as essentially a dual system where some sale for resale occurs but where the priority is to move tocontracts and use of a spot market

The evolution of the marketplace into the final structure will be managed as a critical part of the transition process Certainly the requirement for a legal framework will be a triggering mechanism for additional change but other preconditions must be met before a comprehensive move to the final stage occurs

These preconditions include the need for a uniform system of accounts, transparent economic dispatch, and sufficient sophistication among all generators, major industrial

buyers and AO Energos to ensure that the market will work These preconditions are discussed further in Chapter 7 which concerns the transition process

4 6 1 Wholesale Market Structure

The Wholesale Market is defined by which entities participate in it and what and how its products are bought and sold

The following are participants in the Wholesale Market

- RAO EES Rossii owner and operator of the national high-voltage transmission grid, operator of the single-national and seven-zonal economic dispatch centers, and coordinator / operator of the Wholesale Market
- All power generation plants All electric power production (except for own-use production) must be sold to / through the Wholesale Market
- All AO Energos All regional distribution companies must buy all their electric power requirements from / through the Wholesale Market
- "Independent" customers large customers that choose to buy their electric power directly from the Wholesale Market
- Allied Entities engineering, construction, maintenance and repair organizations for the electric power system and related academic institutes

The formation and implemention of a wholesale market will mark a substantial shift in the amount of central control that will normally be applied to the electric power system The "invisible hand" of the market will begin to assume some of the responsibility RAO EES Rossii will retain the rest, but it will do so only in its proposed role as "supplier of last resort", not as chief administrator of the system

4 6 2 Wholesale Pricing

Price plays two separate and distinct roles in an economic system First, it (together with the quantity of output) establishes the amount of revenue that the selling entity can generate This revenue can be used to pay the entity's expenses, to accumulate capital for future investments by the entity, and to pay dividends to its shareowners

Secondly, and no less importantly, price provides vital signals and incentives about the efficient use of economic resources to all entities in the economic system For the most efficient use of economic resources, economic theory dictates that the price of a product should be equal to its "marginal cost" of production, transmission, and distribution In the case of electric energy, the price of a kilowatt-hour should equal the "variable cost" of the "next" (at the margin) kWh

The logic behind this theory rests on the observation that no economic benefit to society should be of lesser value than the cost that the society must pay to produce that benefit If cost exceeds benefit, then the society is wasting scarce economic resources Therefore all customers should be charged marginal cost so that each customer can be made aware (signal) of the cost that society is bearing to produce the economic resource that the customer is using, and so that each customer has an incentive to stop using the resource to produce goods that have a benefit to society that is less than the cost of the resource used

The most rigorous analysis of economically-efficient electricity pricing was done by Fred C Schweppe, of the Massachusetts Insitutue of Technology in 1988 and has since

become an electricity industry standard [5] Schweppe demonstrates that in order to attain maximum economic efficiency, each individual bus on the network should have its own individual price This price should vary, hour by hour, according to system marginal generation costs, transmission line losses, generation security of supply costs, and transmission and distribution security of supply costs at each bus

If an electric system has adequate generation reserves, sufficient transmission and distribution capacity (no chronic bottlenecks), and an automated economic dispatch system, then price differences among the individual buses will be quite small, and will be governed principally by transmission line losses and the occasional forced outage of generators Only when such outages or the loss (or lack of) a major transmission line occur will there be significant differences in price In effect, therefore, the marginal-cost prices of all buses in the entire network will normally be roughly equal in the final state of the electric power system Economic efficiency therefore strongly suggests the superiority of a "single market / "single price" approach to the structure of the Wholesale Market The only situation arguing against this would be a case where there is a permanent long-term difference in the marginal costs of production in seperate regions [6] In particular, Schweppe warns of the economic inefficiencies introduced by "decomposing" the system into separate segments or customer categories[7]

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[5]Fred C Schweppe, Michael C Caramanis, Richard D Tabors, and Roger E Bohn, Spot Pricing of Electricity , Kluwer Academic Publishers, Boston, 1988

[6]If such a situation exists in Russia, then a single market / single price approach would introduce economic inefficiencies, primarily through the mechanism of mis-locating new industry There is no evidence that this is the case, however Although there is evidence that average costs differ between regions in Russia (primarily those with significant hydro power), there is no evidence that any one region has any long-term marginal advantage in building its next unit of production over another region, particularly if environmental costs are considered As far as existing hydro is concerned, marginal production is severely limited by freezing in the winter and lack of water in the summer, and, particularly if environmental costs are considered, it is not clear new hydro generation will have any significant marginal cost difference than other forms of new generation.

[7]Op cit p 191

The pricing system discussed above will be used to set electricity tariffs in the final state of the system However, a period of transition to allow the system and its customers to adapt will be required before this final state can be achieved During this period, RAO EES Rossii must substantially improve its automated economic dispatch and communication systems and use the differences in marginal costs among the network's buses as signals for aggressive additional transmission line investments

Since the single market/single price approach will characterize the final state of the electric power system, the benefits of consistency and continuity suggest that it also be used in the Transitional Period In addition it helps mitigate the problem caused by giving away ownership in entities before they could be priced fairly, as windfall benefits can be equally distributed until competition, new plants, and time, take this problem away

The Wholesale Market electricity price will rise and fall over the period of a day (sometimes called "Time-of-Day" or "Real Time" pricing) because price is determined by marginal cost, and, as demand rises and falls, the marginal cost of production also rises and falls This is a natural consequence of the least-cost methodology used to dispatch the generating plants These daily cost variations can be approximated in a "stepped" structure of two or more price levels A "base-load" price would apply in periods (e g , from 10pm until 6am) when customer demand is low and therefore generating costs are low A "peak-load" price would apply in periods when customer demand is highest and therefore generating costs are highest One or more "shoulder" prices could also apply in intermediate periods until, eventually, the whole system has enough information technology in place, and people trained in using it, to go truly "real time "

Such a stepped structure of daily price levels gives customers a richer set of choices not just "buy" or "not buy", but "when to buy" as well Customers would be given both the

signal and the incentive to schedule low-economic-benefit uses of electricity in periods when its price (and its cost) is low The stepped structure therefore allows the customers' elasticity of demand (the responsiveness of the level of demand for a product to a change in the price of the product) to produce an increase in economic efficiency both for electricity customers themselves and for the society as a whole (For example, rather than building a new plant to cover an increase in loads during normal working hours, customers will be encouraged through price differences to change buying (e g production) patterns to times when the system is currently in excess capacity, avoiding building new generation)

RAO EES Rossii incurs costs by owning and operating the transmission grid and dispatch centers and by coordinating / operating the Wholesale Market These costs will be added to the marginal-cost-based electricity price and charged to the electric power distribution companies and "independent" customers based on their purchases of electrity from the Wholesale Market These additional costs can be apportioned in a variety of methods based on each customer's peak power demand on the system, his average power demand on the system, on his total energy purchases, and so forth A choice of method for the final state of the system need not be selected now In the Transition Period, however, a good argument can be made for the "peak demand" method, which emphasizes and enhances the economic benefits of customers' demand elasticity as noted in the paragraph above

The electric power system under the pricing structure discussed above will generate "surplus profits" The level and the disposition of these surplus profits introduces the social-political issue of equity already mentioned above This issue could have been solved had the individual entities been priced on an open market before ownership was

distributed to shareholders They weren't, and the problem that remains will continue to be highly sensitive

4 6 3 Apropriateness

The structure and pricing recommendations for the Wholesale Market described above have been tailored to produce an electric power system for Russia that is actually more economically efficient than the system installed in the United Kingdom several years ago

In addition, the recommended system reflects (and is specifically meant to reflect) the unique social, political, and economic features of the Russian Federation Russia is an enormously larger and vastly more heterogeneous country than the U K The centrifugal forces that threaten fragmentation and decline will plague Russia now and in the future to a far greater extent than they will the U K

Further, the Russian economy has only recently begun to experiment with market-based (as opposed to command-based) pricing and resource allocation, whereas the U K has many generations of experience One nation's example (with all its benefits and especially its faults) should not be simply transplanted to another

Many of the features that make the U K system attractive from an economic efficiency perspective (such as merit-order dispatch, competition among generators, market-based pricing for new investments, etc) are included in the recommendations given above But the manner in which these features are inserted into the system (single market / single price, contract-based for sale of power from existing generators, etc) reflects the unique nature of the Russian context Other features of the recommended Russian system, notably those dealing with transmission pricing, are clearly superior to those in the U K

4 6 4 Retail Pricing

The exercise of establishing the structure and level of prices that are charged by a regulated entity is sometimes called "ratemaking" The design of "rates" for the retail sale of electricity is part science and part judgment As a general principle, a customer should be charged a price that is equal to the cost incurred to serve him, but there is no universally-accepted method for actually doing so that applies in every situation A more detailed discussion of alternative methods can be found in the Retail Pricing Appendix

In special circumstances society may choose to offer a specific class of customer a subsidy by charging a price for electricity that is less than its cost For example, aluminum smelters are given subsidies (rightly or wrongly) by virtually every electric power system in the world Aged, disabled, or poor residential customers are also frequently offered subsidized prices for electricity Such explicit exceptions to the general principle are generally normal and acceptable, so long as they remain small in relation to the overall size of the system

Unintentional subsidies (subsidies that are given to customers because the electric power system does not know or, for political reasons, cannot charge a price large enough to recover the costs incurred to serve them) are far more dangerous They give customers incorrect signals and incentives about the consumption of electricity If the price is too low then the customer will tend to use too much and valuable economic resources will be wasted If too high, the customer will use too little and will not produce as much of his own output as economically optimal

The second most severe problem that now plagues the Russian electric power system is waste (the first is non-payment) At least 25%, and perhaps as much as 45%, of the

production of electric power is "wasted" through inefficient and uneconomic use This waste can be blamed at least partially on the legacy of the old Soviet economic system in which measures of "quantity" overwhelmed measures of "quality" It is also due to a general level of electricity pricing that is too low to recover the costs of generation, transmission, and distribution and too low to provide enough incentive to the customer to reduce waste

"Quantity-focused" economic incentives and incorrect price signals constitute only one aspect of the problem Waste of electricity can also be blamed on the customer's lack of access to energy-efficient end-use energy equipment The Energy Research Institute of the Russian Academy of Sciences has found that inefficient electric motors, industrial process heating, cooking appliances, and lights are the main sources of waste

The electric power system, and particularly the AO Energos, face an enormous opportunity to improve this situation The system can reliably serve a growing demand for electric power by investing capital to purchase and install efficient end-use energy assets for its customers, and do so at a cost substantially cheaper than that of building new power plants, transmission lines, and distribution networks

As a "free" by-product of these investments, the customers' own production processes will become more efficient, more controllable, and will generate more salable product with less waste, helping to meet the fundamental objectives of fostering recovery and enabling Russia to be a stable international trading partner Each customer should be charged separately for the cost of the specific new end-use energy assets that he employs That customer, on the other hand, will realize energy cost savings that are large enough to more than offset the cost of the new equipment Such an investment and pricing scheme

introduces no subsidy into the pricing system for electricity - no customer is charged for benefits that are provided to another customer

4.7 System Reliability

4 7 1 Four Levels Of Protection

In opening the power sector to the beneficial forces of competition and diversity, great care must be taken to preserve the reliability of the electric supply system Russia benefits greatly from its national grid In the process of restructuring the sector, existing regional and national economic dispatch methodologies should be strengthened, not weakened Our joint proposal envisions four levels of shared responsibility for maintaining and enhancing system reliability

1) The Central Resource Planning/Procurement Group of RAO EES Rossii will be responsible for the reliability of power generation and the national and inter-regional high-voltage power transmission network

2) Each AO Energo will be responsible for the reliability of its own dedicated transmission and distribution network

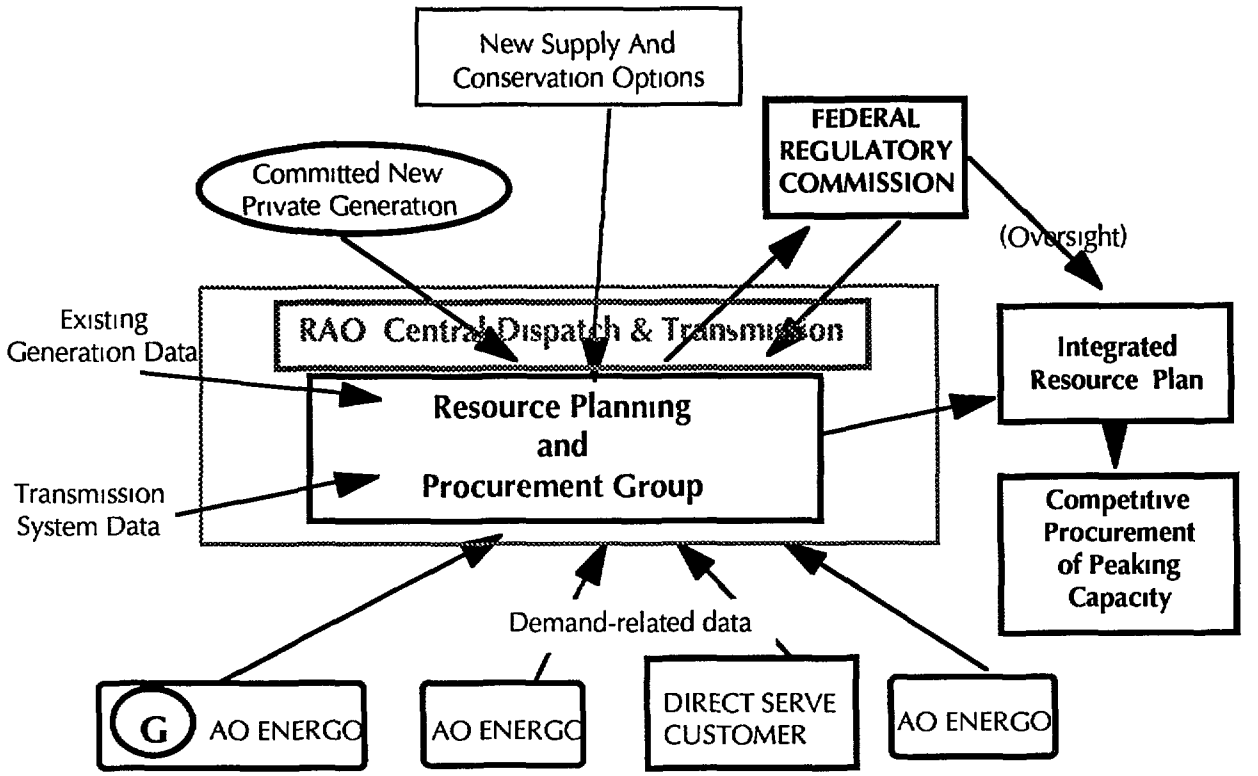
3) The Central Resource Planning/Procurement Group of RAO EES Rossii jointly with the AO Energos will be responsible for developing forecasts of regional demand

4) These resource plans and procurement decisions will, in turn, be reviewed by Federal and Regional Regulatory Commissions

The overall framework is depicted in Chart 4 4 below

Chart 4.4

Resource Planning Framework For The Wholesale Power Market



4 7 2 RAO EES Rossii's Role

RAO EES Rossii will preserve the integrity of the national grid and will centrally dispatch all major power generation plants (those with capacity above 100MW) Its Central Resource Planning/Procurement Group will collect and maintain all relevant demand-related data and forecasts from each of the AO Energos and also from each direct-serve customer

To these demand-related data it will add supply-related data and forecasts from each existing and new private power generator plus its own transmission system data and

forecasts These data and forecasts will be combined into an official Integrated Resource Plan that specifies the new investment projects that RAO expects will be needed to preserve and maintain the electric supply system This Integrated Resource Plan will be available to all existing and new entities in the electric power sector A Federal Regulatory Commission will have oversight responsibility for the planning process and the plan itself

RAO EES Rossii will have responsibility for procuring and deploying transmission investments called for in the plan Other than generators needed to preserve transmission security and stability, RAO EES Rossii will not invest in new power generation

RAO, which will be responsible for dispatch as an integral part of transmission, should remain unbiased in its role of dispatching generating plants in least-cost merit order, a vitally important feature of an economically-efficient power system Where generating plants cannot be dispatched in strict least-cost merit order because of transmission constraints, RAO should have both the information and the incentive to correct this problem by making the appropriate transmission investments RAO's ability to mix generation investments with its premier transmission role and responsibility could dilute this information and seriously weaken these incentives

It might be argued that regulation could help prevent bias in this regard Regulation, however valuable in preventing errors of commission, is far less effective in preventing the generally-less-visible errors of omission Incentives usually motivate better than regulation in preventing both Furthermore, an essential feature of the restructuring program itself is the expansion of competition (and therefore diversity) wherever possible Incentives are the sharp spurs of competition

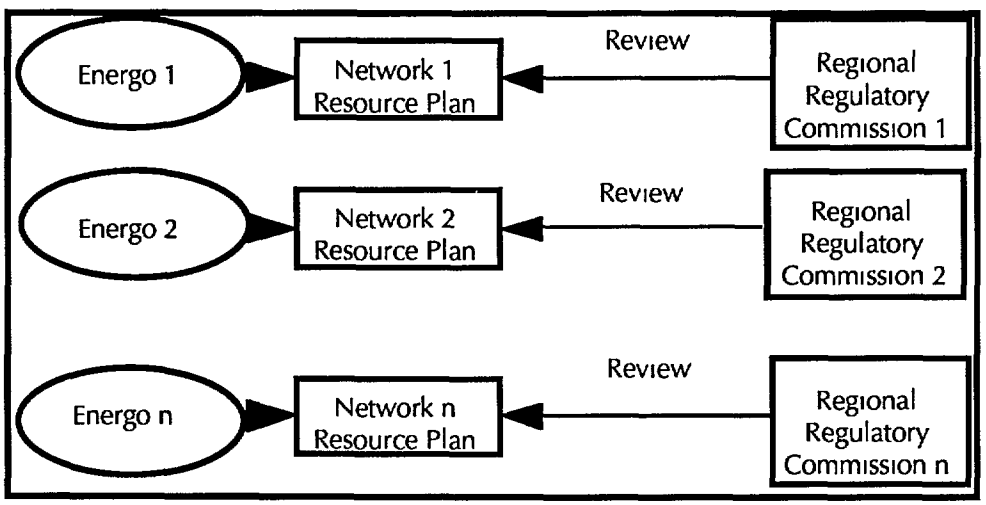
When RAO is able to dispatch all generating plants (above 100 MW) in strict least-cost merit order by removing transmission bottlenecks and constraints it will also simultaneously maximize its own profit if it has no other source of profit (such as its own generation assets) to complicate the equation

New generation capacity should be added either by the AO Energos or by new private generation investments (or perhaps alternatively by investments to make the consumption of electric power itself more efficient and thereby reduce the net requirement for new generation)

Each of the AO Energos will produce a Network Resource Plan for its own territory covering existing and planned future generation, transmission, and distribution investments The Regional Regulatory Commission for the region in which the AO Energo is located will be responsible for oversight for the plan Chart 4 5 illustrates

Chart 4 5

Supply Reliability Is Further Enhanced Through Regional Planning And Regulatory Oversight



4 7 3 AO Energos And System Reliability

Unlike RAO itself, the AO Energos will be allowed to make investments in power generation, subject to two constraints First, the AO Energo must allow its generation larger than 100 MW to be centrally dispatched Thus the AO Energo will suffer a disincentive to build large-scale generation capacity that is not needed and/or is economically less efficient than generation that is now (or can in the future be) provided by its competitors The arbiter of this decision to dispatch will be RAO EES Rossii, an entity with its own strong incentive to dispatch strictly on merit order

The second constraint applies to AO Energo generation that is smaller than the central-dispatch limit The effect of this smaller-scale generation will to reduce the AO Energo's demand for power from the regional power pool in which it is located Since this power will be priced by the pool to the AO Energo at pool average-cost, not pool marginal-cost, there will be less of a financial incentive for the AO Energo to attempt to pre-empt competitors' generation with investments of its own that are not economically justified

The AO Energo would also have no financial incentive to prefer power generation investments over energy efficiency investments which would similarly reduce the AO Energo's demand for power from the region's pool The AO Energo is likely to be entity with the greatest focus on and the greatest understanding of its individual customers' energy efficiency possibilities This, not power generation, may well represent the locus of the AO Energo's greatest competitive advantage in the power sector

4 8 Implications Of These Reforms

As the Russian electric power system works to achieve the Final State for the system structure and pricing regime outlined in the text above, it should focus particular attention and considerable resources on the following areas

4 8 1 Solution To Existing Problems

Three severe problems that currently plague the electric power system must be (and this chapter assumes will have been) solved non-payment, fuels pricing, and heat pricing

If a substantial proportion of its customers are unable or unwilling to pay their electricity bills, then no amount of internal reorganization or restructuring of the power system itself will solve this problem Furthermore, if non-payment becomes chronic, then the economic efficiency benefits of restructuring will not be achieved The team has developed one potential solution to the problem which needs further discussion Other solutions may also be attractive

The largest single element of cost born by the electric power system is the cost of fuel The cost of fuel also dominates economic dispatch methodology which is central to the success of the new system If fuel prices continue to be determined by the old command methods, rather than by the operation of free markets, then the success of this recommended reorganization of the electric power system will be held hostage by the old, unsuccessful economic foundation This issue, although beyond the scope of this program, must be resolved if reorganization is to succeed

Likewise, heat prices are also determined by command, not by market factors Since much of the electric generating capacity in the Russian Federation produces a combination

of heat and power, the old economic foundation is therefore able to intrude upon the new and to compromise its success

If, over the period of a year, the total demand for heat is roughly comparable to the total demand for electric energy, the combined production of heat and electricity in a single plant is almost certainly more efficient than the production of each separately (even with "advanced" electric technologies such as combined-cycle natural gas generation) A reasonably good economic solution to the pricing problem seems to be fairly straightforward Price heat on precisely the same basis as electricity, on its marginal cost of production

You can produce heat without producing electricity You cannot produce electricity without producing heat When the central heating plant (CHP) follows a thermal load ("heat" is on the margin), then the heat- rate for electric energy is 3412 Btus / kWh, and the heat rate for thermal energy is the heat rate for the overall plant minus 3412 Btus / kWh, as you must pull away heat energy to drive the electric generator When the plant follows an electric load, however, ("electricity" is on the margin), then the heat rate for electricity production is the heat rate for the plant as a whole and the heat rate for thermal energy is roughly zero, since heat is a by-product you can't choose not to produce Since the relevant heat rate and the price of fuel together determine the largest component (fuel cost) of variable production cost, a reasonable approximation of marginal cost for both heat and electricity can be made The implementation of this economic "solution", however, may be politically quite difficult

4 8 2 Economic Dispatch

The single most important internal element in the process of change is economic dispatch It is the means by which the beneficial pressure of competition penetrates and permeates the electric power system The dispatch mechanism should be as free from bias against or preferential treatment for any generator and as transparent as it can be made

If, in the Final State of the system, RAO EES Rossii plans to dispatch every generating plant in Russia, it should make the necessary investments in communications and computing equipment to ensure that this enormous task can be done in a fair and transparent manner Dispatch of the smaller plants "by hand" will not be sufficient because it will be seen to offer too great an opportunity for bias and preference

As a general principle, no plant should be dispatched unless it can be dispatched by an impartial computer algorithm which is available for inspection by every entity in the market The cost of a "state of the art" computerized economic dispatch system for the whole nation should be far less than the cost of a single modestly-sized power generation plant

The customer counterpart to investment in economic dispatch is the installation of interactive, time-sensitive, metering and control equipment Without this equipment, time-of-day pricing cannot be implemented With it, the customer can actually become an integral part of the electric power system He can then offer services to the system, such as the provision of the equivalent of "spinning reserves", in many cases at costs cheaper than those the system itself would incur

4 8 3 Internal Signals and Incentives

The single market / single price structure of the Wholesale Market has many advantages that make it an appropriate choice for Russia It also has potential drawbacks that need to be addressed The most important of these drawbacks concerns economic signals and incentives for additional transmission line investments In a single market / single price structure only RAO EES Rossii can see these signals and incentives, they are not obvious to the other entities in the system If RAO EES Rossii continually makes the appropriate transmission investments based on these signals, then the economic efficiency of the electric power system will be continually enhanced If they don't, it will be difficult to know whetehr they aren't and therefore difficult to know if the situation needs correction

Transmission line rights-of-way as routes for fiber optic telecommunication cables also offer RAO EES Rossii an enormous potential opportunity to obtain new foreign investment capital Foreign long-distance telephone companies are circling the globe with fiber optics to handle the rapidly growing flow of computer-generated data These companies are generally willing to pay substantial sums for access to secure sites for these lines These same rights-of-way, of course, offer RAO EES Rossii sites to make the communications investments necessary for economic dispatch (as discussed in the section immediately above) Foreign telephone investors might be persuaded to pay for these communications investments and for the transmission lines themselves

4 8 4 Training People

The new economic foundation for the electric power system cannot produce the full benefits that are expected unless the people that manage and operate the system know how to make it work Electric systems worldwide have very strong "cultures" (fixed

ways of doing things that every employee understands implicitly) The replacement of an old by a new culture can be a slow and painful process Without a considerable investment in training to hasten it, the change can take a generation to occur

The need for a new "Uniform System of Accounts" (USOA) for all entities in the Wholesale Market offers a good example The USOA is necessary for fair and transparent economic dispatch Without it the economic dispatch system will process inaccurate or even deliberately false data, and therefore will not achieve the desired improvements in economic efficiency Likewise, foreign investors will require that entities in the Russian electric power system display financial accounts that these investors understand and trust before they will be willing to invest substantial new capital into the system

But a totally new way of dealing with the concept of costs and the creation of financial accounts will require a massive program of training - for literally thousands of people - throughout the entire electric power system Not only will training have to impart new knowledge, skills, and abilities, but a whole new culture will have to be established Such a task cannot be accomplished successfully in a matter of months, perhaps two years or more will be required The sooner this process is begun, the sooner it will produce the anticipated benefits

CHAPTER 5

REGULATORY

To be provided by Latham & Watkins

CHAPTER 6

INVESTMENT STRATEGY FOR THE ELECTRIC POWER SECTOR

6 1 Introduction

The purpose of this chapter is to present the results and recommendations of the Working Groups on Securities and Finance and Investment Promotion of the US-Russian Cooperation on Restructuring and Privatization The work began one year ago and has continued throughout 1994 When this project was started one year ago, it was said that it would be possible for the power sector to develop new sources of financing and attract investors, but that it would not be easy One year later, there are positive signs and the process of identifying capital requirements, locating investors and meeting investor's criteria is well underway

A strategy for pursuing these investors is being implemented The strategy acknowledges that resolution of the payments crisis is key to both accessing new sources of financing and increasing the amount of internally generated funds for investment The strategy also envisions that over the long-term the Russian power sector will be financed primarily from domestic resources since the domestic nature of the electricity business cannot be fundamentally altered

However, the current investment climate of Russia, which in many respects is beyond the control of the power sector, is such that it could take many years before the long-term strategy will be realized Therefore the strategic focus over the next one to three years relies heavily on introducing project financing to realize new investments, establishing credit relationships with international and domestic financial institutions, seeking long-

term strategic partnerships, and laying the foundation for meeting the stringent financial and accounting disclosure criteria demanded by the international capital markets

In terms of a corporate strategy, it entails a combination of financial management, the development of legal, regulatory and tax conditions that favor investment, developing good investor, customer and government relations and pursing corporate development and strategic planning objectives

It is expected that capital requirements for the power sector will change over time Current critical financing needs are for working capital and funds for operations Over the next two years, these needs will expand to include requirements for completion of plants, rehabilitation and repowering of existing plants, transmission upgrades, and some new capacity in deficit regions

Over the medium term, extensive rehabilitation and repowering, new technology introductions, new capacity additions and other capital investments will be required and desirable This will happen in parallel with increased economic growth and will place heavy capital demands on the sector

Estimations of the amount of capital required for these time periods are preliminary For the purpose of this chapter the capital requirements range from a low of $1 5 billion per year (based upon current capital constraints) in 1994 increasing to $8 - $10 billion per year by 1999

The current investment climate of Russia is such that it could take years before the long-term strategy will be fully realized Although there are many positive signs that the investment climate is improving and domestic capital markets are developing, investors in

Russian equities and Russian Federation Treasury Bills are still demanding returns in excess of 100%, reflecting investor's perceptions of Russian risk

Access to different types of capital will depend heavily on the Russian power sector's ability to meet the criteria required by the investor and the pace of domestic capital market developments Many issues which affect the ability to attract financing -- such as the overall investment climate in Russia -- are not in the control of the power sector and yet they have a direct bearing on the ability of the power sector to attract foreign capital With this in mind, the power sector must work even harder to implement actions over which it has control in order to attract needed capital

Over time the sources of financing and types of investors will also change Currently, there has been virtually no access to third party financing and the only sources of financing are internally generated funds from customer payments and limited amounts from proceeds of shares through the privatization process

Access to loans from international financial institutions, export credit agencies and strategic investors is being developed For several reasons these institutions are the next most logical class of investor for the Russian power sector The World Bank, EBRD, OPIC and others already have a presence in Moscow through their lending operations in other sectors, they have all expressed an interest in principle in lending to the power sector Second, it is vitally important for the power sector to develop

credit relationships with medium and long-term lenders At the moment these are the only institutions lending on a term basis Third, although the sums available are small relative to the capital requirements of the sector, international financial institutions act as a catalyst in terms of attracting other lenders and investors

Official sources of financing could continue over a period of years, but more than likely they will be eventually displaced by equity and debt from international and domestic capital markets as well as by signficantly increased internally generated cash, some of which could be used for the payment of dividends

The lack of any significant amounts of long-term debt on the balance sheet of Russian electric companies puts them in a good position to attract long-term debt However, given the uncertainties regarding the timing of access to the debt markets, it is not possible at this point to estimate the ratios of sources of financing for a Russian electric company

6 2 Current Period — Capital Requirements and Sources of Capital

The main source of funds currently for RAO EES Rossii and the AO Energos is the receipt of payments from the sales of electricity to customers Currently, the payments crisis is inhibiting the receipt and use of the funds to meet the critical needs of the power sector, including payment of fuel expenses and maintenance expenses It is estimated that collection of payments is currently about 50% of total revenues It is commonly believed, but not known for certain, that if the payments crisis were resolved, the power sector would generate sufficient cash flow to cover most of its operating expenses

Both the Government of Russia and RAO EES Rossii have attached a high priority to resolving the payments crisis Current actions include increasing the non-cash component of payments, and implementation of a variety of programs of penalties, incentives and customer credits

Sales of additional shares of stocks are another potential source of financing for current and future capital requirements Although trading volumes remain low, the emerging

capital markets represents an important potential source of domestic financing Following completion of the voucher auction this year, the Government continues to hold 30 percent of the shares of RAO EES Rossii which in turn owns controlling shares in the 72 AO Energos The disposition of these shares could provide a source of financing in the future as well as the creation of a wide range of investment options for the Russian population RAO EES Rossii could also sell some of the shares it currently owns The next stage, sales of stock for cash, is about to begin

Customers must have an incentive to pay their bills Currently, the source of finance for operating expenses and capital investments comes from the payments receipts from electrical customers These customers must first of all be able to pay, and then they must be willing to pay These customers will demand reliable and efficient service at prices they can afford In addition, they will want to be treated fairly -- that is, if a customer is paying and another is not, the paying customer will want to receive better treatment They will need some incentives to pay and disincentives not to pay They will also be looking for alternative sources of power if the AO Energos or RAO EES Rossii do not provide for their needs in a reliable and efficient manner

Portfolio investors seek a high return on their investment, commensurate with perceived risk They need accurate company information and predictable earnings forecasts Purchasers need a liquid market for trading the stocks, which currently is underdeveloped in Russia The market will determine the share value, not the asset or book value, and thus the company must make itself attractive to the market

The price of RAO stock price has increased from $5/share in May 1994 to $30/share in September 1994 Many of the current owners of RAO shares are speculators and hedge funds that typically seek a short-term (1-3 year) return of 100% percent per year They

are willing to invest in RAO shares in spite of the lack of satisfactory financial information based on their perception that RAO shares have upside potential over the next year or so Many equity fund managers have expressed an interest in investing more money into the Russian equity market if the equities were available and the problems of custodial relations and regulations eliminated Equity shares of RAO are clearly perceived to be "blue chip" Russian equity due to RAO's size, scope for increasing tariffs and profits, and innovative management This could be an additional source of funding as more shares are released on the market

In the immediate-term, relations with customers are the most critical It is necessary to turn around the payments problem immediately This can be done through introducing incentives for those companies who can pay but are not paying to come current with their payments This could include discounts for early payments and preferential treatment for those paying customers in terms of supply reliability For those customers who are not paying, several ideas could be implemented First would be a "phase out" procedure whereby the power supply eventually will reflect their payments Incentives to reduce late payments due to inflation should be considered A credit history on customers payments records can be made public In all cases, fairness of treatment to customers, reflecting their payment status, should be maintained

Investors are critical to the future of RAO EES Rossii Attention should be given to developing good relations with investors, including official financial institutions As many classes and types of investors as possible should be pursued simultaneously In the immediate term, developing relations with financial press, brokers, commercial banks and strategic investors will be key The creation of a group to spear-head this process will be critical Their job can also be to educate investors on the special features of the Russian

power sector This can be done as well through enhanced financial disclosure and audited accounts

6 3 Next Two Years - Sources of Capital

In light of the credit risk problems facing the Russian Federation, the possibility of project financing becomes an important consideration Project financing can be structured in a way that isolates the financing from unacceptable country risks This year the working group on investment promotion has pursued with RAO the concepts and methodologies of project financing The group has taken a look at how power project financings were structured in other countries, including the United States, Hong Kong, Pakistan, and the United Kingdom Through the joint work of RAO EES Rossii and K&M Engineering and Consulting four projects were evaluated for their potential for foreign investment, primarily through project financing In addition, RAO visits to suppliers of project financing for the power sector were made recently in New York City In this meeting and during the course of our joint work, it has become clear that project financing packages for specific power projects can take one to three years to develop and cost several million in upfront development costs Returns of at least 20% per annum are expected by equity investors

It is important to note that several financial institutions are prepared to invest primarily on a project finance basis, including the Overseas Private Investment Corporation, the International Finance Corporation, the US Export-Import Bank, and perhaps the European Bank for Reconstruction and Development Thus, the need to develop adequate project financing proposals remains an important objective These institutions are ready to seriously review the project information developed this year by the Investment Promotion Working Group

The ability of the power sector to attract strategic equity investors has also been slower, but it is still positive It is important that the power sector develop more strategic alliances with foreign and Russian companies because it is these alliances which will assist the power sector to develop its future business interests and meet its long term investment requirements

Foreign official investors will require certain criteria in order to invest in the Russian power sector These include financial statements according to international standards, although not necessarily audited in the first instance The multilateral investment banks (EBRD, World Bank and IFC) will require identification of a cash flow in foreign exchange that will cover loan repayments Some loans may require guarantees from the Russian Federation and Ministry of Finance approvals Projects must demonstrate financial and economic viability (with adequate tariff levels and full cost recovery) The justification for a particular project must be made within the context of a least cost plan The technology used must be proven

Competitive bidding for equipment and services, whether a requirement or for economic efficiency reasons, must be achieved and verified Projects financed by official investors will be consistent with the policy objectives of the institutions including safety of plants, environmental soundness, energy efficient The financial arrangements should be tailored to each project Adequate collateral and documentation as well as legal enforceability will be required

As with domestic private sources of capital, foreign sources will demand a record of financial data, prepared and audited financial statements, and business plans Commercial banks will be looking for audited accounts, payments history of receivables, contract

enforceability, access to foreign exchange for repayment, and demonstrated ability to repay

Strategic investors will look for the potential success of the venture, with a rate of return in the long-term commensurate with the risk associated with the project They will want a relationship with the management of the firm that provides them with confidence in the information provided and in their ability to run the company and the project successfully Partnerships with industrial alliances are a good area to explore because of the many common interests shared by the power sector and industry

The G-7 countries (Britain, Canada, France, Germany , Italy, Japan, and the United States) are in the process of strongly supporting the economic reform process in Russia They endorsed a $43 billion package of bilateral and multilateral aid to Russia at the Tokyo Summit in 1993 based on implementation of a sound economic reform package Included in this package was $3 billion from a new facility (the Systemic Transformation Facility - STF) at the International Monetary Fund (IMF) which has been disbursed in 1993/94 and a $4 billion Stand-by loan and $6 billion currency stabilization fund which are still under discussion At the July 1994 Naples Summit, the G-7 added $5 billion to this package which included a further drawing of $2 billion from the STF, an allocation of the IMF's currency Special Drawing Right (SDR) of approximately $1 5 billion, and increased access under the Stand-by loan of $1 5 billion Continued support by the IMF will not directly provide financing for the Russian power sector, but it will improve the overall investment climate in Russia and send a positive signal to foreign investors

The power sector should pursue relationships with official international financial institutions These institutions do not number more than twenty worldwide, but their importance is not proportional to the amoung of money they lend or invest They are

willing to provide credits when other private financial institutions will not By working with them, individual AO Energos and RAO EES Rossii can develop a much needed history of credit repayments Once this has been accomplished, private financial institutions will follow

The numbers shown on the table below represent an achievable goal over the next several years These numbers have been provided by the institutions themselves as amounts of funding potentially available, assuming investor's criteria can be met

Table 6 1

Next Two Years Investment Criteria

Next Two Years	Investment Criteria
Official Investors	• Financial statements according to international standards, not necessarily audited • Identification of a cash flow for repayment in foreign exchange • Demonstrated financial and economic viability of project (adequate tariff and full cost recovery) • Justification of project need and fit with least cost plans • Competitive bidding for equipment and services > Proven technology > Consistent with policy objectives safety, environmental, energy efficiency and others issues specific to each institution > Adequate collateral and documentation arrangements -loan agreements, collateral security, escrow accounts, power purchase agreements
Strategic Investors	• Strategic necessity for the success of the venture (example oil and gas company acquiring reserves to build global market share, or aluminum company obtaining a low cost supply of electricity to lower its unit costs of production) • Long-term sustained return, not only measured by cash returns • Clarity of contractual relationship, which can be complicated Adequate enforceability of contracts • Relationship with management • Access to foreign exchange if strategic investor is foreign • Confidence in information provided • Willingness to accept unconventional terms and conditions

Table 6 2

Next Two Years Investment Tools

Next Two Years	Investment Tools
Tools and Structures	
International official investors have various tools for financing including	• Limited-recourse project finance • Export credits (with or without sovereign guarantees) • Special purpose investment funds • Political risk insurance • Private power structures • Other corporate financing techniques, e g , sovereign guaranteed loans
Strategic Equity investors have some of the same and several different tools	• Private placements • Power purchase and sales agreements • Direct ownership of projects or plants • Licensing agreements • Sale-leaseback agreements • Operation and maintenance agreements • Distribution agreements • Cooperative agreements with other electric utilities

Table 6 3

Next Two Years Investment Strategies, Procedures and Laws

Next Two Years	Strategies, Procedures and Laws
Financial Management	• Continue to resolve the payments problem • Value existing and future assets (plants, etc) by using net present value methodology
Legal, Regulatory and Tax Considerations	• Draft model contracts • Develop procedures for establishing contractual relationships • Recommend package of tax incentives
Corporate and Project Development	• Select projects that international institutions want to finance (eg fit their criteria) • Implement investment planning policies • Put out a show piece project for bid, for example, Krasnodar Gres
Strategic Planning	• Identify opportunities for strategic investors • Select strategic partners Suitable partners include organizations with access to capital or to foreign exchange, partners with common lines of business, technology partners or partnerships with large industrial customers
Government Relations	• Work with Government bodies such as the Ministry of Finance and the Ministry of Economy to access financing from international financial institutions • Recommend to GKI an approach whereby the proceeds from the sale of RAO EES Rossii and AO Energos are reinvested into the power sector

Table 6 3 (Continuted)

Next Two Years Investment Criteria

Next Two Years	Strategies, Procedures and Laws
Investor Relations	• Develop good working relationships with official financial institutions • Pursue many classes and types of investors and financing simultaneously and on a parallel basis, given the uncertainties of the investment climate • Educate investors on the intricacies of the Russian power sector Do this through increased financial disclosure and audited accounts as well as with the development of an investor relations department
Financial Innovation	• Consider raising funding requirements directly with the public The power sector could open and maintain a financial services network providing retail banking services as well as credit operations In this way the power sector would play a lead role in the development of domestic savings and capital markets • Be a leader in the development of domestic capital markets by issuing short-term debt securities similar to Ministry of Finance treasury bills This leadership role serves two important purposes it provides the sector with a source of financing for its capital and it provides the Russian people with an attractive and stable investment opportunity • Become one of the first Russian companies to list shares on the international market through ADR's • Become a leader in innovative funding mechanisms by developing financial structures for specific project financing and through the development of funding mechanisms for the industry as a whole • Develop a regional or centrally-owned financial intermediary for the power sector (Power Bank) In addition to providing capital, the objectives of the Power Bank could provide discipline and efficiency in project selection, leveraging of limited financial resources, and become a lender of last resort

6 5 Beyond the Next Two Years - Access to the International Capital Markets

to be written by Price Waterhouse

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D R A F T

Russian and American Cooperation in Electric Power Sector Privatization and Investment Promotion

Working Group C
Securities and Financial Markets

Phase One - Final Report
Chapter 6

Elements of Investment Strategy

The capital requirements of the electric industry in Russia require that RAO position itself to compete for capital from investors around the world These foreign and domestic investors will look critically upon the Company's operations and management performance before making the favorable investment decisions that will provide the basis for RAO's future growth and success This chapter reviews the work of Working Group C -- Securities and Financial Markets -- and discusses the principal areas of that group's investigation

1) Accounting and Financial Disclosure
2) Asset Management Issues
3) Penetration of Russian Financial Markets, and
4) Approaches to Western Securities Issues

Accounting and Financial Disclosure

In order to be successful in the competition for capital, RAO must (a) maintain its financial records in strict conformity with generally accepted international standards and (b) make those records available to current and potential investors for their inspection and analysis

The basic information package presented in US style annual reports consists of

a) audited financial statements consisting of two years' balance sheets and three years' statements of income and cash flows,

b) management's discussion and analysis ("MD&A") of financial condition and results of operations for those three years, and

c) selected financial data for five years

The MD&A must focus on the three key aspects of liquidity, capital resources and results of operations The detailed contents of the discussion and analysis are governed by a specific SEC regulations

US GAAP requires strict adherence to the historical cost convention It is not possible to revalue upwards property, plant and equipment or investments This principle of the pre-eminence of historical costs is consistently followed throughout US GAAP

Asset Management Issues

Currently the financial functions within RAO are divided structurally into six divisions or directorates 1) Finance, 2) Capital Budgeting, 3) Contracting, 4) Collections, 5) Securities Management, and 6) Accounting It is the intention of management over the long term to collapse the financial function into perhaps three directorates As a first step in this direction, the Asset

111

Management Directorate, a new unit, was created and given three specific activities

1) Improve collections of accounts receivable through the bills of exchange mechanism as is done currently

2) Invest residual cash available at the level of the holding company into marketable securities listed on the International (or Russian) stock exchanges

3) Leverage capital ( ) through a variety of activities, e g (a) prepare prospectus for the issuance of debt or equity securities ( ) in the public markets, (b) identify strategic investors for selected privatization and presumably (c) design and conduct an IPP ( ) program These activities would have to be coordinated within the energos

Within the new directorate the immediate focus of activity must be the liquefaction of receivables ( ) Cash management and capital leveraging are not near term activities, although capital leveraging will require enormous preparation prior to approaching the market

The foundations for successful capital leveraging have to be put in place These preconditions may include, but are not necessarily limited to

1 Completing the ongoing process of converting RAO financial statements from Russian to internationally accepted accounting standards

2 Consolidating financial statement of RAO with those of its subsidiaries and its affiliates

3 Securing a credit rating ( ) from rating agencies such as Standard & Poors, Moody's, or others for both the Russian Federation and RAO

4 Ensuring an adequate legal and regulatory framework that is synergistic with the objectives of leveraging capital

5 Defining what kind of organization RAO will be ten to fifteen years from now (Forward visioning by management is one of the keys used by investment and commercial bankers to determine how credit worthy RAO is likely to be over the long term)

6 In the context of (3), (4) and (5), defining what kinds of capital leveraging RAO wants to initially rely upon For sound reasons, two good choices might be (i) bond issuances to finance own generation, transmission or distribution activities, ( ) and (ii) Build-Own-(Operate)-Transfer (BOT) variations to ( ) create wealth through additional capability

7 Understanding services rendered by the international financial community in respect of the capital leveraging which RAO management chooses to rely upon, e g main players, reputation, role of mandates,( ) what to include/exclude in a mandate, fees, other services, etc

The investment of residual cash into marketable securities will also require some preparation From an executory perspective, the functions require policy definition in the following areas

1 Attributes of acceptable investable securities in terms of issuer's credit rating, term, yield, currency, type of security, etc

2 Maximum that can be invested in one or more securities denominated in one currency, one country's securities, etc

3 Procedures to be followed when taking investment positions including permissible delegations of authority

4 Conducting end-of-day reconciliation

5 Scope and content of auditing function

Procedures in respect of the above should not be viewed as controls, rather they assist in defining the boundaries within which the unit can operate freely

Cash Management

The difficulty with RAO cash collection of accounts receivable is an important problem plaguing RAO's cash flow and limiting RAO's capital improvements and maintenance project funding Currently, approximately 14 trillion rubles are owed to RAO through the energos and represent 30 percent or more of RAO's current assets This debt is expanding rapidly due primarily to unfavorable economic conditions and tariff increases recently implemented by RAO companies

The research performed has verified that accounts receivable is an urgent issue requiring the adoption of new business practices by RAO Further, present economic conditions in Russia along with planned tariff increases in the electric industry are expected to worsen this problem in the near future Because it is vital to RAO's financial health and its ability to raise capital in financial markets, the importance of improving cash flow by resolving the accounts receivable problem can not be overstated

Several factors are contributing to the growth of RAO's accounts receivable Among these are poor general conditions characterized by declining production and a high level of inflation The decline in production has resulted in cash flow problems for many business enterprises which are RAO customers These cash flow difficulties prompt companies to delay or omit payment for electrical service

Compounding the cash flow problem is hyper-inflation The absence of effective late payment penalties coupled by RAO with the ability to delay payment and subsequently settle accounts in devalued rubles continues to cause companies to intentionally accrue debt

A third factor, particularly in RAO energos which served formerly highly subsidized industries is the impact of the reduced federal budget For example, Khabarovskenergo services a region which has a considerable military complex Information provided by Khabarovskenergo management indicates that 40 percent (80 billion rubles) of the accounts receivable (200 billion rubles) are attributable to military accounts Payment of these accounts is, of course, tied directly to the federal budget crisis

Finally, as energos have begun to increase tariffs closer to market prices and operating costs, energy has become more expensive and a larger segment of private and enterprise costs Consumer reaction has been to neglect or delay payment This can be expected to worsen non collection in the short term as energos have plans to increase tariffs which will increase both revenue and the accounts receivable

The limited data supplied to us confirms that the focus of solving the accounts receivable problem should be upon the large volume customers Large enterprises account for 80 per cent of the 14 trillion rubles owed to the energos While the amount owed by residential customers is also large --

approximately 2 8 trillion rubles -- this amount is owed by a large number of customers and focus upon this customer group would require an extremely broad-based collection effort Accordingly, the energoes should initially focus attention upon the smaller number of customers that both individually and collectively owe the greatest amount

The nature of the accounts receivable problem varies from region to region For example, our analysis of the accounts receivable data supplied by Khabarovskenergo disclosed that outstanding debt is occurring at the rate of about 3 8 billion rubles monthly As of April 1, 1994, 200 billion rubles were outstanding with nearly three quarters of this debt having been accrued during the 1993 heating season This demonstrates that growth is relatively new and that district heating plays an important role in the overall accounts receivable picture

By contrast, Kubanenergo, a company with a larger customer base but situated in a warmer climate, has a lower level of accounts receivable are lower in total apparently because of much lower district heating requirements and the general economic affluence of the region

Vastly different findings within the two regions visited suggest widely different accounts receivable problems among the 72 energos serving Russia Moreover, it should be determined how much of the debt is associated with district heating versus electrical consumption

The following are some of the approaches employed by the Energonadzors in attempting to collect payment for accounts receivable

a Late Payment Charges

Energos are permitted to apply late payment charges to encourage timely settlement of accounts Because of volatility in Russia's inflation rate it is difficult to determine the effectiveness of late payment charges applied to customer account balances With the growth in customer debt it is logical to presume that late payment charges have been ineffective probably because the rate charged is lower than inflation and, consequently, is viewed as little or no penalty by consumers To be an inducement for consumers to pay on time, late payment charges must be set at a rate significantly above the inflation rate

b Bills of Exchange

A large number of account balances are settled via the use of Bills of Exchange These transactions can be initiated either by the debtor or the Energo and involve a formal agreement to exchange materials or services for accounts receivable debt forgiveness To use a Bill of Exchange, the debtor initiates a formal agreement through a bank An interest rate is charged by the bank Bills of Exchange take on the character of commercial paper and can be used in a chain of transactions involving several business customers of the energos

c Barter

Like Bills of Exchange transactions, barter entails the agreement to accept goods or service in exchange for a write down of accounts receivable These transactions usually involve only the energo and a debtor customer who produces a product useful to the energo As in the case of Bills of Exchange, these non cash agreements impair the financial position of RAO by reducing RAO's cash flow

d Service Disconnection

The termination of service option is used very sparingly due to constraints by Government and pressure by regulatory regional regulatory commissions

Energonadzor management expressed concern for the strict limitations imposed on service disconnection indicating that both business and residential consumers seldom take attempts to resolve debt problems seriously because of the lack of any consequences if no payments are made

As tariffs are increased to reflect current operating expenses, it is likely accounts receivable outstanding will continue to increase and the growth in accounts receivable will accelerate The constraints to effective management will become increasingly important

Taxes are a significant portion of RAO's operating expense Under current tax regulation, tax must be paid on all revenue, collectible or not Such regulation penalizes RAO as taxes must be paid on revenue which will, in some cases, never be collected Tax law changes should be considered which allow RAO to pay taxes only on collected revenue

Penetration of Russian Financial Markets

By far the easiest method to issue securities for ownership equity is to issue such securities locally in Russia Some major foreign investment organizations have already formed investment funds to purchase such securities in Russia, many new foreign investment funds are presently planned The advantage of this approach is that RAO will not have to meet extensive foreign disclosure requirements On the other hand, the managers of such foreign investment funds are sophisticated and will require a range of financial information to be disclosed before these investment funds are willing to invest Nevertheless, the legal reporting requirements will be less burdensome than if funds were sought publicly in the United States

Major western investment houses have entered the Russian marketplaces and are trading directly from inside Russia These Western investors include CS First Boston, National Westminster Bank, and Citicorp Other major funds include Baring Asset Management, and Framlington

The greatest constraints to RAO in the raising of funds are the lack of well defined property ownership rights in Russia and the lack of well functioning Russian markets for financial instruments The Russian government is presently taking a number of actions to create a legal framework that will provide a conducive environment for the development of well functioning securities markets

To date, USAID has financed the creation of two depositary and settlement centers in Moscow and St Petersburg The plan is that these centers will operate as self-regulated market bodies and create a pool of nominee share ownership The implementation of these USAID financed plans will increase the liquidity of Russian stocks and therefore make it easier for Russian companies to raise funds through share issuance

Presently, all securities in Russia are "registered securities" This means that when the holders of these shares transfer their shares to new purchasers, each company must record the transfer in its own share register There is no central registry of shares To register transfers of shares, the new purchaser must inform the company of the purchase and complete formalities for registration This process may take weeks to complete, thereby constraining the ability to buy and sell company shares

Development of Stock Management Strategy

Decisions as to how to raise funds should be based upon the corporate goals of RAO The issuance of securities that give equity ownership to new investors or more to additional investors creates the prospect of a new dominant shareholder or a new dominant collection of shareholders

115

The private placement of equity ownership stakes will provide the next most likely source of funds that will enable current shareholders to maintain their dominant position However, depending upon the rights associated with such shares and the proclivities of the owners of the new shares, the current position of dominant shareholders may either be strengthened, maintained, or threatened

The public placement of equity ownership stakes could threaten the current position of dominant shareholders depending upon the rights associated with such equity ownership shares

Accessing Capital Markets

RAO has four vehicles for the raising of funds from the investment community to finance RAO's physical assets and operations equity financing, commercial credit financing, bonded debt financing and project financing Any or all of these methods require that the following actions be taken by RAO

Record Financial Data This step entails collecting financial data on RAO and RAO subsidiaries This financial information is essential to the development of financial statements Financiers will utilize these financial statements to decide how to structure the terms of their investments in RAO

Obtain Specialized Financial Expertise This step requires consultation with financial advisors to initiate processes to raise capital on favorable terms to RAO in ways that will help RAO to achieve RAO's objectives

Attain Flexibility in Operations and Financing This process will enable RAO to obtain the best terms when financiers offer to invest in or lend to RAO RAO will attain flexibility in financing by increasing its collections RAO will attain flexibility in operations by its efforts to improve all aspects of its business activities Specific activities that RAO will wish to undertake in this regard are those that will assist develop a basis for a conducive regulatory environment to ensure RAO has access to sufficient revenues in the future

Develop Business Plans The development of business plans will allow RAO to market specific projects to financiers Business plans may entail efforts to reorganize RAO, to develop specific projects to finance, and to leverage both RAO and RAO subsidiaries through debt These business plans will guide RAO investments activities

Prepare Audited Financial Statements The preparation of audited financial statements will assist RAO to obtain financing from financiers and from stock exchanges These financial statements are necessary for RAO to obtain financing on a US stock exchange

Prepare Prospectus A prospectus will be developed for each particular business plan marketed to investors The prospectus will provide financiers information about RAO's planned use of the funds that RAO is seeking The prospectus should also provide information about the economic and legal context of the entity into which the funds will be directed

Identify Potential Lenders and Investors Once RAO has completed the previous steps, RAO will be in a good position to identify and then approach potential lenders and investors Potential lenders include international financial institutions such as the International Bank for Reconstruction and Development (which is called both the IBRD and the World Bank), foreign governments, suppliers, commercial bankers, and financiers Potential investors include private investment funds and private financiers, as well as investors who invest via world capital markets At this stage RAO will have the information necessary to begin the process of negotiating with lenders, investors, and underwriters

Recommendations

Accounting and Financial Disclosure

1 Prepare financial statements in accordance with International Accounting Standards ("IAS") as a supplement to the balance sheet required by the tax authority This will entail the following significant changes

2 Prepare the equivalent of a "Management's Analysis and Discussion" which would summarize current financial plans with respect to liquidity, capital resources, financing and construction activities

3 Make the financial statements and management analysis available to stockholders of the company and other interested persons

4 Develop an efficient mechanism to develop consolidated financial statements on a timely basis This could involve a PC-driven solution in which the various subsidiaries and affiliate companies submit a trial balance to RAO electronically

5 Perform tax planning In the Russian system, a balance sheet is prepared for the tax authority for each legal entity No consolidated tax return is permitted In the absence of any possible change by the tax authority to permit consolidated reporting for tax purposes, there is a potential to reduce tax expenses by combining loss companies with the parent or other profitable entities

6 Monetary assets, such as trade payables and receivables, are not indexed for inflation IAS 29 requires assets and liabilities linked by agreement to be carried at an adjusted amount in the balance sheet RAO should study the possibility of revising its contractual relationship with its customers to require an inflation adjustment increase if payment is not received within normal terms RAO should be willing to offer similar terms to its vendors and suppliers

7 To further accelerate collections, RAO and its regional affiliated companies should consider implementing a "phase-in" plan whereby continued service to ultimate customers would be subject to termination if some agreed-upon percentage of prior arrearage is not paid

8 A dividend reinvestment plan should be considered to allow shareholders the opportunity to reinvest their earnings, thus increasing cash flows available for other purposes Such a plan would be attractive to some investors who wish to avoid a dilution of their percentage ownership share in light of the apparent decision of the State to reinvest its portion of the dividend recently declared

9 Recovery of financing costs incurred during the construction period for self-constructed assets is essential and is provided for in the accounting and ratemaking schemes of many countries Such costs are considered a part of the cost of the assets and recovered over time through depreciation charges

10 The efficiency of the accounting process would greatly be enhanced by the development of a computer network which would process information within RAO EES Rossii as well as among its various business units The greater use of a computer within each department would also facilitate the development of a management information system which will be required by The Company as it seeks to achieve its market-oriented goals User-focused computer training would be required to implement this recommendation

117

Asset Management - Accounts Receivable

1 RAO should act in an advisory role with regard to resolving the accounts receivable issues through the Asset Management Directorate Specific issues of interest for this Directorate would include the following

a Energo policy formulation for the collection of accounts receivable inclusive of the planning and use of Bills of Exchange and Central Bank issued bonds,

b development and execution of Energo credit and collection strategies to maximizes the value of RAO cash reserves,

c and, planning for cash handling procedures and the investment strategies to maximized the value of RAO finances

Policies and programs for the collection of accounts receivable rests with the individual Energos and the Energonadzor function As extensive changes in collection policies will be considered, it is recommended that a committee of Energonadzor managers be organized to provide a forum for discussing collection methods and experiences gained from the adoption of new methods

2 Reliance on Bills of Exchange in the settlement of accounts is growing as the banking system has begun facilitating this process and as a result of the Presidential Decree authorizing the use of Bills of Exchange The use of Bills of Exchange should be continue but only as a short term measure to control accounts receivable The following programs should introduced during the phase out of Bills of Exchange

a Late payment charges should be increased to reflect the inflationary impacts of the economy, i e late payment charges should be set at rates above the existing inflation rate

b A further measure to influence prompt settlements would be the adoption of a timely payment discount By assessing the average period of payment for present settlements, RAO will be able set a time period during which the prompt payment discount would be in effect, i e , payment made prior to the expiration of this time period would result in a percentage discount to customers

c Implement a deposit program ( ) requiring slow paying customers to pay a security deposit

d Offer a levelized billing program to reduce seasonal cash flow and customer payment difficulties Such a program would enable businesses to pay a standard amount each month based on projected annual costs for energy related service

e A formalized theft of service program should be instituted Customer accounts should be periodically inspected for declining usage using parameters design to uncover energy use not registered on metering equipment

f Consolidated statistical reporting should be developed to provide both Energo level detailed reporting and a series of "roll-up" reports at the RAO level These reports should be available to the appropriate Asset Management Directorate and Energonadzor staff as a debt management tool( )

g To assess the impact of inflation, accounts receivable should be indexed in some manner A study should be commissioned to determine the proper indexing methodology

h Regional accounts receivable impacts should be studied These studies will act as a guide to implementing a variety of alternative debt resolution programs as outlined in these recommendations

i Accounts receivable should be dis-aggregated to disclose the impact of district heating and electrical consumption on each Energo and the RAO sums

j Develop specific performance measures for the management of accounts receivable Further, use of electric industry standards for other countries, RAO and Energo performance can be benchmarked to Western companies using statistics available from organizations such the Edison Electric Institute

4 RAO should influence Regional Energy Commissions to establish formalized rules for collecting accounts receivable and the termination of service Such rules would include

a The establishment of "Requirement to Serve" rules which set forth the circumstances by which RAO companies are required to serve customers and, most importantly, the obligations of customers including their requirement to pay for service in a timely manner

b Expanded service disconnection authority

5 In order to achieve the maximum effectiveness with the array of new collection programs, a systematic program of publicity should be developed The risk of non-payment of energy bills must be understood and the changes introduced by RAO can be greatly enhanced in effectiveness through public awareness

6 An analysis of software requirements for the procesing and management of accounts information should be conducted

7 Routine accounting reports should be designed to track the influence of accounts receivable and uncollectible on RAO's financial positions Within the framework of converting to Western accounting practices, establish an accounting reserve for uncollectible losses Rules should be initiated to periodical write-off accounts receivable for financial records when further actions will not result in payment

Appendices
Task 1 Report - Accounting and Financial Disclosure
Task 2 Report - Asset Management
Task 3 Report - Securities and Financial Markets

CHAPTER 7

RECOMMENDED TRANSITION PROGRAM FOR THE ELECTRIC POWER SYSTEM

7 1 Introduction

Both Russian and American joint study participants understand that restructuring Russia's electric power system will take time The length of this period of time, referred to as "the transition period" in which preparation for and initial steps toward implementation occur, has elicited considerable discussion

The team concluded that approximately 7-10 years would be required It will take that long because the process involves not just a restructuring of the business' economics and a reorganization of the system's structure, but also a comprehensive cultural and organizational transformation, something that has not existed in Russia for decades Virtually every aspect of the business must be re-established systems, staffing, skills, style, strategy, organizational structure

The process of defining the transition stage contains inherent difficulties it must be comprehensive, and yet the process of implementation itself will also act as an agent of further changes Two elements are required to overcome these difficulties First, a framework that gives context and organization to the transition agenda is needed Second, a process of transition management which follows the transition agenda must be put into place This chapter will consider both elements

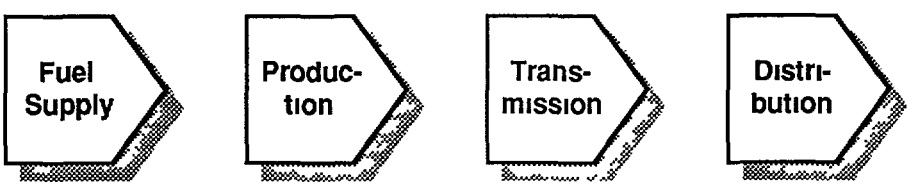
7 2 The Scope Of The Transition

Russia's electric power system is the largest in the world From the standpoint of geographic scale alone restructuring this system is a monumental undertaking But scale is just the tip of the iceberg The recommended changes involve transforming the system structure from that of a single large integrated national monopoly to that of a complex disaggregated competitive industry This transformation also increases the uncertainty (and therefore the appearance of risk) in the system in order to ensure that it becomes and remains economically efficient over the long-run

One of the most useful ways to appreciate the scope of the restructuring effort, and therefore the magnitude of the transition agenda, is to examine each segment of the system in which value is added to the product Chart 7 1 summarizes this "value chain" [1]

Chart 7 1

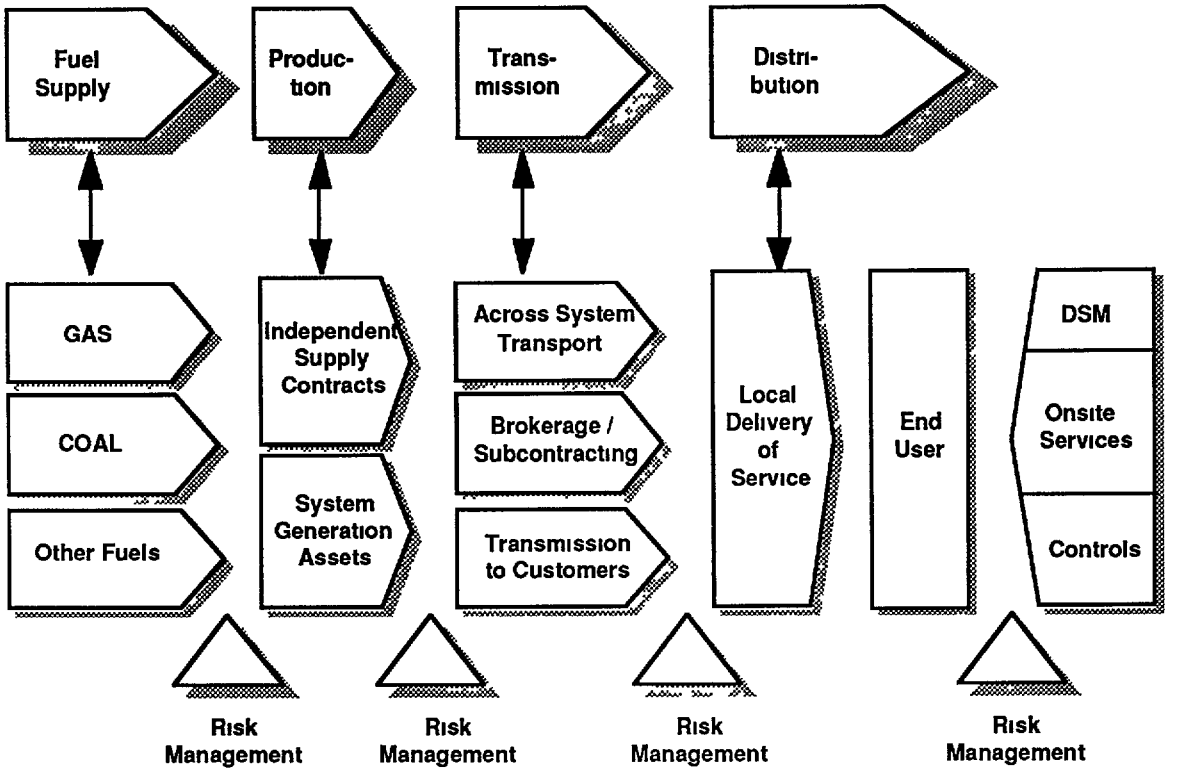
The Traditional Value Chain Of The Russian Electric Power Sector



The traditional value chain was a simple set of steps all of which were controlled by a single state-owned monopoly Fuel was acquired and converted into electricity which was, in turn, transmitted and distributed to end-users The structure that will replace this traditional value chain is far more complicated, as depicted in Chart 7 2

Chart 7 2

The New Value Chain Of The Russian Electric Power System



Fuel supply, once a monopoly integrated into the electric power sector, will become a competitive system of its own Gas, coal, and other fuels will compete in the marketplace

Power production traditionally existed as part of the integrated power system of Russia In the restructured system, independently owned and operated generating companies will compete for customers RAO EES Rossii and the AO Energos may also retain some generating capacity to ensure system reliability

Fracturing of the fuel supply and power generation monopolies into competing entities introduces new risks They include concerns about price, availability, and reliability of fuel supply over time Generators may want to hedge these risks by developing multiple sources of supply and, perhaps, by structuring certain of its power supply services offerings so that temporary reductions in output can occur safely

As fuel supply and electricity generation are fractured into competing markets, transmission will remain integrated New demands will be placed on it, however In order for a competitive electric power system to operate, transmission must be open to all suppliers and customers Transmission must therefore be viewed in three "competing" dimensions

- Competition for access to the transmission system, especially in areas where there are transmission constraints,
- Competition among brokers who buy rights to transmission and leverage those rights to bring suppliers and customers together,
- Competition between high-voltage transmission and low-voltage distribution for certain customers

Risk hedging will actually become a necessary and critical new function for all entities in the electric power system The importance of risk management will foster the birth of new business entities to manage it Indeed, a new supplier, the broker, will develop under the design terms set forth in these recommendations

Finally, an entirely new domain of competition will develop Users of electricity, especially large ones, will be able to increase their control over the amount and type of

their energy inputs This will be done by introducing traditional demand management programs, by installing on-site generation, and by implementing process controls that reduce energy consumption while simultaneously increasing productivity and product quality

7 3 A Framework For Establishing A Transition Agenda

If the focus were simply on structure, the changes recommended in this report will appear to be less significant than they actually are The magnitude of the restructuring becomes more apparent and more profound when an organization change and management perspective is added to the equation The organization development literature in the West offers a rich field of insight into the requirements for significant organizational change

McKinsey and Company, one of the world's leading management consulting firms, has argued that successful organization change requires the systematic change of seven related variables strategy, structure, systems, staffing, skills, style, and shared values

The Massachusetts Institute of Technology "Management in the 1990s" Research Program offers another perspective This group of distinguished researchers concluded that effective organizational transformations (which are required to adapt to the new information technologies of the 1990s) involve four domains of change

- Change in competitive strategy,
- Change in the structure of the organization,
- Change in individual roles and responsibilities,

- Change in information technology

Restructuring of the Russian electric power system involves even more than either of these approaches suggests Nothing short of a total organizational transformation This transformation involves migration from a single "machine bureaucratic" organizational form to a new mix of forms divisionalized forms, professional bureaucracies, and adhocracies

A machine bureaucracy, typical of government bodies, is old, large, and is controlled by largely non-automated technical systems Tasks are highly specialized, behavior is highly formalized, and the structure of the organization dominates its decision-making Machine bureaucracies must operate in a stable environment Their prime organizing principle is the *standardization of work processes*

A divisionalized form of organization is typical of corporate enterprises with many lines of business It's primary means of coordination involves *standardizing outputs* making products and moving them to markets The key managerial cadre is the organization's middle managers The organization's divisions are usually focused on specific markets If, for example, a generating company were to serve both AO Energos and large industrial customers, it might have two distinct operating divisions, one focused on each market

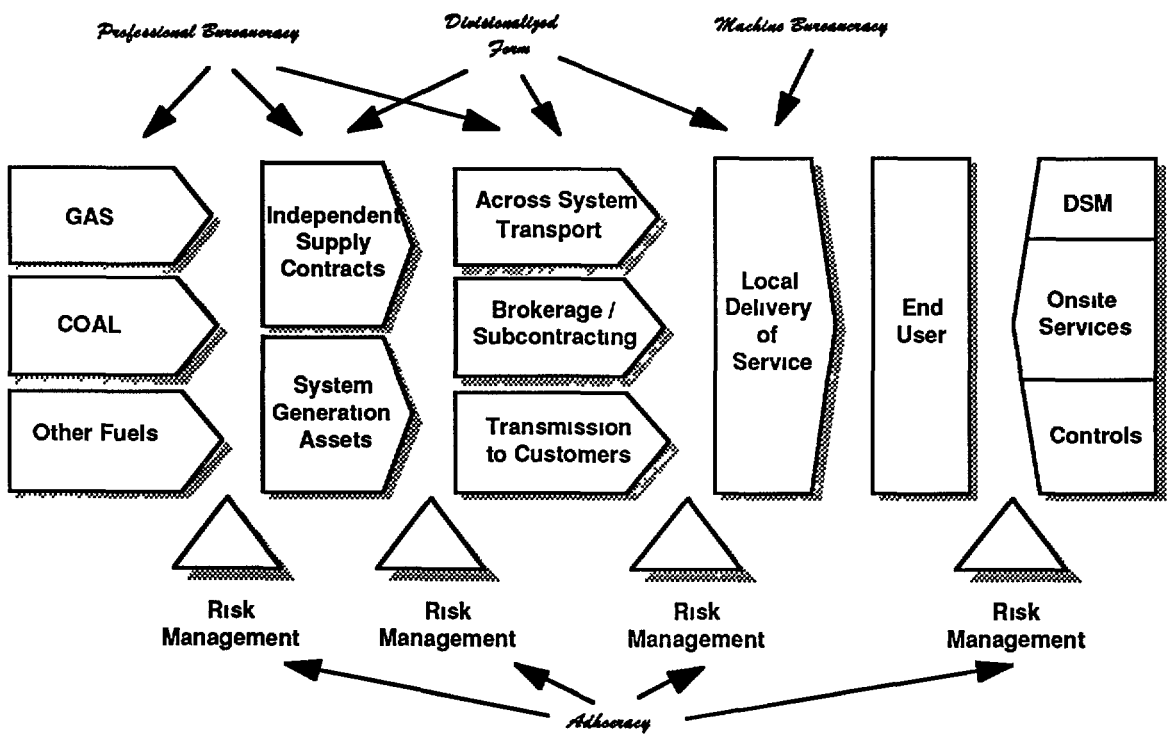
Professional bureaucracies are typical of service companies like consulting, accounting, and brokerage firms *Skills are standardized* and used as the principal means of coordinating actions within the organization The business's operating core is its most important structural component the "doers" of the organization are also its decision-makers Professional bureaucracies tend to be "horizontal" structures with few management layers Independent power developers are good examples

Adhocracies are a loosely structured organizations with little formalization of behavior They tend to assume a variety of temporary configurations based around individual projects or short-lived markets Brokerage and risk hedging services entities have many of these characteristics

These many organizational forms can be seen as emerging and evolving in the restructured electric power system Chart 7 3 illustrates

Chart 7 3

The Emerging Diversity Of Organizational Forms In The New Value Chain Of The Electric Power System Of Russia



The transition agenda itself cannot create detailed organization structures for each step in the value chain because market conditions and competitive strategy will also affect the

shape the actual structures Nevertheless, the transitional agenda should include the essential building blocks that such a monumental transformation will require

Three organizational design factors must be included in the transition agenda to ensure that it is sufficiently robust

(1) *Systems of flows* Organizational structures involve complex flows of materials, information, authority, decision-making, and capital

(2) *Structural parameters* All structures are defined by parameters such as definitions of functions, the formality of behavior, training, the size and grouping of units within the structure, lateral linkages for planning and control, and lines of decision-making

(3) *Contingency factors* Factors, such as the organization's age and size, the status of its technical systems, the environment in which it operates, and the conditions of power and influence that govern it, place barriers and constraints on its structure

Using the restructured value chain as a framework, and the factors noted above as guides, a comprehensive inventory of restructuring issues can emerge Chart 7 4 summarizes

Chart 7 4

Transition Agenda For Restructuring The Electric Power System Of Russia

	Fuel	Generation	Transmission	Distribution
Systems Of Flows				
> Material	• Fuel sourcing and contracting ←	• Equipment sourcing • Inventory controls Fuel Supply &	• kWh flows • Plant & equipment sourcing Heat Pricing →	• kWh flows • Plant & equipment sourcing →
> Information	• Market & cost data →	→	→	→
		Accounting & Control System →	→	→
		SCADA →	→	→
		Benchmarking →	→	→
> Authority	• Contracting & sales →	→	→	→
> Decisions	• Cost-based competition →	→	→	→
		← Dispatch	Improvements →	→
> Capital		← Ownership	Changes →	→
		← Investment	Process →	→

Structural Parameters				
> Func-tional focus	• Cost competitive prices ← Regulatory	• Production management ← Liscensing	• Network management → Definition	• Network management →
> Behavior formaliza-tion	• Negotiating of contracts ← Pricing	← Uniform ← Dispatch ← Regulatory	System of Improvements → Definition → Regimes →	Accounts →
> Training	• International bidding practices • Risk management	• International bidding practices • Project development • Risk management	• Settlements function management • International bidding practices • Information intensive economic dispatch	• Customer service • International bidding practices • Risk management
> Unit size/ grouping		Organization	Development of	Companies
> Lateral linkages planning & control, liaison devices	• Fuel forecasting and planning • Risk hedging programs • Customer relations	• Production planning	• System planning • Regulatory review processes	• Resource planning
> Decision making lines	• Strategic planning →		• Supplier of last resort →	

Contingency Factors				
> Age & size	• Fuel mix	• Asset mix	• Network flexibility	• Network flexibility
> Technical systems	• Quality control	• Quality control	• SCADA	• SCADA
> Enviroment	• Controls →	→	→	→
> Power	• Prices & price methodology →	→	→	→

A successful transition to the recommended final structure will require systematic attention to the issues identified in Table 7 4 There are limitations to this approach The agenda is unwieldy because issues overlap and their number seems overwhelming But these issues actually fall into two main groups

(1) The introduction of new principles of operations and management, and

(2) The resolution of problems related to investment

New principles of operations and management pertain to improvements in dispatching, operations, sourcing, and asset mangement The resolution of problems related to invesmtent involves matters of asset management, financing, legal, and political climate

One of the principal factors that prompted this program of reorganization and privatization of the electric power system is the desire for greater economic efficiency The efficient use of economic resourses (investment capital, labor, technology, and natural resources such as fuel) involves (among other things) the rigorous control of costs This is far more easily said than done To control costs you first must know what they are And to know what they are you must have an accounting system that

i) identifies each type of cost accurately and unambiguously,

ii) tracks each type of cost rigorously, and

iii) displays these costs clearly in a "transparent" set of accounts

If each entity in the electric power system were to have a different method for identifying, tracking, and displaying costs, then comparing costs among these entities would be difficult and therefore the appropriate dispatch of generating plants would also be difficult

The search for greater economic efficiency will be greatly enhanced by the establishment of a "Uniform System of Accounts" which all entities in the electric power sector will be obliged to use The establishment of such accounts is not enough Accounting personnel and managers must be trained thoroughly in their proper preparation and use If such training is not given and the data that the accounting system tracks are therefore poorly collected and organized, then even the most rigorous and transparent of accounting systems will supply faulty information for decision-making and the desired improvements in economic efficiency will not occur

The use of a "Uniform System of Accounts" creates a second important method of increasing economic efficiency It is called "benchmarking" Benchmarking involves

- the identification of organizations and operators that manage costs particularly well (only the use of the "USOA" makes this identification possible),
- the identification of these operators' practices and procedures that permit such a low-cost operation, and

- the transfer of the knowledge of these practices and procedures from the most successful operators to other organizations and operators in the electric power system

Such a transfer of technology and experience is an essential tool for increasing the efficiency of the entire system By this method, "best practices" can be spread throughout the system quickly and thoroughly

Once the USOA and benchmarking are established some other important building blocks for supporting operations in a competitive system can be created

- Management of both generation and the high- and low-voltage networks can focus on productivity enhancements and continuous improvements of technology These are the sources of cost savings, competitive advantage, and quality improvements

- Planning for future system needs and resource requirements can be done with reliable information This reduces risks of over- or under-estimating future demand, thus improving the precision with which the electric power system can acquire capital

- Better information helps improve investment priorities, thus increasing the stability and predictability of the system, attributes that the investment community values highly

- Better asset management, which involves optimizing all aspects of the electric power system, becomes possible with more reliable information

The restructured electric power system will require an important new set of skills concerning the acquisition of material inputs to production, plant and equipment, and other new resources such as capital The process of acquiring these needs is referred to as "sourcing" Sourcing is increasingly done through international bidding processes to ensure the lowest cost/highest quality inputs

A entirely new dimension concerns managing risks in a market-based competitive system Risk management must be developed and used throughout the entire value chain It will not be used equally effectively by all competitors and it will therefore become a principle differentiator of winners and losers in the competitive environment of the future

Pricing will also be a major factor in the effectiveness and ultimate success of restructuring

Fuel-Supply and Heat Pricing

During the transition phase the electric power system can offer an attractive example of the benefits of privatization and reorganization to other basic industries in Russia To do so, the electric power system must stay ahead, but not too far ahead, of the others If it moves too far too fast, then it risks becoming isolated island in a potentially hostile sea, cut off from the mainland economy

The electric power system's future is strongly influenced by the availability and price of fuel (its single largest component of cost) and by the price of heat These commodities are still based on the old structure of "command" economics and they have the potential to hold the new market-based economics of the electric power system hostage One

potential solution to the heat pricing problem has been mentioned in Chapter 4 above and will be discussed in greater detail in Appendix ?

Solution of the fuels pricing problem, however, will be enormously more difficult In particular, the coal price that the electric power system pays (the only market for many of Russia's coals) carries immense political implications Coal miners lead difficult lives and they generally have no other source of employment The United Kingdom has wrestled with its coal industry's lack of competitiveness for almost three decades and has, even now, failed to resolve the problem completely

Gas presents a different, but just as severe, a set of problems The gas industry is both a supplier to and a competitor of the electric power system If gas prices for power generation can be controlled by "command", then the gas industry has the opportunity to place the power system in a vice, pushing its costs of generation up on the one hand, and pressing its revenue potential down on the other, by setting gas prices at different levels for different customers Resolution of this fuels cost problem will require the electric power system's careful political attention early on in the transition phase

Electricity Pricing

Chapter 4 describes (and Appendix ? discusses in greater detail) the basis for setting electricity prices after the transition phase is complete At that time prices will be based on the marginal cost of generating, transmitting, and distributing electricity Russia's immediate leap to this pricing structure, however, is impractical, if not impossible

First of all, no one has sufficiently-good data today to demonstrate what these costs actually are And no one will until a Uniform System of Accounts is installed in every

electric system entity and system personnel are thoroughly trained in its use Secondly, the electric power system's economic dispatch hardware and software and its communication links between the dispatch centers and the other system entities must be substantially expanded and enhanced in order to make effective use of the USOA cost data Thirdly, large industrial customers (at a minimum) must be fitted with time-of-day metering and communications equipment if they are to be able to respond rationally to the new pricing structure If they cannot adapt their use of electricity to the signals and incentives that economically-efficient pricing creates, then this pricing system will remain a sterile exercise with little benefit to the customer, to the electric power system, or to the society as a whole

The electric power system has little surplus power generation capacity Its first objective, therefore, must be to keep its existing plants (efficient and inefficient) financially solvent and available to carry the customers' load As a consequence, these plants must be supplied with sufficient revenue to meet their operating costs and to pay for essential maintenance and repairs This necessity requires that the dispatch function be separated from settlements (payment) function during the transition phase Economic dispatch will minimise the costs of electricity production, regardless of the financial settlements paid to generating plants Settlements to generating plants must be sufficient to keep each plant alive, regardless of that plant's position in the dispatch merit order

These two requirements can be met by (among other methods) initially setting the wholesale market price for electricity equal to its average (total) cost of production and transmission By definition of "average", this price times the total amount of electricity sold produces a sum that is sufficient to supply all power plants (and RAO EES Rossii) with enough revenue, but without producing any "surplus profits" for the electric power system

As the electric power system progresses through the transition phase and new, more efficient power generation plants are placed on line, then the growing surplus of generation will allow older, less efficient plants to be closed New power plants (built with private capital capital at risk) will be paid system marginal cost, not average cost, for their production As a consequence, marginal production costs for electricity will, on average, tend to decline, and marginal-cost electricity pricing may therefore become a cheaper and politically more palatable choice for the Russian economy

The transition phase must must address the problem of attracting capital for future investment as well as deal with operational matters such as dispatch improvements, asset management, sourcing know-how, and pricing regimes The acquisition of capital is, in fact, strongly linked to operations Pricing regimes and bill collection govern the investor's ability to earn a profit on his investment Asset management affects the business's ability to sustain itself Sourcing know-how enables the business to control its costs

Pricing from an operational perspective has been discussed above Investors will focus on the need to bring prices to "world levels" Unless its prices reflect these world levels, investors will question the business's ability to generate sufficient cash to cover its loan repayments and pay dividends on its equity

Pricing is quite complicated and the transition must sort out these complications, which include

- Concerns that price increases will have serious, detrimental social and political consequences, including political resistance in the form of voting the reform regime out of office, or perhaps worse,

- Concerns that higher prices will lead to a precipitous drop in demand which, in turn, may reduce the business's ability to satisfy the expectations of its debt and equity owners

Russia's electric power system will be well positioned to attract capital at attractive rates and terms only if these complicated matters are successfully dealt with

At the core of the problem of investment are two additional, related matters capital investment process and changes in ownership

Capital Investment Process Improvements

As the transition phase continues, the electric power system will begin to display increasingly more accurate signals and offer increasingly more persuasive incentives for the appropriate type and placement of new capital investments These market-based signals and incentives will provide a more efficient methodology for investment planning than the old command-based system In addition, a diverse set of new investors will be able to see these signals and incentives and to interpret them independently Diversity of decision-making adds an essential robustness to the process of investment planning If a private investor's decision is wrong, only he, not the society as a whole, will suffer as a consequence If the central planners' decision is wrong, however, everyone will suffer

Three broad, generic types of investments are possible, those in generation (both central-station and distributed), transmission, and end-use energy efficiency equipment Electric power systems world-wide (for reasons that were perfectly valid historically but are much less so today) tend to focus their attention primarily on generation Of course Russia does need new, more-efficient generation It is not clear, however, that these

plants should be large (300 - 1000 MW) central station generators Since the economies of scale in electric power generation have largely eroded during the past 25 years, smaller (10 - 100 MW) plants located at the sub-station level, or even very small (1 - 10 MW) plants located on customers' premises may well offer superior economic performance and certainly offer lower risks for the system

Furthermore, additional transmission investments may produce more cost-effective results that additional generation Once the USOA and a fully automated economic dispatch system have been successfully installed, RAO EES Rossii will have the information necessary to make informed and efficient trade-offs between generation and transmission investments

The trade-off between "supply-side" (generation and transmission) and "demand-side" investments, however, will be harder to make, if only because demand-side investments are relatively new and unfamiliar Furthermore, early in the transition phase the incentives for investments in new generation (which produce higher, marginal-cost-based revenues) will appear to exceed those for investments in end-use energy efficiency (which produce lower, average-cost-based revenues) unless additional incentives are offered to overcome this bias As the transition phase progresses this bias will shrink and the two incentives will approach parity

Diversity of decision-making is beneficial and it should be encouraged, but this "invisible hand of the market" will remain rather feeble in Russia for some time to come To insure electric system reliability during the transition phase, a "supplier of last resort" should be appointed The supplier of last resort will be responsible for creating annual estimates of customers' future needs for electric power and energy and an annual plan for investments in the electric power system to meet these needs If no other investors are willing or able

to make these (or other comparable) necessary investments, then the supplier of last resort must step in and make them itself The only entity with sufficient knowledge, experience, span of control, and resources to perform this task successfully is RAO EES Rossii

Ownership Structure

The path that the electric power system has chosen through the transition phase entails fundamental changes in the ownership structure of system entities Under the old economic foundation the electric power sector operated as a horizontally- and vertically-integrated monopoly All the means of production were owned and operated as an arm of the State itself In 1992, Presidential Decrees 922 and 923 began the process of transforming this state "ministry" into privately-owned joint stock companies

Currently, RAO EES Rossii owns 49% of the shares of the AO Energos and from 49% to 100% of the stock of the large existing generating companies on behalf of GKI This state of afairs is both necessary and desirable for the electric power system RAO EES Rossii is the only entity with the expertise and experience to help install, test, refine, enhance, and expand the new economic elements that are necessary for transition Furthermore, no other entity has sufficient knowledge of the generating plants' cost structures to be able to negotiate and, if necessary, to impose appropriate electric power sales contracts on existing large generating plants

After the transition phase is completed and the system has learned to operate in its new competitive environment, RAO EES Rossii's continued ownership of other entities will cease to be necessary In fact, because of the potential for conflict of interest and the incentive for biased operation of both the wholesale market and the economic dispatch

function, RAO EES Rossii's continued ownership would actually carry some negative aspects

Although RAO EES Rossii's ownership in these entities will decline during the transition phase and will be replaced by that of private entities, the level of ownership, if any, that RAO EES Rossii will retain (and the level of ownership, if any, that the State will retain in RAO itself) has yet to be decided Resolution of this issue, one way or the other, carries important consequences for the acquisition of future capital from foreign investors In general, the greater the level of State ownership in an electric power system entity, either directly by GKI or indirectly through RAO EES Rossii, the greater the ability to acquire debt capital, and the smaller the ability to acquire equity capital

Investors who loan money to commercial entities are usually attracted by a country's sovreign guarantee of that loan's repayment (if the country actually has the ability to make good on the guarantee) On the other hand, when equity investors see a substantial level of government involvement in an entity's ownership, they assume that management has little ability to influence an entity's performance (because the State ultimately exercises control of it) and they tend to shy away

Politics, Law and Regulation

Underneath matters pertaining to price and the capital investment process lurk the most challenging concerns, the ones that are the least controllable These matters relate to the political, legal, and regulatory climate which have been discussed in Chapter 5

The transition phase must integrate these corporate and government processes Unless the public sector and the newly developing private sector work together, the monumental

transformation of the electric power system will be exceedingly difficult Chart 7 5 organizes this "joint public/private" effort to illustrate the responsibilities each side

Chart 7 5

The Joint Effort Of Government And Corporate Institutions In The Restructuring The Electric Power System Of Russia

	Role Of Government	Role Of Companies
I. New operations and management principles		
A Accounting & financial information	• Require audits • USOA required by law	• Corporate information systems • Audit process implemented
B Pricing/Tariffs	• Pricing duties of regulators defined	• Cost accounting systems in joint stock companies established
C Corporate governance	• Already covered in existing law	• Effective boards & management organizations established
D Contracting	• Contract law terms re power contracts	• Effective contracts among joint stock companies
E Licensing	• Law spelling out terms	• Registration & completion of licensing requirements
F Dispatch regimes	• Law on the technological management of the power system	• New SCADA technology • Settlements function developed
G Capital allocation		• Capital budgeting systems implemented
H Investment promotion	• Law allowing foreign investment	• Investor relations programs • Corporate communications programs

II. New competitive behavior A GENCO competition	• Law on the wholesale market	• Cost-based competition requires cost-accounting & control systems • Strategic plans for market competition for joint stock companies
B New IPP development	• Same as above	• Power contracts signed between all generators and their customers
C Fuel supply competition	• Law on fuel supply competition	• Cost-based competition • Resource plans that diversify fuel mix
III. Problems concerning clarifying investment risk A Address problems related to "fairness"	• Law on the wholesale market	
B National vs regional priorities in capital allocation	• Law on the wholesale market • Law on the technological management of the power system	
C Preserve national security	• Same as above	
D Clarify fuctions of government bodies	• Laws defining regulatory functions and roles of FEC and other institutions	• Definition of functions of RAO and private companies recommended to Duma by these companies
E Environmental protection standards	• Law on environmental protection, including water use	
F Consumer rights	• Law on consumer rights	• Consumer relations programs • Public affairs programs
G Nonpayments problems	• Existing laws enforced	• Special initiatives to address the problem
IV. Problems concerning investment development A Overall investment strategy		• Corporate financial strategy
B Role of government financing	• Law on the use of special tariffs and taxes for power sector reconstruction	• Use of funds in capital programs as appropriate
C Role of independent investment	• Law defining allowable investment and terms of it for foreign independent developers	

V. Problems of regulation and social responsibility A Public policy process re power sector restructuring	• Law defining requirements of public involvement, e g , Northwest Power Act	• Public involvement programs
B Regulatory structure	• Law defining functions regulatory institutions, both Federal and Regional	
C Planning	• Law defining the need for electric power planning and who does what and how	• Corporate and resource planning systems established
D Administrative law review process	• Included in law on regulatory roles and functions	
E Social safety nets	• Law on social safety net	

1 4 The Transition Process As An Innovation Problem

The recommendations of this report will require a massive transformation in the electric power system Literally all of the component parts of the system must change to establish competition as the focal point of activity This requires a tremendous "re-programming" of institutions and behaviors diverse and multiple strategies replace a single directed approach to operations, diverse organizational structures replace the single configuration of the state monopoly, new systems, skills, staffing requirements, and values must be implanted and nourished if the restructuring is to be successful

The transition program cannot be viewed as a linear set of sequential steps that are checked off one after another The transition program will be dynamic and will require adaptation, evaluation, and modification of direction as it evolves A framework in which to interpet and manage actions is therefore beneficial The most useful framework for restructuring the electric power system derives from the study of how innovations diffuse through a society

Innovation occurs in any organization or society for one of four reasons

1) It is consistent with and enhances a previous practice

2) It successfully addresses a widely recognized problem or "felt need"

3) Its benefits are compelling

4) It fits the norms of the social system

These conditions act to prime the potential customer's acceptance of the innovation

In looking at these conditions, is there a compelling logic for why the Russian electric power system's restructuring should be successful? First, is the proposed restructuring consistent with previous practice? Second, does the innovation itself (the restructuring and all its component parts) offer compelling new benefits to Russia? Last, does the innovation fit the norms of the society? The answer to each of these questions would seem to be "Yes" The magnitude of the change required is so overwhelming, however, that strongly tenacious "Yes" will be required

There are five steps to the process of acceptance

1) Acquire knowledge about the innovation For example, introduction of a USOA must begin by building awareness of its importance among those who must implement it

2) Become persuaded by the innovation The acceptors of the innovation must be able observe, touch, and understand it in quite concrete terms, and to see its benefits clearly

3) Decide whether the innovation should be adopted

4) Implement the decision to adopt or reject

5) Based on the results of initial tests, the innovation is validated and the diffusion process is continued If an initial USOA trial works successfully then the implementation of the broader program will likely follow

Each of the principal agenda items in the transition will go through this process of awareness, persuasion, decision, implementation, and confirmation This process will take time It cannot be circumvented

This paper recommends that the transition agenda focus on a few critical initial steps and ensure they are successfully taken If they are, it is likely that the larger transition agenda leading to a successful restructuring can be implemented

The top five initiatives to begin the transition process should include

1) Introduction of a USOA

2) Establishment of an effective wholesale market

3) Creation of an effective body of law that defines the electric power system

4) Introduction of a critical information infrastructure settlement, accounting, and management systems

5) Introduction of an effective pricing regime

Even if these five transition priorities are implemented, the immensely complex process of restructuring remains Many issues will surface that no one can foresee from this early stage of design Accordingly, there needs to be a "transition manager" who has the responsibility to insure that the process of implementation actually happens RAO EES Rossii was created to be, in effect, this transition manager This role should be formalized to become an important element in RAO EES Rossii's charter

CHAPTER 8

IIE'S ENERGY TRAINING PROGRAM

8 1 Introduction

An essential part of the electricity privatization project has been a training program designed to support the other working groups The need for training is essential if Russia's electric power sector is to successfully transform into a "corporatized" and competitive industry sector This training work has been carried out through the auspices of the Institute of Interational Education

8 2 Background On IIE

The Institute of International Education (IIE) was founded in 1919 IIE is today the oldest and largest private, not-for-profit U S international educational exchange organization Over the decades, IIE has played a seminal role in responding to the challenges of a turbulent century

Last year nearly 9,000 men and women studied, conducted research, received practical training, or provided international technical assistance under 228 programs IIE administrated for 212 sponsors They came from, or went to, 170 countries or other geopolitical entities

IIE also provided information on international education to several hundred thousand students, educators, policymakers, and others around the world through publications and videos, information centers, seminars, school outreach programs, and overseas university fairs More than 600 regionally accredited U S colleges and universities were affiliated

with IIE as Educational Associate institutions, and 50 foreign academic institutions and U S non-governmental organizations were affiliated as International Associates

IIE began working with policymakers, international development assistance agencies, business leaders, scholars, and scientists with the end of the Cold War and the rise of the regional economic partnerships IIE's objective is to strengthen U S citizens' international competence, to assist former Communist nations in building democratic institutions and market economies, and to address the task of creating partnerships to meet, on a global scale, challenges ranging from hunger and health care to human rights abuses and the degradation of the environment

For the Newly Independent States (NIS) of the former Soviet Union, freedom has brought Herculean tasks building democratic institutions that work, mastering the transition to a market economy, and reversing the effects of environmental abuses IIE was called upon to

- Provide training in efficient, environmentally sound energy management
- Arrange academic and on-the-job training in business, free-market economics, law, and public administration
- Provide on-the-job training and special courses in financial skills for Russian entrepreneurs
- Place in U S universities candidates selected by new Fulbright Commissions in Eastern Europe and the Baltics

Under a cooperative agreement with AID, awarded in September 1993 for the NIS Energy Training Development Program, IIE is providing a wide range of local and U S - based professional training and support services in the energy sectors of the NIS Its goal

is to develop national competence in exploring, planning, managing, evaluating, and using energy resources efficiently The focus is on energy industry functions in free-market economies Training is targeted to professional managers, policymakers, operational managers, and senior directors of the newly reorganized energy companies in the oil, oil refining, gas, coal, and power sectors IIE has opened a project offices in Moscow, Russia, and plans to open offices in Kiev, Ukraine, and Almaty, Kazakhstan

IIE continues to support USAID's training efforts in Russia by managing the following responsibilities

Implementing a training program in line with the terms of the co-operative agreement, the requirements of the USAID Mission RET, and USAID Washington, to include

1 Conduct training needs assessment,

2 Identify courses and obtain agreements,

3 Identify and select training participants,

4 Design courses and prepare course materials,

5 Deliver planned training courses,

6 Evaluate the training, and

7 Human resource institution building

Coordinating the training program components to respond to the needs of the Russian Energy Sector, and supporting other activities of USAID RET, including

1 The Power Sector Privatization Initiative (PSPI),

2 The Joint Energy Alternatives Study (JEAS), and

3 The Energy and Environment Commodity Import Program (EECIP)

In May 1994, IIE submitted its 1994 Training Plan to USAID Moscow The plan called for seven courses to be taught in Russia and one course to be taught in the United States Each of the courses was scheduled for a period of two weeks with an estimated 300 participants being trained

The training was designed to provide managers and energy personnel with essential training for implementing energy-sector price and market reforms, and improving the efficiency of energy production, distribution and land-use in the NIS Based on the participants' evaluations and final reports from the instructors, IIE-Moscow training has advanced the USAID's mission to assist Russian and Ukraine in meeting the challenges posed by the transition to a free market economy

IIE offered nine courses in their 1994 Training Program for participants employed with RAO EES Rossii, the Ministry of Fuel and Energy of Russian Federation, the Ukrainian Ministry of Fuel and Energy, ROSUGOL, and the Armenian Ministry of Fuel and Energy

The result of the training was well received by the participants and the management of these Russian partners The training represented the industry's interest as well as the interest of other USAID contractors such as RGG/Hagler Bailly, Burns & Roe International, and IDEA

Training courses included in the 1994 Plan were as follows

General Economics and Management of a Power Company was offered both in Russia and the Ukraine The course provided participants with relevant, practical experience concerning modern-day industry practices for analyzing economic and financial viability of investment projects

Upon completion of the training, participants understood

- types of utility costs (I e , unit costs)
- alternative decision-making concepts
- average unit cost calculation

Participants also were able to create a cash flow diagram and were able to do economic alternative decision-making for utility projects/operations

Environmental Management was offered in Moscow The course was designed to provide the knowledge and practical planning and conceptual tools necessary for managers of energy companies to set up and implement an effective environmental management program as an integral part of their normal operations

The workshop was designed as a management, rather than a technical workshop It addressed the particular requirements of energy firms related to their production, transport, or consumption of large quantities of energy It produced the basic elements of the economics of environmental management

Marketing Coal and Coal Products was held in Kemerovo, Siberia The objectives of the course were to build familiarity with marketing techniques as they applied to coal and

coal products The emphasis was on understanding market and customers' needs Special emphasis was given to the relationship between sales and marketing, conducting a marketing campaign, customer service, and the competitive environment

The emphasis was on both domestic and international marketing with special attention paid to unconventional payment arrangements and to information and data management

The course was designed principally for the commercial directors of the coal producing associations who are responsible for sales, marketing, or consumer relations It was found that the course also served the needs of deputy directors, assistant commercial managers and sales directors

Economic Evaluation and Investment Decision Making, was offered in both Russia and Armenia The course gave the participants the ability to handle the concepts of "time value of money" and the application of those concepts to analyze virtually all types of investment situations, including electric power utility investments The course material was based on and included a translated version of the textbook, *Economic Evaluation and Investment Decision Methods* by Franklin J Stermole and John M Stermole

Human Resource Development and Management was held in Austin, Texas in October of 1994 The course included one week of formal classroom training and one week of touring electric utility facilities in Houston, Dallas, San Antonio and Austin A second offering of the course, two weeks of classroom training, was held in Armenia

The course was designed to increase participants' knowledge and skills that are required to develop and manage complex systems of human resources development It dealt primarily with modern concepts of adult learning, manpower planning, and the technology and effective management of human resource development systems

Tariff Structure, Rate Making and Electricity Pricing was offered in Moscow The course was designed with two main objectives in mind

The first was to inform policy makers and planners in government and utilities of the conceptual considerations of utility ratemaking The second objective was to provide fundamental training in the methods of ratemaking for future rate analysts

The course provided participants with the understanding and tools required to

1) integrate rate tariffs with desirable economic policy objectives of government or the electric utility companies,

2) the ability to identify the data requirements of a professional cost allocation and rate design system for wholesale, retail and purchased power rate structures,

3) perform the tasks of a professional rate analyst, and

4) analyze the cost and rate significance of long-term electric system development

Produced Waste Water Treatment course scheduled in Moscow was designed to show the methods and systems, equipment and materials, planning and effectiveness of treatment and disposal systems used for the waters produced in association with oil, gas, or condensate production

The course demonstrated both advanced technologies and simple technologies and made comparison of their effectiveness and the costs of using them Focus of the course is on systems planning of such pollution reduction methods, with additional focus on the

evolution of regulatory and environmental standards and the potential hazards of waste water pollution

Regional Air Pollution Monitoring provided participants with full practical and theoretical experience in sighting, installing, operating, and maintaining area air quality monitoring stations, as well as analyzing and reporting the monitoring data in conformity with reporting standards It was designed to be a highly practical, applicable experience

Electric Power Project Financing was designed to enhance the financial analysis capabilities of participants, to provide them with the ability to evaluate energy projects and to select appropriate financing for private power projects The objectives were to ensure that quality control standards are established and implemented before a program begins to lead to successful expansion of power generation projects The course focuses on financial models and computer applications to reach these goals

Concerning the 1994 training plan, participants' evaluations indicate positive reactions to the various training courses Of the participants responding, 79% responded that the courses were "Definitely Useful" with another 79% responding that the instructors were "Highly Effective" When asked about the content of the courses, 93% of the participants stated that they were "Definitely Useful"

When asked what content material could be added or deleted from the courses, comments ranged from applying "knowledge to the situation in Russian economy" to "prolonging the course for several days in order to have more time for solving problems"

Overall, comments have been positive and the participants have stated that they have gained by investing their time in the courses

Within the RAO EES Rossii organization, IIE has been fortunate to have had participants from 36 different companies These are Amurenergo, Astrakhanenergo, Baltenergostroi, Boguchangasstroi, Dalenergo, Ivenergo, Kabbalkenergo, Karelenergo, Khabarovskenergo, Kirovoenergo, Kolenergo, and Komienergo

Also Kostromaenergo, Lenenergo, Lipetskenergo, Marienergo, Novgorodenergo, Novosibirskenergo, Omskenergo, Orelenergo, Orenburgenergo, Penzaenergo, Samaraenergo, and Saratovenergo

As well as Sibirenergo, Smolenskenergo, Sverdlovenergo, Tsentrenergo, Uralenergo, Urengoienergostroi, Volgogradenergo, Vologdaenergo, Voronezhenergo, Vostokenergo, Yantarenergo, and Yuzhenergo

In the Ukraine, IIE has worked with an additional seven companies These are Crimeaenergo, Dneproenergo, Donbassenergo, Kharkivenergo, Kievenergo, Odessaenergo, Tripolskaya Power Plant, and Vinnitsaenergo

An additional 10 companies have sent participants to the training in Erevan, Armenia These companies are Armelectroproekt, Armenenergo, Armgasproekt, Armgasprom, Armgidroenergostroi, Armseisproekt, Arpa-Sevan, Ergoelectroset, Gidroproekt, and Gidrosetstroi

During the later part of 1994, meetings were held with the Institute of International Education's (IIE) Russian partners, RAO EES Rossii, the Ministry of Fuel and Energy, ROSUGOL, and representatives of the Ministry of Fuel and Energy in both Armenia and Ukraine, to discuss their training needs for 1995 and 1996 During these meetings, each organization expressed a desire to continue in the same realm of training that was done during 1994

In its proposal for training in Russia during 1995 - 1996, IIE made every effort to incorporate the various representatives' current view that training courses should concentrate on issues of practical importance to utility operations

IIE, knowing that it is difficult to project a work plan into the future, proposed a plan based on the priorities of the Russian training needs and in support of the privatisation efforts in the Russian power energy sector and other USAID RET project activities

IIE is fully aware that changes would be probable, especially in the 1996 plan, however for a comprehensive look at the training plan, it was necessary to look at more than the immediate time-frame

The underlying theme of IIE's training plan is that training should be a comprehensive arrangement, and that no specific entity should operate in a vacuum For training in Russia to be effective and commiserate with the investment being made by USAID, all energy training programs need to be implemented with common themes and common goals in mind

IIE realizes that it is imperative that they work with the energy component of NET training so that energy training efforts will not be duplicated The classroom and United States training done by IIE and the United States study tours offered by NET must compliment rather than duplicate each other Without co-operation, the various Russia partners do not benefit from the added value that can be offered by the various components of energy training

When and where possible, IIE proposes that the study tour follow the classroom training in order to re-enforce what has been learned in the classroom IIE continually emphasizes to its Russian partners that that inclusion in a classroom training course in no way

guarantees participation in a study tour In fact, each provider is a separate entity, and while co-operation is necessary, each training plan is independent of the other

RAO EES Rossii is organized into seven (7) regional groups These groups are

1 Vostokenergo - headquartered in Habarovsk

2 Sibirenergo - headquartered in Krasnojarsk

3 Uralenergo - headquartered in Ekaterinburg

4 Volgaenergo - headquartered in Samara

5 Yuzhenergo - headquartered in Pjatigorsk

6 Sevzapenergo - headquartered in Moscow

7 Tsentroenergo - headquartered in Moscow

The individual entities under the RAO umbrella are experiencing financial difficulties which cross over into the training programs The companies are finding that they are unable to send participants to training in the Moscow area due to the costs involved

In the 1995-1996 Plan Years, IIE proposes that training be regionalized for each of our Russian partners This approach was tried in 1994, in that training for ROSUGOL was taken to Siberia to facilitate the participants While this approach will create an additional cost to IIE and USAID, it should enhance the overall training program

Regional training will reduce travel costs for participants This approach will address the needs of the individual companies that cannot afford to send employees to participate in needed training, by facilitating their needs in their Region or at least in a Region closer than Moscow

Within RAO EES Rossii, regions 1, 2 and 3 have very sparse populations compared to the other regions They also have greater needs for training concerning transmission

Regions 4, 5, 6 and 7 share common problems in that they are highly populated and have expressed interest in courses such as tariff making, Power Systems Control and Protection, and Energy Planning and Policy

It is IIE's intent that some training will be offered in two regions, back-to-back This will provide training in some subjects for all the regions, while lowering travel costs for the individual companies

In its training, IIE will continue its current approach of providing instructors with first-hand knowledge of U S utility operations While RAO EES Rossii, Ministry of Fuel and Energy, and ROSUGOL employees will continue to be the primary emphasis of the Russian training, IIE proposes to include educators from three institutions that have provided training for employees in the past, in hopes that these representatives may assist in providing future training

The institutions that will be contacted for possible participation in each training session are

- Moscow Power Engineering Academy
- Moscow Institute of Advanced Training for the Energy Sector

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- Moscow Power Engineering Academy
- Moscow Institute of Advanced Training for the Energy Sector

- Leningrad Institute of Advanced Training for the Energy Sector

Two participants from the Moscow Power Engineering Academy attended the training offered by IIE concerning Human Resources Development The course was offered in Texas, USA, in October 1994 Both the Dean, Faculty of Advanced Training of Leading Specialist, Russian Joint Stock Company of Unified Energy System of Russia and a Research Fellow joined the Russian participants from RAO for the training In their written comments at the end of the course, they mentioned the value of promoting a "system of continuous training"

IIE and USAID believe that it is necessary to ensure that something tangible is left behind at the end of the USAID Russian Energy Training Program By including trainers in the course being offered, RAO EES Rossii will be building a base of educators who can either offer training or who can co-ordinate future training

RAO EES Rossii currently has a training unit reporting to Mr Vyacheslav M Gorynov under the direction of Mr Igor N Muravyev This unit is small (three persons) and currently has no training facility in which to conduct training It is our hope that through the efforts of RAO EES Rossii and with the support of USAID, that a training unit will exist after the on-going energy re-structuring

Future study needs to be done to determine how such an organization would be developed, who the key players would be, how and where it would reside, and how it would be financed It would appear that such a training organization could be established as an independent profit center

A training unit that can organize needed training in the future would be a valuable addition to the overall re-structuring of the energy sector It would be beneficial if such a unit could be created over the next two years within the RAO EES Rossii umbrella It

will be needed in the future, and it should be charged with the responsibility of establishing training needs, designing courses, and bringing in practitioners to teach the participants

The training unit will need to be broad-based and will need to offer services to all of the individual RAO EES Rossii entities after the re-structuring It is feasible that such a training unit could benefit not only RAO EES Rossii, but if it is a separate profit center or a stand-alone company, it could offer training to other energy sector partners such as the Ministry of Fuel and Energy

1995 - 1996 Training Plan

The 1995 course breakout and number of training weeks follows

SECTOR	COURSES	TOTAL WEEKS
Electric Power	7	14
Environment / Energy	3	6
Oil and Gas	0	0
Coal	2	4
TOTAL	12	24

The 1996 course breakout and number of training weeks follows

SECTOR	COURSES	TOTAL WEEKS

Electric Power	7	14
Environment / Energy	3	7
Oil and Gas	0	0
Coal	2	4
TOTAL	12	24

Expected outputs

Twelve (12) courses for a total 24 weeks of training will be designed and delivered by IIE in each of the training years In-country training will account for 20 weeks of training and study tours to the United States will account for four weeks of training Approximately 300 participants will be trained in 1995, and another 300 in 1996

In addition to the IIE training, but implemented by a completely separate entity, will be the NET training that will be offered in the United States This training will add another approximate 150 participants It is expected that where training is held in the United States, the participants will be elected from those participants who have taken part in the in-country training offered by IIE It is to be emphasized that all participants who complete in-country training will not be given the opportunity to travel to the United States for training due to budgetary limitations

IIE believes that the 1995 -1996 Training Plan will benefit by repeating several of the courses offered in the 1994 Training Plan Using input from discussion with our Russian partners and with other USAID contractors, IIE is recommending the following list of courses to be implemented in the 1995 -1996 Training Plan

1995-1996 Training Work Plan
Courses Outline

No	Course Proposed	Audience	Region and/or Location	Date
1	Management and Development of Human Resources	RAO EES Rossii	Ekaterinburg	Mar 1995
2	Role of the Union	ROSUGOL	Kemerovo	Apr 1995
3	Functioning of Electricity Distribution System in Private Power Station	RAO EES Rossii	Moscow	Apr 1995
4	HRD and Performance Through People	ROSUGOL	Moscow	May 1995
5	Regional Air Pollution Monitoring	Ministry Fuel & Energy	Western Siberia or Far East	May 1995
6	Financial Markets	RAO EES Rossii	St Petersburg	Jun 1995
7	State Regulation System in Power Industry	RAO EES Rossii	Moscow	Jul 1995
8	Train the Trainer	RAO EES Rossii	U S	Aug 1995
9	Economic Evaluation and Investment Decision Making	RAO EES Rossii	Saratov	Oct 1995
10	Management of Environmental Clean-up	Ministry Fuel & Energy	Tjumen	Oct 1995
11	Functioning of Power Transmission Lines System in Private Power Industry	RAO EES Rossii	Krasnojarsk	Sep 1995

12	Environmental Requirements of Investment Projects	Ministry Fuel & Energy	Irkutsk (Listvjanka)	Sep 1995

No.	Course Proposed	Audience	Region and/or Location	Date
13	Technical & Economic Feasibility Analysis	RAO EES Rossii		1996
14	Corporation Basics	RAO EES Rossii		1996
15	General Management of Electric Utility	RAO EES Rossii		1996
16	Accounting, Auditing & Fiscal Controls	RAO EES Rossii		1996
17	Generation Cost Analysis & Control	RAO EES Rossii		1996
18	Corporation Market Pricing & Economics	RAO EES Rossii		1996
19	Corporate Financial Strategies for Financing	RAO EES Rossii		1996
20	Electric Utility Regulation and Tariffs	RAO EES Rossii		1996
21	Policy Issues in the Power Sector	RAO EES Rossii		1996
22	Functioning of Electricity Distribution System in Private Power Station	RAO EES Rossii		1996
23	Regional Air Monitoring	Ministry Fuel & Energy		1996

2 4	Ecologically safe technologies of storage, disposal and utilization of waste	Ministry Fuel & Energy	1996