RUSSIAN FEDERATION

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1. ENERGY, ECONOMIC AND ELECTRICITY INFORMATION

1.1. General Overview

Russia is a large country occupying the eastern part of Europe and the northern part of Asia. In the north the country is bounded by the Arctic Ocean, Finland being the farthest northwest neighbour. In the west and southwest, the country is surrounded by the new independent states, the former republics of the Soviet Union. In the south and southeast, Russia has a common border with Kazakhstan, Mongolia, China and North Korea. The eastern border of the country is the Pacific Ocean; here Japan and the Alaska state of the USA are the nearest neighbours.

The total area of Russia is about 17,075 thousand km^2. The country consists of a large number of administrative units: regions (provinces) and republics. The regions of the country differ widely in territory, natural conditions, the structure and national composition of the population, and economic development. The climate of country is marked by very wide regional variations. A significant part of northeastern Russia falls within the frigid zone, while the Black Sea region has semitropical conditions.

Russia is abundant in energy resources of various kinds. The energy sector is a well-developed and important part of the national economy, producing about 10% of national Gross Domestic Product (GDP). Totally up to 95% of the country's energy consumption is met by fossil fuel. Despite its rich oil, gas and coal potential Russia was one of the first countries to master nuclear energy for peaceful uses. In 1954, the Obninsk Nuclear Power Plant was commissioned and connected to the grid.

According to the latest statistics, the population of Russia amounts to about 144 million (Tables 1 and 2). The average population density is about 8.5 inhabitants per km^2. This number greatly varies around the country: from more than 100 inhabitants per km^2 for some regions in the European part of Russia through less than one for large territories in Siberia and the far northeast.

TABLE 1. POPULATION DISTRIBUTION

Year	Population (millions)					Population Density
	TOTAL	Urban	Rural	Men	Women	(inhab/km^2)
1985	143.8	104.1	39.7	66.1	77.7	8.42
1986	145.1	105.7	39.4	67.7	77.4	8.50
1987	146.3	107.1	39.2	68.4	77.9	8.57
1988	147.4	108.4	39.0	69.0	78.4	8.63
1989	147.4	108.4	39.0	69.3	78.1	8.63
1990	148.0	109.2	38.8	69.6	78.4	8.67
1991	148.5	109.8	38.7	69.8	78.7	8.70
1992	148.7	109.7	39.0	69.9	78.8	8.71
1993	148.7	108.9	39.8	69.9	78.8	8.71
1994	148.4	108.5	39.9	69.8	78.7	8.69
1995	148.3	108.3	40.0	69.7	78.6	8.69
1996	148.0	108.1	39.9	69.6	78.4	8.67
1997	147.5	107.8	39.7	69.3	78.2	8.64
1998	147.1	107.5	39.6	69.1	78.0	8.62
1999	146.7	107.3	39.4	68.9	77.8	8.59
2000	145.9	106.5	39.4	68.6	77.3	8.54
2001	144.8	105.6	39.2	67.8	77.0	8.48
2002	144.0	105.1	38.9	67.4	76.6	8.43

Source: Russia in figures, Summary Statistical Transactions, Moscow (2002)

TABLE 2. POPULATION INFORMATION

	1990	1996	1997	1998	1999	2000	2001	2002	Growth rate (%/yr) 1990 to 2002
Population (millions)	148	148	147.5	147.1	146.7	145.9	144.8	144.0	-0.2
Population density (inhabitants/km²)	8.7	8.7	8.6	8.6	8.6	8.5	8.5	8.43	-0.2
Urban population as percent of total	74	73	73	73	73	73	73	73	-0.1
Area (1000 km²) 17,075.4									

Source: IAEA Energy and Economic Database; Country Information.

Economic Indicators

The historical data presented in Table 3 clearly reflect the economic crisis accompanying the process of economic transition reforms. The Gross Domestic Product (GDP) values have been declining since 1990. Lately, there has been some improvement in the macro-economic parameters, but it is still too early to assert that the recovery from the crisis has begun. Figure 1 shows the GDP structure in 2002.

TABLE 3. GROSS DOMESTIC PRODUCT (GDP)

	1980	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Growth rate (%/yr) 1980 to 2002
GDP[(1)]	540.2	644.2	26.6	81.1	178.3	268.3	335.2	415.9	427.3	266.4	184.3	258.8	309.5	321.7	-2.3
GDP[(2)]	817.5	644.2	25.7	76.4	164.0	241.8	295.6	359.8	362.6	223.3	152.2	209.5	244.7	254.7	-5.1
GDP[(3)] per capita	3,860	4,353	0,179	0,546	1,199	1,808	2,260	2,810	2,897	1,811	1,256	1,774	2,137	2.259	-2.3
GDP by sector (%):															
-Agriculture	N/A	15	14	7	8	6	7	7	6	5	6	6	6	6	
-Industry	N/A	35	38	35	32	31	27	27	26	27	29	28	26	27	
-Transport	N/A	8	7	7	7	8	10	10	9	9	8	7	7	7	
-Construction	N/A	9	9	6	7	9	8	8	7	7	5	6	7	8	

(1) Billions of current US$.
(2) Billions of constant 1990 US$.
(3) Current US$ per capita.
Source: Russia in figures, Summary Statistical Transactions, Moscow (2002)

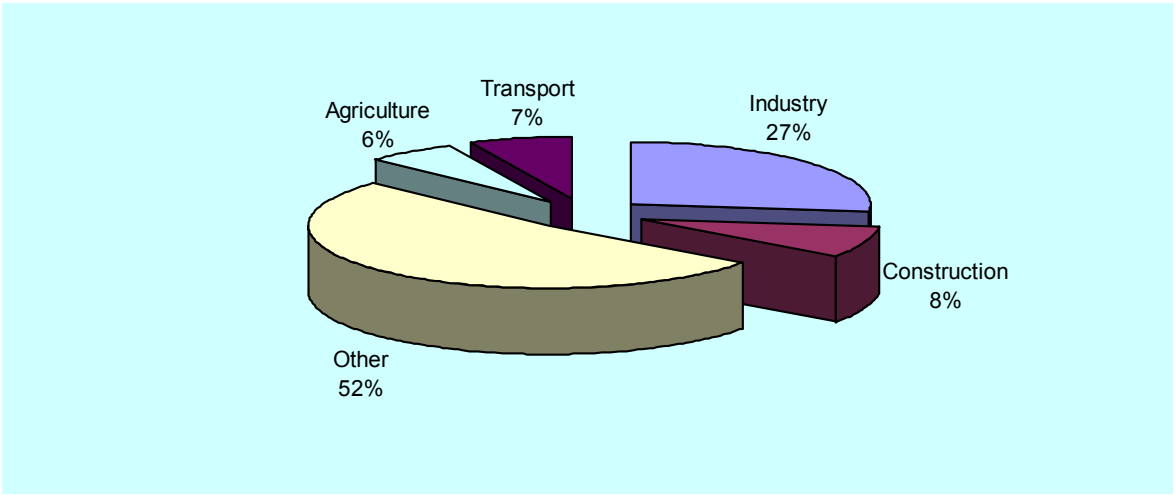

FIG. 1. Gross Domestic Product (GDP) structure in 2002.

Energy Situation

Energy reserves are shown in Table 4. Fossil fuels form the basis for the Russian energy sector. Table 5 gives the consumption of the primary energy resources in million tonnes oil equivalent and Table 6 the historical energy data. The share of nuclear energy in the energy supply is only 2%. Hydro energy, which currently is the only meaningful renewable energy resource in Russia amounts to about 3%.

TABLE 4. ESTIMATED ENERGY RESERVES

	Estimated energy reserves in (Exajoule)					
	Solid	**Liquid**	**Gas**	**Uranium (1)**	**Hydro (2)**	**Total**
Total amount in place	4412.29	279.47	1620.43	76.93	269.92	6659.05

(1) This total represents essentially recoverable reserves.

(2) For comparison purposes a rough attempt is made to convert hydro capacity to energy by multiplying the gross theoretical annual capability (World Energy Council - 2002) by a factor of 10.

Source: IAEA Energy and Economic Data Base; Country Information.

1.2. Energy Policy

"The Energy Strategy of Russia" states priorities as well as means for the radical revision of structural and technological policies that pertain to the nation's energy supply for the period 1995-2010. Its main goal is to achieve the European level of per capita energy consumption and ecological safety of population. Emphasis is placed upon the complex approach towards the solution of regional energy supply problems.

TABLE 5. CONSUMPTION OF PRIMARY ENERGY RESOURCES IN 2001

Energy Source	mln toe
Coal	160
Liquid Fuel	205
Natural Gas	487
Nuclear	28
Hydro	37
Other	18

Source: Country Information.

The prognosis of energy sector development in the near future is based on:

- overcoming the national economic crisis and subsequent rise;
- new investment strategy;
- new price and taxation policies;
- privatisation and denationalisation;
- modernisation of national laws and regulation in energy sector.

The structural policy of the energy sector for the next 10-15 years aims:

- enhancement of the efficiency of natural gas utilization and an increase its share of domestic consumption, especially in ecologically strained regions;
- in-depth processing and comprehensive utilization of hydrocarbon raw materials;
- enhancement of the coal quality, as well as the stabilization of coal production volumes;
- reversal of the decline in, and moderate expansion of, oil production;

- intensification of local and renewable energy resources development (hydro and wind power, peat, etc.);
- priority in electricity generation development based on competitive and ecologically clean power plants;
- safety and reliability enhancement of the first generations' NPPs and development of new advanced nuclear power plants.

The new technological energy policy is oriented toward:

- radical enhancement of both the cost effectiveness and the energy efficiency of all stages of the extraction, conversion, distribution, and utilization of energy resources;
- effective decentralization of the energy supply;
- ecological and accident safety, as well as the reliability of the energy supply, and;
- development of qualitatively new technologies for the stable evolution of power industry: ecologically clean coal-fired power plants, safe nuclear power plants, efficient processes for the utilization of new sources of power, etc.

TABLE 6. ENERGY STATISTICS

Exajoule

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Av. annual growth rate (%) 1992 to 2002
Energy consumption												
- Total [1]	34.4	32.31	28.28	30.43	28.48	26.80	25.98	26.31	26.81	27.32	28.04	-2.02
- Solids [2]	7.7	7.17	6.26	6.00	5.67	4.81	4.27	4.77	5.15	4.72	4.63	-4.95
- Liquids	9.5	8.71	6.53	6.22	5.47	5.39	5.15	5.25	5.14	5.14	5.59	-5.16
- Gases	14.5	13.77	13.04	15.74	14.89	14.29	14.26	14.19	14.76	14.77	15.12	0.42
- Primary electricity [3]	2.7	2.66	2.45	2.48	2.45	2.30	2.28	2.10	1.76	2.70	2.70	0.00
Energy production												
- Total	48.2	44.83	41.93	44.16	43.25	41.28	41.38	41.83	42.80	43.41	45.79	-0.51
- Solids	7.8	7.00	6.18	6.02	5.85	4.82	4.30	4.65	4.81	4.99	4.89	-4.56
- Liquids	16.7	14.72	13.22	12.77	12.61	12.72	12.61	12.65	13.42	14.44	15.72	-0.60
- Gases	20.9	20.28	19.89	22.70	22.15	21.24	21.99	21.96	21.97	21.86	22.38	0.68
- Primary electricity [3]	2.8	2.84	2.65	2.67	2.64	2.49	2.45	2.57	2.61	2.80	2.80	0.00
Net import (import - export)												
- Total	-13.5	12.16	-12.75	N/A	-14.57	-14.82	-15.11	-15.52	-15.98	-16.97	-18.37	3.12
- Solids	N/A	0.03	0.06	N/A	-0.17	-0.10	-0.08	-0.12	-0.12	-0.31	-0.50	
- Liquids	-7.3	6.54	-6.60	N/A	-7.14	-7.33	-7.49	-7.71	-8.02	-8.47	-9.44	2.60
- Gases	-6.2	5.65	-6.21	N/A	-7.26	-7.37	-7.53	-7.68	-7.84	-8.19	-8.43	3.12

[1] Energy consumption = Primary energy consumption + Net import (Import - Export) of secondary energy.
[2] Solid fuels include coal, lignite and commercial wood.
[3] Primary electricity = Hydro + Geothermal + Nuclear + Wind.
Source: IAEA Energy and Economic Database; Country Information.

Regional energy policy takes into account the existing principal differences of energy supply conditions and structures of fuel resources of various parts of Russia. Regional energy self-governing and self-consistency is envisaged as a major challenge, i.e., sustaining the unified national energy sector through the development of federal energy systems: electricity, gas and oil supply networks.

1.3. The Electricity System

Structure of the Electricity Sector

The National Electricity Supply System consists of the Unified Electricity System (UES), the Regional Electricity System "VOSTOK" and the Isolated Local Electricity Systems.

- **Unified Energy System**

The UNIFIED ENERGY SYSTEM of RUSSIA (UESR) is a unique system, which creates significant economic benefits for both the Russian people and Russia's industry. The technical basis of UES of Russia is comprised of:

- 440 electric power stations with a total installed capacity of over 197 thousand MW, including 22.2 thousand MW at nuclear power stations, which produced 892 billion kW·h of power in 2002 year;
- a total of 3,018 thousand km of electric power lines;
- a supply regulation system that unites physically all power installations with a single 50 Hz current frequency.

The organisational basis of UES of Russia is comprised of:

- RAO UESR, which acts as a central locus that implements the functioning and development criteria established by the government based on effectiveness and provides operational supply management aimed at increasing economic efficiency at UESR;
- 74 power suppliers that supply electric and heat power to consumers throughout the Russian Federation;
- 34 large electric power stations that operate independently on the federal (national) wholesale electric power market;
- Over 300 organisations providing technological back up and development for UES of Russia, and which ensure the viability of the industry as a whole.

Large regional UES systems are:

- Central Power Pool (~29.8 % of total capacity);
- Middle Volga Power Pool (~10.3 % of total capacity);
- Ural Power Pool (~ 16.5 % of total capacity);
- Northwest Power Pool (~ 4.4 % of total capacity);
- North Caucasus Power Pool (~ 5.5 % of total capacity);
- Siberia Power Pool (~29 % of total capacity).

- **Regional Electricity System "VOSTOK".** This system operates separately from the main grid. It covers the far eastern part of Russia and consists of four Local Electricity Systems generating 41.0 TW·h or 4.4% of total electricity generation in 2000. There is a limited amount energy exchange between the two main country systems.

- **Isolated Local Electricity Systems.** There are five rather small systems situated in remote regions where communication with the rest of the country is difficult. Despite their small size, they are very important locally. In 2000, these systems generated 1.2 TW·h or 0.1% of total electricity generation.

At present, all electricity distribution systems are owned by joint-stock companies with 50% government participation. The basic structure of the national electricity sector is presented in Figure 2. Federal and regional energy commissions are responsible for energy planning.

Decision Making Process

- Pricing and taxation constitute the core of the new energy policies. The liberalization of oil, petroleum products and coal prices, which was undertaken in mid-1993, was not extended to the products of the so-called natural monopolies: natural gas, electric power, and heat from centralized sources. Prices for these energy sources are currently set by the federal regional government agencies responsible for the functions of the fuel and energy sector.
- The creation of a competitive environment within the fuel and energy sector of the national economy will be directed towards reducing production costs and increasing the quality of energy related services. This will be accomplished though industry denationalisation, primarily through the joint-stock companies.
- A system of incentives and conditions for the conservation of energy, as well as the increase in energy production efficiency, is needed in order to realize Russia's vast potential for energy conservation.
- Economic policies will be focused on the promotion of investment activities.

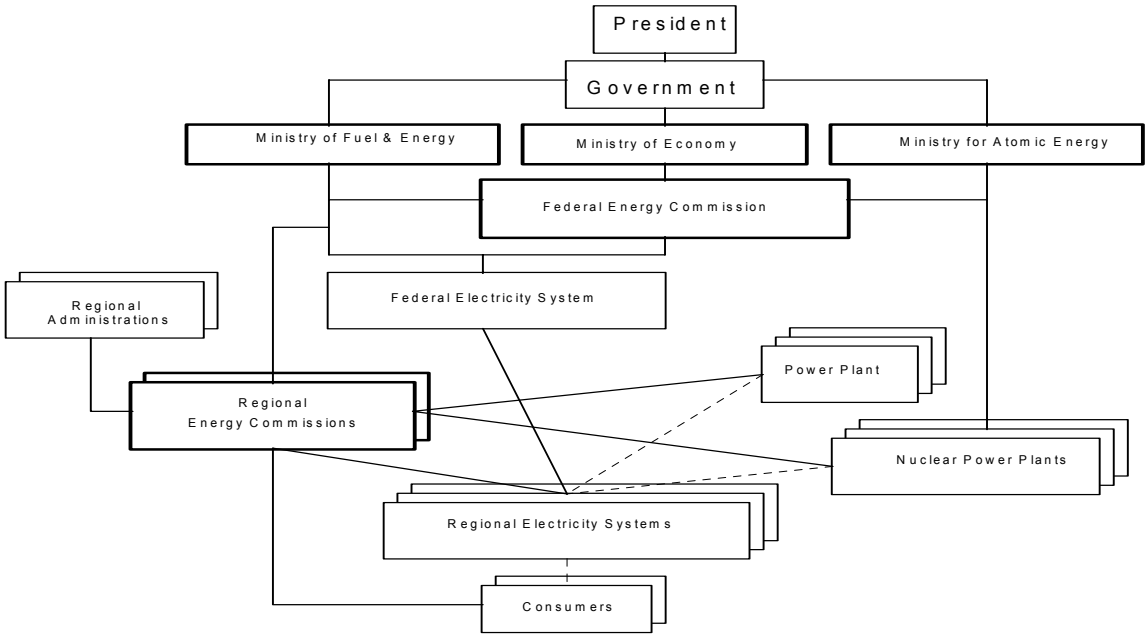

FIG. 2. Basic Structure of the National Electricity Sector

Main Indicators

Table 7 shows the historical electricity production data and installed capacities and Table 8 the energy related ratios.

TABLE 7. ELECTRICITY PRODUCTION AND INSTALLED CAPACITY

	1970	1980	1990	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Growth rate (%) 1980 to 2002
Electricity production (TW·h)														
- Total [1]	470	805	1082	957	876	860	847	834	827	846	862	886	892	0.5
- Thermal	373	622	797	663	601	583	583	567	564	563	568.5	576	578	-0.3
- Hydro	94	129	167	175	177	177	155	158	159	161	165.4	175	175	1.4
- Nuclear	4	54	118	119	98	100	109	109	104	122	129	135	140	4.3
Capacity of electrical plants (GW(e))														
- Total	105.1	165.4	213.3	213.4	214.9	215.0	214.5	214.2	214.1	214.3	204.5	214.9	214.9	1.2
- Thermal	81.3	121.1	149.7	148.8	149.7	149.7	149.2	149.0	148.7	148.3	138.9	148.5	148.5	1.0
- Hydro	23.0	35.1	43.4	43.4	44.0	44.0	44.0	43.9	44.1	44.3	44.4	44.2	44.2	1.1
- Nuclear	0.8	9.2	20.2	21.2	21.2	21.3	21.3	21.3	21.3	21.7	21.2	22.2	22.2	4.0

[1] Electricity losses are not deducted.
Source: Russia in figures, Summary Statistical Transactions, Moscow (2002)

TABLE 8. ENERGY RELATED RATIOS

	1970	1980	1990	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Energy consumption per capita (GJ/capita)	160	250	260	232	219	192	N/A	193	181	176	179	182	N/A	186
Electricity per capita (kW·h/capita)	N/A	N/A	7,311	6,785	6,436	5,903	5,799	5,723	5,654	5,622	5,767	5,908	6,119	6.19
Electricity production/Energy production (%)	N/A	N/A	18	19	19	19	N/A	18	18	17.7	18	18	N/A	N/A
Nuclear/Total electricity (%)	0.74	6.71	10.91	11.89	12.43	11.19	11.63	12.87	13.07	12.58	14.42	15	15.23	15.67
Ratio of external dependency (%) [1]	N/A	N/A	N/A	-39	-38	-45	N/A	-51	-55	-58	-59	-60	N/A	N/A
Load factor of electricity plants														
- Total (%)	51.0	55.4	57.9	54.2	51.2	46.5	45.7	45.0	44.4	44.1	45.1	48	47.1	47.1
- Thermal	52.4	58.5	60.8	54.9	50.9	45.8	44.5	44.5	43.4	43.3	43.3	47	44.3	44.3
- Hydro	46.7	41.8	43.9	45.4	46.0	45.9	45.9	40.1	41.1	41.2	41.5	39	45.2	45.2
- Nuclear	49.9	66.8	66.7	67.6	64.1	52.8	53.6	58.3	58.4	55.7	64.2	69	70.3	71.7

[1] Net import / Total energy consumption
Source: IAEA Energy and Economic Database; Russia in figures, Summary Statistical Transactions, Moscow (2002)

2. NUCLEAR POWER SITUATION

2.1. Historical Development and current nuclear power organizational structure

2.1.1. Overview

1937 Commencement of active experimental studies on the structure of atomic nuclei. Production of "pulse" amount of neptunium and plutonium in Leningrad Radium Institute.

1939 The start of research into the feasibility of achieving a nuclear chain reaction. Installation of the largest cyclotron in Europe in the Leningrad Physical and Technical Institute.

1940 Discovery of phenomenon of spontaneous nuclear fission in uranium. Theoretical demonstration by Soviet scientists of the feasibility of energy release from a uranium nuclear fission chain reaction.

1942 Recommencement of work on the atomic problem interrupted by the outbreak of the war.

1943 Creation of a special physics laboratory - the No. 2 Laboratory in Moscow (now the Russian Scientific Centre "Kurchatov Institute").

1945	Establishment of a governmental interdepartmental body - the First Chief Administration to co-ordinate all work in the field of atomic science and technology.
1945/46	Technology mastering and organization of the production of metallic uranium and high-purity reactor graphite to start up the first experimental reactor.
1946	Achievement of a controlled uranium fission chain reaction at the No. 2 Laboratory.
1948	Start up of the first industrial nuclear reactor.
1949	Testing of the Soviet Union's first atomic bomb.
1953	Establishment of the USSR Ministry of Medium Machine Building as the authority dealing with nuclear science and technology.
1954	Start up of the world's first nuclear power plant in Obninsk.
1957	Ratification of the Charter of IAEA by the USSR.
1964	Commissioning of the first commercial water-moderated, water-cooled vessel-type (WWER) reactor at Novo-Voronezh. Commissioning of the first commercial boiling water-cooled graphite moderated reactor with nuclear superheating of the steam at Beloyarsk.
1970	Establishment of the International Nuclear Information System (INIS) with the active participation of the USSR.
1973	Commissioning of the first commercial water-cooled graphite-moderated channel-type (RBMK) reactor at Leningrad.
1973	Commissioning of the world's first prototype-scale fast breeder reactor (BN-350) in Aktau for electricity generation and desalinated water production.
1976	Completion of the first nuclear central heating and power plant at Bilibino in the far northeastern part of Russia.
1977	Start up of the RT-1 plant for reprocessing of spent nuclear fuel.
1980	Start up of a commercial power-generating unit powered by BN-600 fast reactor at Beloyarsk. Commissioning of the 1000 MW(e) water moderated, water-cooled reactor (WWER-1000).
1984/86	Commissioning of the Zaporozhie and Balakovo NPP's with WWER-1000 serial reactors with full compliance to the new safety regulation.
1986	Accident at unit 4 of Chernobyl NPP. Ministry for Atomic Energy is organized to be responsible for Nuclear Power Plants operation.
1989	Reorganization of the Ministry of Medium Machine Building and Ministry for Atomic Energy as the USSR Ministry of Atomic Energy and Industry.
1992	Establishment of Ministry for Atomic Energy of the Russian Federation (Minatom of Russia, also known as Ministry for Nuclear Power), which replaced the USSR Ministry of Atomic Energy and Industry.
1993	President Eltsyn and President Bush sign SALT-2 Agreement according to which the strategic offensive weapons should be reduced and limited over 7 years. Beginning of conversion of the Russian weapon highly-enriched uranium (VOU) in compliance with the Russian-US Agreement on nuclear disarmament.
1994	The Russian Federation Government makes decision to cease production of weapon plutonium.

1995	The 50-th anniversary of the nuclear power industry of Russia. Beginning of commercial conversion of highly-enriched uranium into low-enriched uranium (the VOU-NOU project) at the Ural Electrochemical Combine (Novouralsk town, Sverdlovsk Region). The FEI RF SSC, Obninsk, Kaluga Region, puts into service the first phase of the Laser and Nuclear Center for nuclei fission energy direct conversion into laser radiation. The first phase of the diamond production is put into service at the VNIIEF RF NC as a part of the conversion program.
1996	Approval of programs for support of the industry major schools of thought. Sea trials of PETR VELIKY nuclear-powered cruiser are completed. Completion of the removal of the Soviet Nuclear weapons to be disassembled from the CIS countries to Russia
1997	Beginning of batch production of a news header type of munitions for the SRF TOPOL-M missile complex
1998	Decision-making on production of the first batch of pilot uranium-plutonium fuel assemblies. Fabrication of a pilot batch of ADE-2, -4, -5 reactor conversion fuel rods. Approval of the program to develop nuclear power engineering of the Russian Federation from 1998 to 2005 and to 2010. Activities to elaborate a draft "Strategy for Nuclear Power Development" (a 50-ty year forecast) are started
1998	Process to fabricate weapon plutonium base mixed fuel is devised and brought into commercial practice at the Research Institute of Nuclear Reactors State Research Center of the Russian Federation. A pilot batch of that fuel for BOR-60 and BN-600 reactors is fabricated
1998	Establishment of the Information and Analytical Center of Minatom of Russia to ensure information and analytical support of the Ministry administration and of the Industry Emergency Commission both under normal operation and in case of emergency at the industry enterprises.
1999	Commissioning of the Kursk NPP 2 power unit upon completion of overhaul with monitoring of all fuel channels and with their partial substitution according to the check results. That work is carried out in the industry for the first time.
1999	Start of implementation of wide-scale measures to accelerate utilization of nuclear-powered submarines removed from military service and ecological recovery of sites of the Ministry of Defense dangerous installations handed over to Minatom of Russia in compliance with the decision of the Government of the Russian Federation
1999	The 50-th anniversary of the Nuclear weapons of Russia. The nuclear weapon system is now a model of Research and Development Associations with the worldwide significance high-capacity pilot-scale productions enabling to tackle large-scale high technology problems.
2001	Putting into operation the first unit of the Volgodonsk (Rostov) NPP
2002	25-th anniversary of putting into operation PT-1 plant at " MAYAK" Production

2.1.2. Current Organisational Chart

Figure 4 shows the institutional organization of the nuclear industry in Russia.

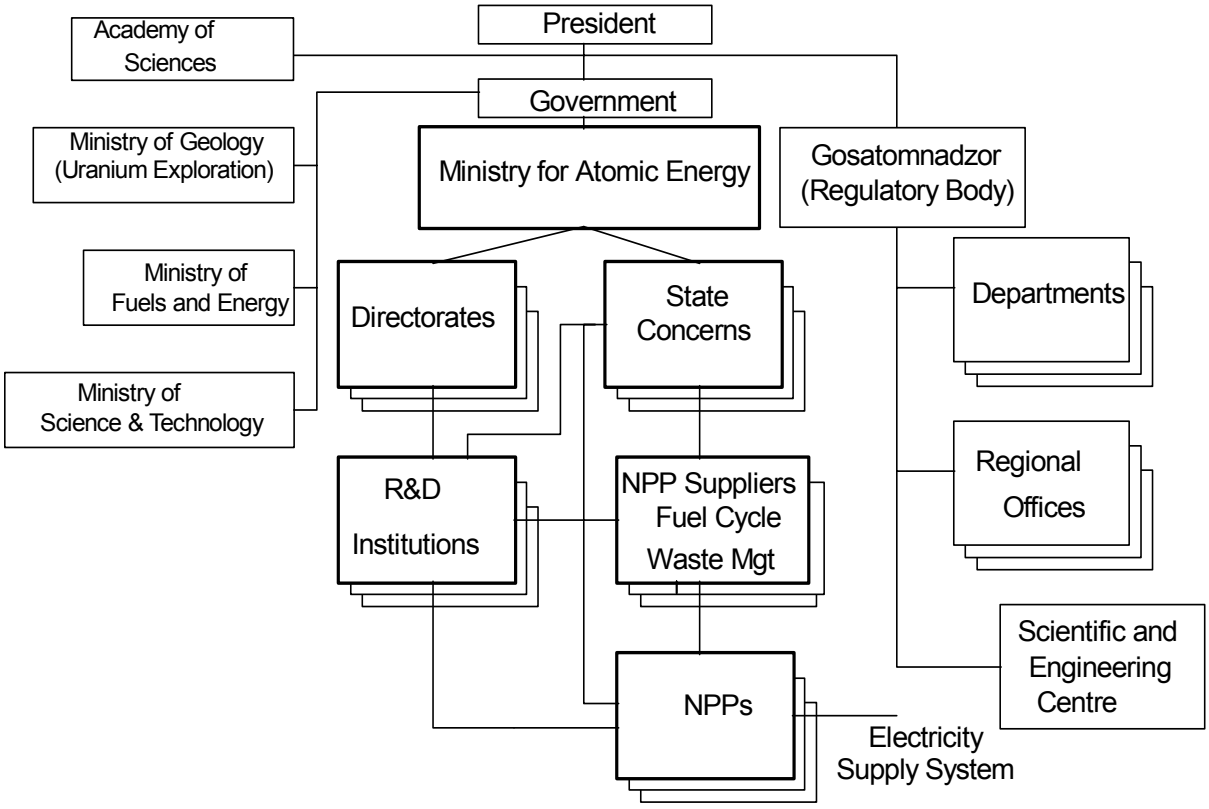

FIG. 4. Institutional Organization of Nuclear Industry in Russia

- Departments of the Gosatomnadzor (Regulatory body):

  - science and engineering;
  - NPP nuclear and radiation safety;
  - research reactor nuclear and radiation safety;
  - nuclear power plant design and construction supervision;
  - nuclear equipment production supervision;
  - radiation safety supervision;
  - nuclear and radiation safety regulating.

- Directorates of the Ministry for Atomic Energy:

  - design and investment;
  - information, nuclear materials and installations protection;
  - nuclear ammunition design and testing;
  - nuclear ammunition production;
  - nuclear chemistry;
  - science and technology;
  - nuclear reactor development and designing;
  - nuclear physics and fusion;
  - nuclear power advancement;
  - information and public relation.

- State concerns under the Ministry for Atomic Energy:

  - Atomredmetzoloto (uranium mining);
  - TVEL (fuel fabrication);
  - Rosenergoatom (nuclear utility company);
  - Progress (construction and industrial holding company);
  - Atomstroi (construction company);
  - Spetsatommontazh (industrial company);
  - Spetsstroimaterialy (construction materials for nuclear industry);
  - Tekhsnabexport (export company);
  - Eleron (security technology company).

2.2. Nuclear Power Plants: Status and Operations

2.2.1. Status of nuclear power plants

Figure 3 shows the map of Russian nuclear power plants. Table 9 shows the current status of the Russian nuclear power plants. In the former Soviet Union, there were 10 nuclear reactors under construction at the late 80s. However, the construction of all new nuclear power plants was interrupted in 1989-1990, partly due to negative public opinion. Today, economical difficulties play a more significant role. In fact, unit 1 of Rostov NPP commenced commercial operation on 30 March 2001 and only 3 reactors are currently under construction (unit 2 of Rostov NPP, unit 5 of Kursk NPP and unit 3 of Kalinin NPP).

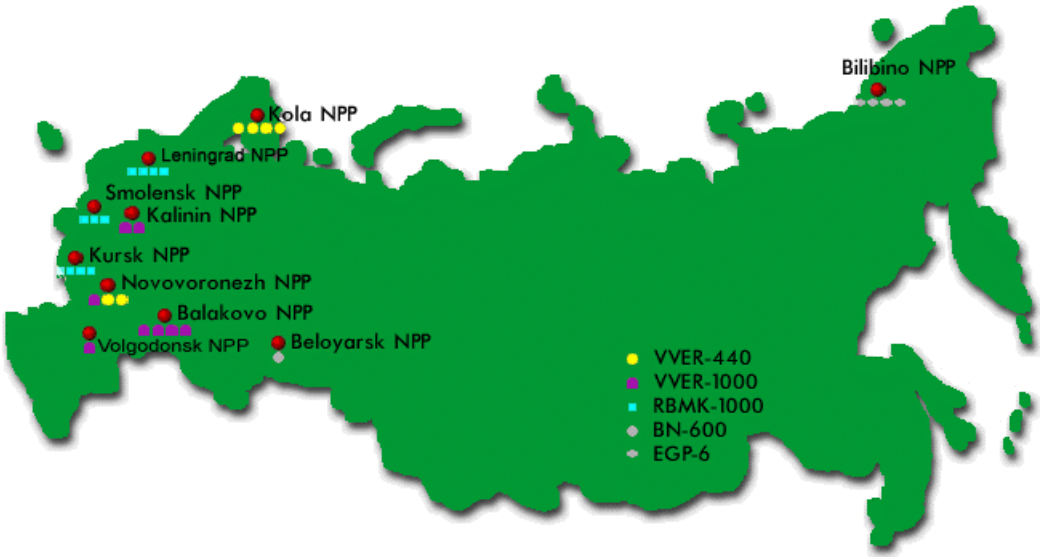

FIG. 3. Map of Russian Nuclear Power Plants

TABLE 9. STATUS OF NUCLEAR POWER PLANTS

Station	Type	Net Capacity	Operator	Status	Reactor Supplier	Construction Date	Criticality Date	Grid Date	Commercial Date	Shutdown Date
BALAKOVO-1	WWER	950	REA	Operational	MNE	01-Dec-80	12-Dec-85	28-Dec-85	23-May-86	
BALAKOVO-2	WWER	950	REA	Operational	MNE	01-Aug-81	02-Oct-87	08-Oct-87	18-Jan-88	
BALAKOVO-3	WWER	950	REA	Operational	MNE	01-Nov-82	16-Dec-88	25-Dec-88	08-Apr-89	
BALAKOVO-4	WWER	950	REA	Operational	MNE	01-Apr-84	03-Apr-93	11-Apr-93	22-Dec-93	
BELOYARSKY-3	FBR	560	REA	Operational	MNE	01-Jan-69	26-Feb-80	08-Apr-80	01-Nov-81	
BILIBINO UNIT A	LWGR	11	REA	Operational	MNE	01-Jan-70	11-Dec-73	12-Jan-74	01-Apr-74	
BILIBINO UNIT B	LWGR	11	REA	Operational	MNE	01-Jan-70	07-Dec-74	30-Dec-74	01-Feb-75	
BILIBINO UNIT C	LWGR	11	REA	Operational	MNE	01-Jan-70	06-Dec-75	22-Dec-75	01-Feb-76	
BILIBINO UNIT D	LWGR	11	REA	Operational	MNE	01-Jan-70	12-Dec-76	27-Dec-76	01-Jan-77	
KALININ-1	WWER	950	REA	Operational	MNE	01-Feb-77	10-Apr-84	09-May-84	12-Jun-85	
KALININ-2	WWER	950	REA	Operational	MNE	01-Feb-82	25-Nov-86	03-Dec-86	03-Mar-87	
KOLA-1	WWER	411	REA	Operational	MNE	01-May-70	26-Jun-73	29-Jun-73	28-Dec-73	
KOLA-2	WWER	411	REA	Operational	MNE	01-Jan-73	30-Nov-74	09-Dec-74	21-Feb-75	
KOLA-3	WWER	411	REA	Operational	MNE	01-Apr-77	07-Feb-81	24-Mar-81	03-Dec-82	
KOLA-4	WWER	411	REA	Operational	MNE	01-Aug-76	07-Oct-84	11-Oct-84	06-Dec-84	
KURSK-1	LWGR	925	REA	Operational	MNE	01-Jun-72	25-Oct-76	19-Dec-76	12-Oct-77	
KURSK-2	LWGR	925	REA	Operational	MNE	01-Jan-73	16-Dec-78	28-Jan-79	17-Aug-79	
KURSK-3	LWGR	925	REA	Operational	MNE	01-Apr-78	09-Aug-83	17-Oct-83	30-Mar-84	
KURSK-4	LWGR	925	REA	Operational	MNE	01-May-81	31-Oct-85	02-Dec-85	05-Feb-86	
LENINGRAD-1	LWGR	925	REA	Operational	MNE	01-Mar-70	12-Sep-73	21-Dec-73	01-Nov-74	
LENINGRAD-2	LWGR	925	REA	Operational	MNE	01-Jun-70	06-May-75	11-Jul-75	11-Feb-76	
LENINGRAD-3	LWGR	925	REA	Operational	MNE	01-Dec-73	17-Sep-79	07-Dec-79	29-Jun-80	
LENINGRAD-4	LWGR	925	REA	Operational	MNE	01-Feb-75	29-Dec-80	09-Feb-81	29-Aug-81	
NOVOVORONEZH-3	WWER	385	REA	Operational	MNE	01-Jul-67	22-Dec-71	27-Dec-71	29-Jun-72	
NOVOVORONEZH-4	WWER	385	REA	Operational	MNE	01-Jul-67	25-Dec-72	28-Dec-72	24-Mar-73	
NOVOVORONEZH-5	WWER	950	REA	Operational	MNE	01-Mar-74	30-Apr-80	31-May-80	20-Feb-81	
SMOLENSK-1	LWGR	925	REA	Operational	MNE	01-Oct-75	10-Sep-82	09-Dec-82	30-Sep-83	
SMOLENSK-2	LWGR	925	REA	Operational	MNE	01-Jun-76	09-Apr-85	31-May-85	02-Jul-85	
SMOLENSK-3	LWGR	925	REA	Operational	MNE	01-May-84	01-Dec-89	17-Jan-90	30-Jan-90	
ROSTOV-1	WWER	950	REA	Operational.	MNE	01-Sep-81	17-Feb-01		30-Mar-01	
KALININ-3	WWER	950	REA	Under Constr.	MNE	01-Oct-85				
KURSK-5	LWGR	925	REA	Under Constr.	MNE	01-Dec-85				

Source: IAEA Power Reactor Information System
Source: Russian nuclear power plants, Rosenergoatom, Moscow 2002

TABLE 9. CONTINUED. STATUS OF NUCLEAR POWER PLANTS

Station	Type	Capacity	Operator	Status	Reactor	Construction	Criticality	Grid	Commercial	Shutdown
SOUTH URALS 1	FBR	750	MAYAK	Under Constr.	MNE	01-Jan-93				
SOUTH URALS 2	FBR	750	REA	Under Constr.	MNE	01-Jan-93				
BILIBINO E	LWGR	31	REA	Planned						
BILIBINO F	LWGR	31	REA	Planned						
BILIBINO G	LWGR	31	REA	Planned						
BN-1600	FBR	1500	REA	Planned						
SOUTH URALS 3	FBR	750	REA	Planned						
BELOYARSKY-1	LWGR	102	REA	Shut Down		01-Jun-58	01-Sep-63	26-Apr-64	26-Apr-64	01-Jan-83
BELOYARSKY-2	LWGR	146	REA	Shut Down		01-Jan-62	10-Oct-67	29-Dec-67	01-Dec-69	01-Jan-90
NOVOVORONEZH-1	WWER	197	REA	Shut Down		01-Jul-57	17-Dec-63	30-Sep-64	31-Dec-64	16-Feb-88
NOVOVORONEZH-2	WWER	336	REA	Shut Down		01-Jul-64	23-Dec-69	27-Dec-69	14-Apr-70	29-Aug-90

Source: IAEA Power Reactor Information System.
Source: Russian nuclear power plants, Rosenergoatom, Moscow 2002

TABLE 10. NPP ELECTRICITY GENERATION SHARE

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Electricity generated at NPP's in Russia (10^9 kW·h)	118.0	120.0	119.6	119.2	97.8	99.3	108.8	108.4	103.5	120.0	128.9	134.9	139.7
NPP electricity generation share (%,)													
Total	11.2	11.5	12.1	12.7	11.4	11.8	13.1	13.2	12.8	15.0	15.0	15.2	16.0
Central Power Pool	21.7	21.3	22.7	23.9					25.1	30.0	29.2	30.0	28.5
Middle Volga Power Pool	10.9	13.6	17.9	16.4					21.8	29.2	29.2	30.0	29.1
Northwest Power Pool	46.7	47.4	43.9	47.8					36.6	41.0	39.0	40.0	41.4

Source: Country Information

2.2.2. Performance of NPPs

In 2002, nuclear power plants additionally generated 5 billion kW·h or by 3.6% more in comparison with 2001, that was provided with Volgodonsk NPP Unit 1 commissioning and growth of NPP load factor to 71,7%, i.e. load factor grew for 2 % in comparison with the value of 2001.

Table 10 shows the NPPs electricity generation share for this period and Table 11 the operational facts of the NPPs in 2002.

TABLE 11. STATUS OF NUCLEAR POWER PLANTS
- OPERATIONAL FACTS IN 2002

NPP, Unit	Capacity Installed, MW(e)	Electricity Generation, 10^6 kW·h	Load Factor, %
Balakovo	4,000	28,027	83.07
1	1,000	7,157.0	81.70
2	1,000	7,116.9	81.24
3	1,000	7,259.2	82.87
4	1,000	6,493.9	76.74
Kalinin	2,000	14,971	85.45
1	1,000	7,613.0	86,40
2	1,000	7,358.0	86.25
Kola	1,760	9,594.8	62.23
1	440	1,995.2	51.76
2	440	1,888.4	48.99
3	440	2,933.3	76.10
4	440	2,778.1	83.12
Novovoronezh	1,834	12,109.2	72.68
3	417	2,643.4	72.36
4	417	2,353.4	64.42
5	1,000	7,112.7	81.2
Beloyarsk	600	4,065.8	77.35
3	600	4,065.8	77.35
Bilibino	48	186.0	44.24
1	12	61.5	58.51
2	12	38.1	36.23
3	12	39.6	37.7
4	12	46.8	44.55
Kursk	4,000	19,527.6	55.73
1	1,000	2,706.3	30.89
2	1,000	3,334.7	38.07
3	1,000	7,485.1	85.45
4	1,000	76,001.6	68.51
Leningrad	4,000	24,844.4	77.51
1	1,000	6,189.9	70.66
2	1,000	7,613.1	86.91
3	1,000	2,793.8	38.05
4	1,000	8,247.9	94.15
Smolensk	3,000	18,220.5	71.99
1	1,000	7,406.7	84.55
2	1,000	3,700.6	42.24
3	1,000	7,813.3	89.19
Volgodonsk	1,000	7,513.1	85.77
1	1,000	7,513.1	85.77
Total	22,242	139,760.2	71.73

Source: Country Information.

2.3. Supply of Nuclear Power Plants

Architect engineers:

- All-Russia Scientific Research and Design Institute of Power Technology (VNIPIET), St. Petersburg;
- Institute "Atomenergoproekt" (AEP), and its branches in Moscow, St. Petersburg, Nizhny Novgorod;
- State Institute of Construction and Design (GSPI), Moscow.

NSS main suppliers:

- "Atommash", an open-end joint stock company - NSS WWER-1000, BN and AST, Volgodonsk;
- "Izhorskie zavody", an open-end joint stock company - NSS WWER-1000 and WWER-440, St. Petersburg;

Main component suppliers:

- "Leningradskiy metallicheskiy zavod", an open-end joint stock company - turbines for NPP's, St. Petersburg;
- "Podolskiy mashinostroitelniy zavod",, an open-end joint stock company - steam generators, separators, piping, etc., Podolsk.

2.4. Operation of Nuclear Power Plants

State enterprise "Russian state concern for generation of electric and thermal power at nuclear power plants" ["ROSENERGOATOM"] was founded in 1992 and up to 2002 executed centralized state management for 8 of 9 Russian nuclear power plants. From April 1, 2002, "ROSENERGOATOM" was transformed into generating company with common rate. 10 NPPs were joined to it as filials, including Leningrad NPP and Volgodonsk NPP, which was commissioned in December 2001.

All NPPs have 30 energy units with total rated power 22,2 GW[el.]. According to Russian federal laws in the area of atomic energy "ROSENERGOATOM" performs the functions of the NPP operating utility and bears complete responsibility for maintaining nuclear and radiological safety at all the stages of NPP operation including measures on elimination of nuclear accident consequences. The ultimate goal of "ROSENERGOATOM" activities is to ensure safe operation of Russian nuclear power plants.

***"ROSENERGOATOM"** IS ENTRUSTED TO PERFORM THE FOLLOWING MAIN FUNCTIONS:*

Ensuring the NPP safe operation, namely:

- development and implementation of NPP safety culture;
- performance of continuous surveillance over NPP safety;
- collection and analysis of the information on NPP accidents, equipment failures and human errors development of corrective measures;
- management of physical protection and fire prevention at nuclear power plants;
- development and management of emergency preparedness plans.

Support of NPP operation, namely:

- providing nuclear power plants with necessary material and technical resources;
- development and performance control for the measures aimed at enhancement of NPP reliability, quality and safe operation;
- development of normative documentation and scientific support of NPP operation, operation licensing;
- operating personnel recruiting, initial and continuous training;

- international activities;
- legal support.

Nuclear power development, namely:

- development and implementation of NPP' erection and commissioning program;
- modernization and upgrading of the operating nuclear power plants;
- solution of the problems regarding to lifetime extension of the operating nuclear power plants;
- design & development activities and NPP construction licensing;
- participation in solution of social issues concerning the nuclear industry employees;
- providing the general public with information on the issues of NPP ecological safety.

2.5. Fuel Cycle and Waste Management

The Russian Federation has capabilities in all segments of the nuclear fuel cycle. The exess of capacities are offered to foreign utilities on a commercial basis. Part of NFCFs are State owned (Minatom); the other part being managed by joint stock companies (TVEL, Rosenergoatom, Atomstroi, etc.) in which controlling interests are retained by the State.

Uranium mining and milling

The Priargunsky Industrial Mining and Chemical Union has a capacity of 3500 t U/a using open pit, underground and ISL extraction methods. This facility is operated by JSC TVEL.

Uranium conversion

Minatom operates Angarsk and Tomsk conversion plants (conversion to UF_6), which have a total capacity of 30 000 t U/a. The excess capacities are offered to foreign utilities on a commercial basis.

Enrichment process

The first civil uranium enrichment plant in the Russian Federation started operation in 1964 at Ekaterenburg. Three more plants came into operation later at Tomsk, Angarsk and Krasnoyarsk. At present, Minatom operates all four plants, which have a total capacity of 15 000 t SWU/a. The excess capacities are offered to foreign utilities on a commercial basis.

Fuel fabrication

Nuclear fuel fabrication is carried out by JSL TVEL at two plants: Electrostal and Novosibirsk. Electrostal produces fuel elements, assemblies, powder and pellets for WWER 440, WWER 100, BN 600, RBMK and PWR reactors. The Novosibirsk plant manufactures fuel elements and assemblies for WWER 1000 reactors. In the production of fuel assemblies for RBMK and WWER 1000 reactors, a quantity of fuel pellets is supplied from the Ust Kamenogorsk plant (Kazahstan). However, new lines for powder and pellet production at the Novosibirsk plant started operation in 2000-2002. Zirconium production for nuclear fuel fabrication capacity (fuel assemblies for different reactor types) of JSC TVEL is about 2600n HM/a. The excess capacities are offered to foreign utilities on a commercial basis.

Reprocessing

The reprocessing option is the one followed for dealing with spent reactor fuel, with the exeption of that originating from RBMKs, the spent fuel of which should be disposed of. Minatom operates the RT-1 Plant in Chelyabinsk for reprocessing fuel from WWER plant's capacity for WWER 440 fuel is 400 t HM/a. The construction of a second reprocessing plant (RT-2) at Krasnoyarsk, which has a first line design capacity of 800 t HM/a has been postponed indefinitely. Reprocessed uranium is used for RBMK fuel production. Plutonium obtained at RT-1 is temporarily stored on-site in dioxide form. Minatom operates several wet AFR fuel storage facilities at RT-1 and RT-2, and at several nuclear power plants, which have a total capacity of about 16 000 t HM/a.

2.6. Research and Development

2.6.1. R&D Organizations and Institutes

Fundamental Research

- Institute of Theoretical and Experimental Physics, Moscow;
- Institute of High Energy Physics, Protvino;
- Institute of Innovation and Thermonuclear Research, Troitsk.

These are major nuclear industry research centres that carry out extensive fundamental theoretical and experimental investigations into the properties of the atomic nucleus and elementary particles, plasma and laser physics, thermonuclear fusion, development of new types of accelerator and reactor technology, and equipment and facilities for physical research.

Applied Research and Development (R&D)

- The Russian Scientific Centre (RSC) "Kurchatov Institute", Moscow;
- The State Scientific Centre "Institute of Physics and Power Engineering" (SSC FEI), Obninsk;
- The State Scientific Centre "All-Russian Inorganic Materials Research Institute" (SSC VNIINM), Moscow;
- The State Scientific Centre Nuclear Reactor Research Institute (SSC NIIAR), Dimitrovgrad;
- Research and Development Institute of Power Engineering (NIKIET), Moscow.

All are major scientific centres in the field of nuclear science and technology. Theoretical and experimental research on nuclear and particle physics, neutron physics, thermophysics, hydraulics, material science, nuclear safety performed at these institutes has received world-wide recognition.

The All-Russian Research Institute for Nuclear Power Plant Operation (VNIIAES) of Moscow, is the scientific centre for Russian nuclear operating organizations. Principal attention is paid to assuring safe operation of the 1st and 2nd generation nuclear power plants.

Major reactor and NSSS design and research

- Experimental Design Bureau "Gidropress" (OKB GP), Podolsk;
- Experimental Design Bureau of Machine Building (OKBM), Nizhny Novgorod.

2.6.2. Development of advanced and new generation nuclear reactor systems

The leading 3rd generation medium and large scale power units of improved safety now include advanced WWER 1000 (for domestic market and export), WWER 1500 (replacement of the 1st generation units and capacity growths), BN-800 (for plutonium utilization and solving of environmental problem), BREST (nuclear technology of the 4th generation).

2.7. International Co-operation and Initiatives

Minatom of Russia cooperates with other countries in many fields of activities, for example:

- nuclear physics;
- fundamental research into matter properties;
- controlled thermonuclear fusion;
- physics of semiconductors and high-temperature superconductivity;
- isotopes;
- technologies of elementary particle accelerators and electrophysical equipment;

- atomic energy generation and nuclear fuel cycle;
- radioactive waste management;
- environment protection.

The Minatom of Russia scientists and researchers are engaged in a wide range of studies conducted by the various international centers for nuclear research, that is: the European Organization of Nuclear Research (CERN); the National Accelerator Laboratory and the Joint Institute for Nuclear Research. Russia participates in the International Thermonuclear Experimental Reactor quadripartite project. The Minatom scientists and engineers participate actively in both the national and the international symposia, seminars and conferences. Minatom of Russia is engaged in the intensive sharing and exchange of information at bilateral level and through the International Nuclear Information System (INIS). Within the Minatom structure there is a special Institute (Atominform) merging all information flows of the industry and dealing with the problems associated with protection of the Minatom rights to the objects of the intellectual property resulting from the activities financed by the Ministry, as well as, legal aspects of the transfer of these rights to third parties.

Recently the problems of spent nuclear fuel reprocessing, of NPP safety and of environment protection have been gaining in importance. Russia cooperates with the US Department of Energy to establish the International Center of Ecological Safety in Russia (Minatom of Russia) and in the USA (the Idaho National Engineering and Environmental Laboratory). Cooperation started in 1993 in management of spent nuclear fuel and of radioactive waste and cooperation in rehabilitation of contaminated territories at the northwest of the Russian Federation with Norway, the European Commission, France, Sweden and USA are still in progress. In 1998 on the Minatom initiative Russia began to cooperate with France and Germany to construct reactor EPR in Russia. The joint working group including experts from Minatom, Framatome and Siemens Company was formed. The European Commission rendering technical assistance on a gratuitous basis with in the frameworks of TACIS Program is one of the leading western partners. In 1998 the implementation of the Partnership and Cooperation Agreement (PCA) between Russia and the European Union was started. Throughout recent years Russia has taken part in activities in compliance with the Agreement on ISTC.

The extensive activities to tackle problems of non-proliferation and safe dismantling of the Russian nuclear weapons and of weapon plutonium and uranium conversion are in progress. For example, throughout 1994-1997 research and development activities to fabricate uranium-plutonium fuel for CANDU reactors from weapon plutonium were carried out in cooperation with Canada. In 1999 cooperation with Germany, Great Britain, Japan, Italy, France and with the US participation within the frameworks of the intergovernmental agreements on rendering assistance to Russia to ensure safe dismantling of nuclear weapons was continued. At present the joint Russian-US efforts are taken for decommissioning of weapon plutonium production reactors. In 1999 a draft Intergovernmental Agreement between the Russian Federation and Netherlands on cooperation in safe dismantling of nuclear weapons reduced in the Russian Federation and in utilization of removed nuclear-powered submarines was elaborated

By convention, designing, mounting and commissioning of NPPs and large-scale production installations at the territories of the CIS and of the other countries form essential part of the international cooperation of Minatom of Russia. Ukraine and Kazakhstan are the most active partners of Russia. A draft Agreement on cooperation in nuclear fuel cycle has been elaborated and coordinated recently with Ukraine. Activities to complete construction and to put into operation the Rovno and the Khmelnitsky NPPs are in progress. Russia supplies nuclear fuel to Ukraine and transports spent nuclear fuel out of the country. Russia cooperates with Kazakhstan in production of nuclear fuel and in other aspects of nuclear fuel cycle. An NPP is planned to be constructed at the territory of Kazakhstan.

Minatom of Russia cooperates with China, Bulgaria, Slovakia, Korea, Indonesia, Cuba, India, Syria, Egypt in construction and operation of NPPs and large-scale production installations. We can note certain progress in the Russian-Japanese relations.

2.8. Human Resources Development

The industry personnel policy serves to keep and to add the personnel potential. There are 6 centers and Institutes for Advanced Professional Training of managerial and engineering staff where up to 10000 persons per year may be trained. The young personnel is trained in 20-ty high educational institutions including 7 industrial ones, in 21 technical colleges, professional and technical schools. The total number of the persons trained in the industry educational institutions constitutes over 18500 including over 6000 students of high educational institutions

Training of scientific personnel of the industry in 30-ty post-graduate schools established on the basis of the industry enterprises and Institutes where up to 500 engineers are trained annually occupies a highly important place.

Changeover from solution of individual problems to the combined implementation of the complex program of job-security, social and economical development, social insurance, etc., in cooperation with the local self-administration bodies is in progress in respect of interaction with closed administrative and territorial entities.

The training and procedure papers, simulators and training equipment have been developed within the frameworks of the international scientific and engineering cooperation with the USA, Japan, Germany, France, Great Britain and Syria. Over 350 Russian engineers were trained abroad and training of foreign students in the industry base Institutes was arranged.

3. NATIONAL LAWS AND REGULATIONS

3.1. Safety Authority and the Licensing Procedures

The Russian Federal Supervision of Nuclear and Radiological Safety (Gosatomnadzor) is the Nuclear Regulatory Body of the Russian Federation with the headquarters in Moscow and seven regional offices throughout the country.

The following regulations determine the procedure for nuclear power plant licensing:

- Regulations on the order of special permission issued by Gosatomnadzor of Russia for examination of design and other materials and documents, substantiating safety of nuclear and radiologically dangerous installations and works: RD-03-12-94.
- Regulations on arranging and carrying out examination of design and other materials and documents, substantiating safety of nuclear and radiologically dangerous installations and works: RD-03-13-94.
- Regulations on the order of issuing of special temporary permissions for designing nuclear and radiologically dangerous installations and works: RD-03-14-94.

The stages of obtaining the temporary permission (license) for NPP unit operation can be represented in brief as follows:

i) License demand (submission of application documents);
ii) Gosatomnadzor decision on the demand control;
iii) Analysis of substantiating materials of demand;
iv) Inspection at the NPP;
v) Conclusion on substantiating materials examination;
vi) Conclusion on NPP inspection;
vii) General conclusion on obtaining temporary permission (license);
viii) License (temporary permission).

3.2. Main National Laws and Regulations in Nuclear Power

In the near future, the main laws controlling nuclear power in Russia will be the law "About utilization of atomic energy" and the law "About state policy in the field of radioactive waste management". Final approval of the law "About utilization of atomic energy" is conditioned by the problems related with property rights in the nuclear industry, nuclear safety and radioactive materials treatment. Presently, several documents serve for this purpose.

Technical regulations created by Gosatomnadzor of Russia, which are in force today, are the legal framework for nuclear energy utilization. These regulations and rules address the aspects of safety assurance during site selection, designing, construction, operation, and decommissioning of nuclear installations. All regulating documents developed by Gosatomnadzor have been compiled into a "List of main scientific and technical documents, used by Gosatomnadzor for safety regulation and supervision during production and utilization of atomic energy, handling of nuclear materials, radioactive substances and articles on their base", P-01-01-92, Gosatomnadzor of Russia, 1992.

Some aspects of nuclear related activity are regulated by decrees of the President or Government of the Russian Federation.

Decrees of the President:

- "About the control of export of nuclear materials, equipment and technologies" of 27 March 1992;
- "About the utilities with nuclear power plants " of 7 September 1992;
- "About privatization of enterprises under the authority of Ministry for Atomic Energy, and their management in a market economy " of 15 April 1993, etc.

Decrees of the Government:

- "About approval of documents, regulating export of equipment and materials and of corresponding technology, used for nuclear purposes" of 29 May 1992;
- "About measures of protection of the population living adjacent to nuclear power installations" of 15 October 1992, etc.

4. CURRENT ISSUES AND DEVELOPMENTS ON NUCLEAR POWER

4.1. Current Policy Issues

Nuclear Development

The current nuclear policy in Russia was formulated by the Minatom in the 1998 "Programme of Nuclear Power Development of the Russian Federation for 1998 – 2005 and Prospects up to the Year 2010" approved by the Government of the Russian Federation on July 21 1998. Its main objectives are as follows:

i) assuring the safety of operating nuclear plants including those constructed in accordance with old regulations and the safety enhancement of nuclear power plants under construction;
ii) development of improved new-generation plants;
iii) feasibility studies on the advanced reactor concepts;
iv) R&D work on closed nuclear fuel cycle;
v) R&D efforts on decommissioning of nuclear power plants;

vi) development of cost-effective and environmentally safe spent fuel and radioactive waste management technology;
vii) safe operation of the research reactors, critical assemblies and other nuclear facilities;
viii) remodelling research centres, experimental facilities and industrial units which support the nuclear industry development programme.

4.2. Privatisation and deregulation

Reforming the Russian electricity sector

The idea of reforming Russian electricity sector has evolved directly from the answer to very simple and evident questions – who pays, how much, whom and what for is to be paid. Today RAO UES is a monopoly in the field of energy supply and is a financial and industrial holding, which consists of a number of regional energetic companies, large federal power stations as well as intersystem electrical grids. The state owns the controlling stake of RAO UES. It regulates all activities of the energy-holding and determines the prices of its services and production.

In order to make market mechanisms work, it is necessary to undertake a variety of reforming measures in energy sector of Russian Federation. On the first stage every regional energy company will be divided into generating company and Grid Company, which will include the dispersing grids and Sale Company. On the second stage the process of dividing will be replaced with interregional integration: regional generating and grid companies will unite. Territorial generating companies will become electricity market participants along with 10 wholesale generating companies, which are now being discussed in the Russian Government. Intersystem and high-voltage electric grids will be united into Federal Grid Company, which will be completely acquired by the state afterwards. The state as the most impartial participant of the process will take the obligation of granting equal reach to the grids for all energy producers and consumers. Dispatching of energy will be conducted by another state-owned corporation JSC “SO-CDU UES”. And finally, non-commercial partnership Administrator of trade system will become the ground for all the sales, pricing, negotiating and contracting of purchase and sale.

It is the state, who will set prices on dispatching services and energy transportation along intersystem and dispersing grids, while the price on electricity, produced by any of the power stations, will be set on the basis of demand and supply balance on the market. This is just the very sphere of electricity sector that will be a subject for essential alteration in the nearest future. Generating enterprises, which have turned into independent companies, will become financially transparent and attractive for investors. The development of this trend will be derived directly from a clear and understandable way of energy pricing. In conditions of harsh competitive market energy producers minimize costs, implement new technologies and lower the price of electricity by using inner reserves in fight for consumers. Therefore competition will become a natural stimulus for stabilization and price-reduction.

Competition will also be introduced in the sphere of energy-sales: several sales companies will work in every region, each specializing in one of the consumer groups. They will compete for these consumers by lowering the price on its services and by offering more profitable and convenient conditions of energy supply. Wholesale sellers will simply lack any space in this scheme, they will become components of regional grid companies.

4.3. Role of the government in the nuclear R&D

Mission of the Ministry of Russian Federation on nuclear energy

The Minatom of Russia is a federal regulatory body with executive authority's functions to carry out the Federal policy in the field of development, production in the sphere of nuclear engineering. It

executes a regulatory agency's functions in management of usage of nuclear energy, and also in licensing and coordination of activities in these spheres of federal organs' responsibility as the executive authority.

The Minatom of Russia within limits of its competence is responsible to the Federal State for further development of nuclear energy complexes. It coordinates activities of corresponding firms and organizations.

4.4. Safety and waste management issues

Russia likewise the majority of the leading nuclear countries has initiated a program to develop a closed nuclear fuel cycle. It will enable in future to reduce uranium mining by half, to apply a new power source, that is, plutonium in the fuel cycle and to reach up and over 60% of fuel burnup in both thermal and fast neutron reactors.

At the present-day phase of scientific and technical development and in the future the nuclear power industry of the Russian Federation has to tackle two basic problems, that is:

- safety improvement of nuclear installations;
- assurance of safe management of spent nuclear fuel (SNF) and of radioactive waste (RW) (storage, transportation, treatment, utilization, disposal).

By now in Russia the procedures ensuring safety of personnel, environment and population are available. These procedures are based on the vast accumulated experience in reprocessing of Russian and foreign WWER-440 reactor spent fuel and of nuclear-powered submarine fuel.

These procedures are based on the vast accumulated experience in reprocessing of Russian and foreign WWER-440 reactor spent fuel and of nuclear-powered submarine fuel.

The main tasks of the present and future development of the nuclear power industry are as follows:

- trouble-free operation of nuclear power installations;
- safety of spent fuel and radioactive waste disposal.

REFERENCES

[1] CIS Countries Economics. Moscow, Finstatinform, (1993) (in Russian).

[2] CIS Countries in 1991. Annual Statistic Report. Moscow, Finstatinform, (1992) (in Russian).

[3] Energy Strategy of Russia. Main Concepts. Moscow, (1995) (in Russian).

[4] Annual Report of Mintopenergo of Russia 1993. Moscow, (1993) (in Russian).

[5] Technical and Economic Characteristics of Electric Power in Russia. NIIEE, Moscow, (1992) (in Russian).

[6] Data of the Ministry of Fuel and Energy of the Russian Federation, (1993).

[7] Fuel and Power in Russia. VNIIKTEP, Moscow, (1992) (in Russian).

[8] Strategy of Nuclear Power Development in Russia. Moscow, (1994) (in Russian).

[9] Performance Indicators of Russian NPP's in 1993. "Rosenergoatom" Concern, (1994).

[10] Minatom of Russia. Atominform, (1992).

[11] International Affairs, Special Issue, Russian Nuclear Complex Opens to the Country and the World, (1994).

[12] NPP's operation in the Russian Federation, The 1993 Report, "Rosenergoatom" Concern, (1994).

[13] On the Activity Related to the Future Development of the Russian Electric Energy Sector in the New Economic Conditions, Energy Construction, Vol 11, (1994) (in Russian).

[14] Programme of Russian Federation Nuclear Power Development in 1998-2005 and for perspective up to 2010. Moscow, (July 21, 1998)

[15] About Status and Perspective of Nuclear Power Development. Rosenergoatom, (1999)

[16] National Report of Russian Federation about Realization of Obligations of Nuclear Safety Convention. Moscow, (1998).

[17] Russian Annual Statistical Transactions, Moscow (1998)

[18] Russian Annual Statistical Transactions, Moscow (1999)

[19] Russian Annual Statistical Transactions, Moscow (2000)

[20] Russian nuclear power plants, Rosenergoatom, Moscow (2001)

[21] IAEA Energy and Economic Data Base (EEDB)

[22] IAEA Power Reactor Information System (PRIS)

[23] Russia in figures, Summary Statistical Transactions, Moscow (2002)

[24] Country Nuclear Fuel Cycle Profiles. IAEA.

[25] Russian nuclear power plants, Rosenergoatom, Moscow (2002)

Appendix 1

INTERNATIONAL, MULTILATERAL AND BILATERAL AGREEMENTS

AGREEMENTS WITH THE IAEA

• Amendments to Articles VI & XIV of the Agency statute	Not ratified	
• Agreement on privileges and immunities	Entry into force:	1 July 1966
• Unilateral safeguards submission (Voluntary offer) INFCIRC/327	Entry into force:	10 June 1985
• Additional Protocol	Signed:	22 March 2000
• Supplementary agreement on provision of technical assistance by the IAEA	Not yet concluded	

MAIN INTERNATIONAL TREATIES

• NPT	Entry into force:	5 March 1970
• Convention on physical protection of nuclear material	Entry into force:	8 February 1987
• Convention on early notification of a nuclear accident	Entry into force:	24 January 1987
• Convention on assistance in the case of a nuclear accident or radiological emergency	Entry into force:	26 February 1987
• Vienna convention on civil liability for nuclear damage	Signature:	8 May 1996
• Paris convention on civil liability for nuclear damage	Not applicable	
• Joint protocol relating to the application of Vienna and Paris conventions	Non-Party	
• Protocol to amend the Vienna convention on civil liability for nuclear damage	Non-Party	
• Convention on supplementary compensation for nuclear damage	Non-Party	
• Convention on nuclear safety	Entry into force:	24 October 1996

• Joint convention on the safety of spent fuel management and on the safety of radioactive waste management	Signature:	27 January 1999

OTHER RELEVANT INTERNATIONAL TREATIES/UNDERTAKINGS

• Improved procedures for designation of safeguards inspectors	Waiver proposal accepted by U.S.S.R. on	15 September 1988
• ZANGGER Committee	Member	
• Nuclear Suppliers Group	Member	
• Acceptance of NUSS Codes	Summary: A good basis for national safety standards. Taken into account in preparation of regulatory/ technical documents. Best form of application in USSR being studied:	30 December 1988
• Nuclear Export Guidelines	Adopted	
• World Association of Nuclear Operators (WANO)	Member	

BILATERAL AGREEMENTS

Bilateral agreements on peaceful use of atomic energy have been signed with USA, UK, Germany, France, Italy, Canada, Republic of Korea, Switzerland and some other countries.

1. "Bilateral Agreement between Governments of the Russian Federation and the United States of America on Scientific and Technical Co-operation in the Field of Management of Plutonium Withdrawn from Nuclear Military Programmes". Moscow, July 24, 1998.
2. "Threelateral Agreement between Governments of Russian Federation and Federal Republic of Germany and Republic of France on Co-operation in the Field of Peaceful Utilization of Plutonium Being Released as a Results of Dismantling of Russian Nuclear Weapons".
3. Russia – US "Agreement on Co-operation in Research on Radiation Effects for the Purpose of minimize the consequences of the Radioactive Contamination on Health and environment". Moscow, January 14, 1994.
4. Russia – US "Agreement on Increasing of Operational Safety, Measures to Decrease Risk and on Nuclear Safety Standards of Civil Nuclear Facilities in Russian Federation". Moscow, December 16, 1993.

Appendix 2

DIRECTORY OF THE MAIN ORGANIZATIONS, INSTITUTIONS AND COMPANIES INVOLVED IN NUCLEAR POWER RELATED ACTIVITIES

NATIONAL ATOMIC ENERGY AUTHORITIES

Ministry of Atomic Energy (MINATOM)
Staromonetny pereulok 26
109180 Moscow

Tel: (7 095) 239 4908
Fax: (7 095) 230 2420
Telex: 411888 MEZON SU
http://www.x-atom.ru/minatom/min_eng.html

Federal Nuclear and Radiation Safety Authority
Taganskaya ulitsa 34
109147 Moscow

Tel: (7 095) 272 0349
Fax: (7 095) 278 0098
Tlx: 411743 SYVIN SU

State Supervisory Committee
for Nuclear Safety and Radiation Protection

Fax: (7095) 278 8090

OTHER NUCLEAR ORGANIZATIONS

Consortium of Russian Nuclear Power Plants
"ROSATOMENERGO"
B. Ordynka 24/26
K-74 Moscow 103074

Tel: (7 095) 239 24 22
Fax: (7 095) 239 27 24
http://www.rosatom.ru/

Obninsk Institute for
Physics and Power Engineering
Bondarenko Sq. 1
249020 Obninsk, Kaluga region

Tel: (708439) 9 82 50
Fax: (7095) 230 23 26
http://www.ippe.obninsk.ru/

All-Russia Scientific Research and Design
Institute of Power Technology -VNIPIET
Dibunovskaya Str.
St. Petersburg

Tel: (812) 239 01 34
Fax: (812) 239 18 98

Nuclear Safety Institute (IBRAE)

http://www.ibrae.ac.ru/

Institute "Atomenergoproekt" (AEP)
Bakunin Str. 7
Moscow

Tel: (7095) 261 41 87

"Atommash"
Krasnoarmeyskaya Str. 206
Volgodonsk
Rostov reg.

"Izhorskie zavody"
Kolpino-1, Lenin Str. 1
St. Petersburg

Fax: (812) 463 92 69

“Rosenergoatom” Kitaisky pr. 7 Moscow	 Tel: (7095) 220 63 01 Fax: (7095) 220 44 88
"Atomredmetzoloto" Bolshaya Ordynka Str. Moscow	 Tel: (7095) 239 44 11 Fax: (7095) 239 46 79
TVEL Concern, Inc. Bolshaya Ordynka Str. Moscow	 Tel: (7095) 239 43 55 Fax: (7095) 233 10 59
Russian Scientific Centre (RSC) “Kurchatov Institute" Kurchatov Sq. 1 Moscow	Tel: (7095) 196 92 41 http://www.kiae.ru/
State Scientific Centre "All-Russian Inorganic Materials Research Institute" (SSC VNIINM) Rogov Str. 5a Moscow 123060	Tel: (7095) 190 82 97 Fax: (7095) 196 41 68
State Scientific Centre "Nuclear Reactor Research Institute" (SSC NIIAR) Box M-5881 Dimitrovgrad Ulyanovsk Region	Tel: (84235) 3 52 80 Fax: (84235) 3 56 48 http://www.niiar.simbirsk.su/eng/riarsb.htm
All-Russian Research Institute for Nuclear Power Plant Operation (VNIIAES) Ferganskaya Str. 25 Moscow	 Tel: (7095) 377 00 75 Fax: (7095) 274 00 73
Research and Development Institute of Power Engineering (NIKIET) P.O.Box 788 Moscow	Fax: (7095) 975 20 19
Experimental Design Bureau of Machine Building (OKBM) Burnakovsky pr. 15 Nizhny Novgorod	Tel: (8312) 46 21 32 Fax: (8312) 41 87 72
Experimental Design Bureau "Gidropress" (OKB GP) Ordzhonikidze Str. 24 Podolsk Moscow region	 Tel: (7095) 137-90-96
Leningrad Nuclear Power Plant	http://www.laes.sbor.ru/

NUCLEAR RESEARCH INSTITUTES

Budker Institute of Nuclear Physics (BINP)	http://www.inp.nsk.su/

Frank Laboratory of Neutron Physics (FLNP)	http://nfdfn.jinr.ru/
Institute of General and Nuclear Physics (Kurchatov Institute)	http://www.ignph.kiae.ru/
Ioffe Institute for Physics and Technology	http://www.ioffe.rssi.ru/
Khlopin Radium Institute	http://www.atom.nw.ru/RIE/
Moscow Power Engineering Institute	http://mpei.ac.ru/
St. Petersburg Nuclear Physics Institute	http://www.pnpi.spb.ru/

HIGH ENERGY INSTITUTES

Bogoliubov Laboratory of Theoretical Physics (BLTP)	http://thsun1.jinr.ru/
Flerov Laboratory of Nucler Reactions (FLNR)	http://sungraph.jinr.dubna.su/flnr/
Institute for Nuclear Research (INR)	http://www.inr.ac.ru/
International Center for Fundamental Physics	http://www.icfpm.lpi.ru/
Joint Institute for Nuclear Research in Dubna (JINR)	http://cv.jinr.ru/
Laboratory of High Energies (LHE JINR)	http://lhe.jinr.ru/
Laboratory of Nuclear Problems (LNP)	http://nuweb.jinr.ru/
Laboratory of Particle Physics (LPP)	http://sunse.jinr.ru/
Skobeltsyn Institute of Nuclear Physics (SINP, Moscow)	www.npi.msu.su:80/inp50/english/index.html
Saint-Petersburg State University (Radiophysics scientific school)	http://www.phys.spbu.ru/Departments/RadioPhysics/
International Science and Technology Center (ISTC)	http://www.istc.ru/

OTHER ORGANIZATIONS

Republican Research Scientific -Consulting Center for Expertises (RRSCCE)	http://www.extech.msk.su/
Federal Environmental Emergency Response Centre Federal Environmental Emergency Response Centre (FEERC)	http://www.typhoon.mecom.ru/