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AUSTRALIAN NUCLEAR SCIENCE
& TECHNOLOGY ORGANISATION

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# ENERGY AND NUCLEAR POWER DEVELOPMENTS IN EASTERN EUROPE

## 1. INTRODUCTION

The two factors most influencing energy policy in Eastern Europe have been the centralised economic planning system and the dominance of coal in domestic energy reserves. The centralised system favoured energy intensive industries, provided all the capital for the energy sector from central funds and subsidised energy prices. As the price structures did not cover costs, and there were no incentives to save energy, energy inefficiencies became a built-in feature of Eastern European economies. Ageing conventional power plants have also contributed to the region's energy inefficiency. The lack of foreign exchange meant that energy imports from outside countries were not considered an option regardless of the cost of domestic production.

The economic restructuring taking place in Eastern Europe will introduce market forces into the energy scene, with deregulated prices, reduced subsidies and energy enterprises meeting their financial needs on the capital market. Poland, for example, has raised its energy prices by a factor of six and is moving towards a free market in coal and the closure of inefficient heavy industries. Energy demand in Eastern Europe is expected to be lower in the short term as the economic restructuring leads to an industrial recession. Industrial output in the East has been reported as below last year's figures.

Coal is the most important primary energy source for Eastern Europe except the USSR where gas supplies most of the energy. The region has 10% of the world's black coal, with the largest reserves in Poland, and 10% of the world's brown coal or lignite. East Germany is the world's largest producer of lignite but at the current rate of production its reserves could be exhausted in about twenty years.

All countries in Eastern Europe depend on energy and electricity imports from the USSR, which is the leading supplier of oil and gas. Only Romania, Hungary and Yugoslavia derive a significant amount of their oil consumption from domestic sources. Hungary imports approximately 30% of its electricity from the USSR and is concerned to increase its energy independence. Increased internal demand may mean the USSR will not be able to export as much electricity in the future as previously. In the past such exports, because they were paid for in Comecon convertible roubles, were underpriced. From January 1991 the Eastern Europe countries will pay for their inter-country trade in hard currency.

The Khmelnitsky nuclear power station in the Ukraine was jointly built by the cooperative efforts of the USSR, Poland, Hungary and Czechoslovakia with the

electrical power being distributed proportionally amongst them. The electricity grids of Eastern and Western Europe are not synchronised. To import Western electricity a country's grid would have to be decoupled from the Eastern grid and integrated into the Western Europe grid. The German Association of National Grid Associations is developing a plan to help the GDR with electricity supplies by building three transformer stations. Some West-East supply arrangements have taken place. West German utilities delivered electricity to Romania via Austria, Czechoslovakia and Hungary between January and March to meet the country's short-term electricity needs.

In 1989 nuclear power supplied 50% of the electricity in Hungary, 33% in Bulgaria, 28% in Czechoslovakia, 12% in the USSR, 11% in Germany D.R. and 6% in Yugoslavia. The low quality of the coal in Hungary and Bulgaria has made nuclear power the single most important source of electricity in those countries. Nuclear power projects are under construction in Romania and Poland. Further nuclear power plants are being built in Bulgaria, Czechoslovakia, East Germany and the USSR and more are planned in all the countries of Eastern Europe except Yugoslavia. In June 1989 the Yugoslav Parliament passed legislation which imposes severe criminal penalties for anyone constructing or even planning nuclear facilities. Yugoslavia continues to operate its one nuclear power plant, a Westinghouse 632 MWe pressurised water reactor (PWR) jointly owned by the Republics of Slovenia and Croatia.

## 2. NUCLEAR INDUSTRY

The USSR exerted an overwhelming technical and economic influence on the European centrally planned countries. The nuclear power programs for Comecon countries outside the USSR, with the exception of Romania where Canadian-designed units are being built, are based on the Soviet VVER-440, a 440 MWe pressurised water reactor (PWR). Before perestroika (economic restructuring), VVER-1000s (1000 MWe units) were planned in every country. In the 1980s the USSR ceased construction of VVER-440s and all its later PWRs are VVER-1000s. The RBMK, pressure tube uranium-graphite Chernobyl-type reactor, was not built outside the USSR.

While the earlier VVER-440 units in Eastern Europe were built solely by the USSR, the situation changed fundamentally after a 1979 Comecon accord. This has resulted in a major transfer of nuclear technology from the USSR to the other countries. They have been encouraged to build up their own expertise according to their industrial capacity, concentrating on particular items rather than trying to develop a complete nuclear manufacturing capability. About 50 industrial companies take part in this cooperation. They include the Volga-Don Atommash heavy component plant in the USSR, the Skoda works in Czechoslovakia, the

Heavy Machinery Construction combine in East Germany, the Chemimach Corporation in Hungary and Zemak in Poland. As a result, the USSR's share as a supplier of major nuclear equipment has decreased to about 50% and its manufacturing resources are concentrated on the VVER-1000 reactor.

After the USSR, Czechoslovakia has the most advanced industrial base. 80% of the components in Czech reactors are domestically supplied and VVER-440s are exported to other countries. Skoda is supplying the four 440 MWe units for the Zarnowiec nuclear power plant being built in Poland. Construction there has been suspended for a year because of economic difficulties. Czechoslovakia specialises in reactor vessels, steam turbines, steam generators, pumps, valves and large pipework. The Skoda works has contracts for the supply of primary circuit components and had hopes of supplying some of the pressure vessels for the VVER-1000 units under construction, and now postponed, in the other countries. Unless the VVER construction program in Eastern Europe is resumed, Skoda expects to run out of major nuclear work before 1995.

In the longer term a significant expansion of nuclear power is expected. The International Energy Agency has estimated nuclear power in Eastern Europe outside the USSR will grow at about 7.5% a year. Nuclear power will be needed to meet electricity demands, to move away from dependence on the USSR and to reduce the present high levels of atmospheric pollution caused by coal-fired power stations. Economic conditions, safety and public acceptance concerns about Soviet-designed reactors and shortage of capital to import the Western technology sought to upgrade or replace them are likely to inhibit any immediate increase in nuclear power production. Decisions are currently being made on whether to continue to operate, or backfit, or close existing plants, on which construction or planned projects will proceed, on what reactor designs will be chosen and on how projects are to be financed.

Barter and cooperative arrangements are significant in the nuclear field. The Eastern Europe countries, except Poland, mine uranium and production was sent to the USSR which supplied all the fuel cycle services (conversion, enrichment, fuel fabrication, reprocessing and high-level waste disposal) to countries using Soviet-designed reactors. Thus, East Germany covered the cost of nuclear fuel with the delivery of U3O8 to the USSR but following July's economic union and adoption of the West German mark it will have to pay for fuel in hard currency. Discussions have been reported between the East Germans and Urenco, Siemens, British Nuclear Fuels and Cogema on a number of fuel cycle services. The arrangement by the USSR to take back spent fuel from the other countries, although reported to be years behind schedule, means they need make no provision for high level waste disposal, with all the environmental and public acceptance problems involved. The USSR has agreed to Czechoslovakia

disposing of the uranium surplus to its domestic requirements and Interuran GmbH of West Germany has been given exclusive marketing rights.

A number of Eastern Europe countries have expressed the wish to obtain Western reactor technology but the lack of hard currency and the high foreign debt make financing difficult in all countries, except Romania which has no foreign debt. Late in 1989 the Hungarian Council of Ministers decided to suspend its agreement with the USSR for the design and construction of two 1000 MWe pressurized water reactors (PWRs) at the Paks nuclear power plant because neither country could finance the project in the foreseeable future. Subsequently Hungary has been negotiating with Electricite de France (EdF) to collaborate on two French PWRs at Paks. Hungary is also studying, with Ontario Hydro and Atomic Energy of Canada Limited, the technical and economic feasibility of fitting a Candu reactor into its grid. Other foreign power plant proposals include three coal-fired stations. In each case, Hungary would repay the investor by exporting some of the electricity to the West, most probably to Austria and Italy. EdF engineers are studying the technical and financial requirements needed to integrate the Hungarian power system with that of the West.

Late in 1989 Nuclear Power International, the joint venture of Framatome and Siemens/Kraftwerk Union, set up a working party with Minatomenergoprom, the Soviet Ministry of Nuclear Energy and Industry, to explore cooperation in the development of future PWRs for the USSR, with an emphasis on enhanced safety standards. The USSR has already been developing two advanced VVER designs, the VVER-88 and the VVER-92. Construction of the first VVER-88, a 1000 MWe PWR, unit 5 at the Khmelnitsky station, is scheduled to begin this year. The VVER-92, intended to be an inherently safe economic PWR that could be supplied to other countries, could be a large reactor evolving from the VVER-88 or it could be a smaller version of about 500 MWe.

In 1989 the decision was formally made to cancel construction of the last four RBMK reactors being built and to build no more of that type. There is only one, Kurst-5, still under construction. Design work is taking place on several advanced model RBMKs. Backfitting is taking place on the fourteen reactors built in the 1970s to raise their safety levels and the oldest Soviet power reactors are being closed down. There are plans to replace or backfit all the steam generators on the VVER-1000s. The USSR has 46 power reactors (32,577 MWe) in operation and 19 units (17,898 MWe) under construction. Official plans project 100,000 MWe of installed nuclear generating capacity by the year 2000. In line with the general economic restructuring in the USSR, Minatomenergoprom is expected to be split next year into independent companies, each responsible for an aspect of the nuclear power and fuel cycle industry and each paying its own way.

## 3. SAFETY OF NUCLEAR POWER

Serious safety concerns have been raised about Soviet-designed PWRs, particularly the first-generation VVER-440s, the Model V230. Comecon officials have acknowledged materials and safety systems deficiencies and admitted that substantial backfitting would be required to bring these plants up to an acceptable safety standard. The four countries operating these plants, the USSR, Bulgaria, Czechoslovakia and East Germany, had agreed on sixteen basic upgrading steps to be undertaken. Some improvements, such as the annealing of some of the pressure vessels, have been carried out.

In East Germany four such units at the Greifswald plant are to be decommissioned by 1995 following a review by West Germany's nuclear safety organisation, Gesellschaft fur Reaktorsicherheit (GRS). Pressure vessel embrittlement has already led to the closure of two of these units. Another has also been ordered shut. Unit 1 is to continue operating until December. By that time Siemens/KWU will have in operation oil-fired heating stations to supply the thermal energy now provided by the Greifswald reactors to a district heating system for some 14,500 households. It has been reported that the West German government is providing the finance (DM 30 million/US$19 million) for these thermal units. The East German government is to decide in December whether to undertake substantial backfitting and continue to operate the plants until the mid-1990s. The GRS review showed backfitting was needed in almost all areas, including instrumentation and control, emergency core cooling and fire protection. Such improvements could be made within three years, at an estimated cost of DM 320 million (US$200 million).

Four of Bulgaria's five operating nuclear reactors at Kozloduy are Model V230s. No announcement has been made about their future. An OSART (Operational Safety Review Team) mission from the International Atomic Energy Agency is to visit the station in October. With the country's lack of energy resources, dependence on nuclear power, budget deficit and other serious economic problems, replacement power supplies would be a crucial issue. The USSR has announced plans to build a two-unit VVER-1000 station at Kola that will replace two Model V230s and two later VVER-440s in operation there. Czech officials have been reported as hoping to replace the capacity of their Model V230s, Bohunice 1 and 2, with that of newer nuclear plants but have announced no definite plans.

The later Soviet-design PWRs, the VVER-440 (Model V213) and the VVER-1000 (Model V320) have significantly improved safety features. The Model V213 has pressure suppression for accident containment. Four such units operate in Hungary, four in the USSR, six in Czechoslovakia and one has begun operation in East Germany. A further three are under construction in East Germany, two in

Poland and four in Czechoslovakia. In Finland, the only country outside Eastern Europe to operate these reactors, the two unit Loviisa nuclear power plant consists of two model V213s but with the addition of a Westinghouse ice condenser and the recent replacement of its computer systems by sophisticated Western models. This combination of later VVER technology together with some Western style safety systems and instrumentation has proved most successful. It is expected to be the approach chosen in Eastern Europe, together with backfitting Western technology, particularly instrumentation and control systems, to their plants. Such backfits are to delay the completion of Temelin 1 and 2 (VVER-1000s) in Czechoslovakia. The start-up of Mochovce 1, scheduled for November 1989, has also been postponed for two years to improve the reactor control and safety systems following a major reassessment carried out by the Soviet designers at the request of the Czechs.

The safety of the later model Soviet PWRs will be tested when the VVER-440s under construction at Greifswald and the VVER 1000s being built at Stendal are subjected to West German licensing procedures. Only one VVER-1000 is in operation outside the USSR - at Kozloduy in Bulgaria. The plans to construct two such units at Paks in Hungary and at Temelin in Czechoslovakia have been cancelled. On the other hand, Finland is assessing the VVER-1000 design as its possible fifth nuclear power plant.

Concern about the seismic risks to Soviet power reactors has been publicly expressed and has led to the cancellation of a number of plants under construction in the USSR. The two Armenian power reactors which operated safely during the disastrous December 1988 earthquake were subsequently closed, because of the expense of backfitting safety equipment, the seismic risk and "to meet the wishes of the Armenian people". Siemens/KWU has been commissioned by Minatomenergoprom to perform seismic analyses of the nuclear power plants under construction in the USSR. Public opposition also contributed to the decision to halt the program of nuclear co-generation plants, the so-called ATETZ stations of two VVER-1000 reactors, which were to be built at Minsk, Odessa, Kharkov and Volgograd.

Construction work at Bulgaria's second VVER-1000 nuclear power station at Belene was suspended in February after protests about seismic safety. Demonstrations have also been reported by the 9,000 workers at the site, concerned about possible job losses. Westinghouse and two other companies have completed a seismic analysis study of the project.

The Soviet Union itself has acknowledged problems with its nuclear power plants and sought Western technology. Recently, substantial commercial contracts have been signed with Western companies for the supply of safety equipment. Siemens/Kraftwerk Union (KWU) has a contract, reportedly worth tens of

millions of dollars, with Atomergoexport to supply reactor loose-parts monitoring systems for all the PWRs operating in the Soviet Union. Electricite de France (EdF) has contracts with the USSR totalling over $2 million to supply computerised systems that will evaluate reactor plant safety.

## 4. THE ENVIRONMENT

The burning of brown coal is responsible for much of the atmospheric pollution in Eastern Europe. Pollution control equipment is virtually non-existent. The lignite burned in Czech power stations contains up to 2.5 per cent sulphur. This has given the country the heaviest sulphur dioxide pollution in the world. In the most industrially polluted areas of northern Bohemia life expectancy is ten years below that of Western Europe. Czechoslovakia has therefore made the closing down of its lignite power plants one of its major priorities and, despite cancelling plans for two Soviet-designed nuclear power units, has affirmed its commitment to completion of the Temelin nuclear power station, which will allow 2000 MWe of coal-fired plant to be shutdown.

The importance the new regimes in Eastern Europe assign to environmental concerns was demonstrated in June when the Environment Ministers from the USSR, the Eastern Europe countries excluding Romania and the countries of the European Economic Community met in Dublin. The Eastern Europe countries frankly acknowledged the extent of their massive environmental pollution and agreed to participate in the European Environment Agency being established by the EEC. The Western Europe countries are to advise on the formation of pollution control bodies, review the safety of 22 Russian-built nuclear reactors, assess the environmental impact of a hydroelectric project Czechoslovakia was constructing on the Danube and set codes of conduct on environmental standards for Western Europe companies intending to operate in Eastern Europe.

Last year a group of 24 industrial donor nations, including Australia, established an EEC-administered scheme, Poland-Hungary Action for Reconstruction of the Economy (Phare), to help the economies of Poland and Hungary. This included aid for specific environmental purposes. It has recently been agreed to extend economic assistance to Yugoslavia, Bulgaria, Czechoslovakia and East Germany. A European Bank for Reconstruction and Development is also being established, with 60% of its loans to be spent on new private enterprises and 40% on infrastructure projects.

## 5. COMMERCIAL OPPORTUNITIES

This report has been prepared from information available to Ansto, together with advice from its Counsellors in Vienna and London. It is proposed to submit copies of the report, together with an Ansto capability statement, to the Central and

Eastern Europe Section of the Department of Industry, Technology and Commerce, to the relevant Austrade offices and to the Counsellor (Nuclear) in Vienna, to assist them to identify possible commercial opportunities in Eastern Europe. For example, the Victoria power generation system is based on burning brown coal. There could be opportunities in Eastern Europe for Australian companies that supply services and equipment to the State Electricity Commission of Victoria and there could be possible uranium sales to Eastern Europe.

Ansto is currently heavily committed to research and development (R&D) and commercial opportunities in its region. However, there could be opportunities for collaborative R&D in radioisotope applications, particularly radiopharmaceutical applications. Ansto could also explore the opportunities for risk and reliability assessments.

Ansto is currently seeking a tender from Techsnabexport (USSR) for 150 HIFAR fuel elements as a result of interest shown during the recent visit to Ansto by the USSR delegation on the Bilateral Safeguards Agreement.

## 6. CONCLUSION

In the short-term major expansion in nuclear power will not be needed as electricity demand is likely to be stable or decline due to economic/industrial recession. The main concern will be the safety of units in operation or under construction.

There is likely to be a major expansion of nuclear power in about ten years, provided Eastern Europe obtains economic assistance from the West. Good opportunities could then arise for Australian uranium sales. The opportunity will be taken to examine and keep under review commercial opportunities in the nuclear area for Ansto and other Australian organisation.

31 July 1990

Nuclear Services Section
External Affairs

LISTING FOR COUNTRY = BULGARIA

In Commercial Operation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| KOZLODUY 1 | PWR | 410 | 1974 | KOZLODUY 2 | PWR | 410 | 1975 |
| KOZLODUY 3 | PWR | 410 | 1981 | KOZLODUY 4 | PWR | 410 | 1982 |
| KOZLODUY 5 | PWR | 953 | 1989 | | | | |

Total = 5 Units 2593 MWeN

Under Construction

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BELENE 1 | PWR | 953 | 1991 | BELENE 2 | PWR | 953 | 1993 |
| KOZLODUY 6 | PWR | 953 | 1991 | | | | |

Total = 3 Units 2859 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BELENE 3 | PWR | 953 | 1995 | BELENE 4 | PWR | 953 | 1997 |

Total = 2 Units 1906 MWeN

LISTING FOR COUNTRY = CZECHOSLOVAKIA

In Commercial Operation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| V1 BOHUNICE 1 | PWR | 410 | 1979 | V1 BOHUNICE 2 | PWR | 410 | 1980 |
| V2 BOHUNICE 1 | PWR | 410 | 1984 | V2 BOHUNICE 2 | PWR | 410 | 1985 |
| V3 DUKOVANY 1 | PWR | 410 | 1985 | V3 DUKOVANY 2 | PWR | 410 | 1986 |
| V4 DUKOVANY 3 | PWR | 410 | 1987 | V4 DUKOVANY 4 | PWR | 410 | 1987 |

Total = 8 Units 3280 MWeN

Under Construction

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MOCHOVCE 1 | PWR | 410 | 1992 | MOCHOVCE 2 | PWR | 410 | 1993 |
| MOCHOVCE 3 | PWR | 410 | 1994 | MOCHOVCE 4 | PWR | 410 | 1995 |
| TEMELIN (MALOVICE) 1 | PWR | 1000 | 1994 | TEMELIN (MALOVICE) 2 | PWR | 1000 | 1994 |

Total = 6 Units 3640 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| KECEROVICE 1 | PWR | 1000 | 1995 | KECEROVICE 2 | PWR | 1000 | 1996 |
| N.MORAVIA 1 | PWR | 1000 | 2001 | N.MORAVIA 2 | PWR | 1000 | 2002 |

Total = 4 Units 4000 MWeN

LISTING FOR COUNTRY = GERMANY DR

In Commercial Operation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NORD (GREIFSWALD) 1 | | PWR | 410 | 1974 | NORD (GREIFSWALD) 2 | PWR | 410 1974 |
| NORD (GREIFSWALD) 3 | | PWR | 410 | 1978 | NORD (GREIFSWALD) 4 | PWR | 410 1980 |
| RHEINSBURG | | PWR | 75 | 1966 | | | |

Total = 5 Units 1715 MWeN

Under Construction

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NORD (GREIFSWALD) 5 | * | PWR | 410 | 1990 | NORD (GREIFSWALD) 6 | PWR | 410 1990 |
| NORD (GREIFSWALD) 7 | | PWR | 410 | 1990 | NORD (GREIFSWALD) 8 | PWR | 410 1990 |
| STENDAL 1 | | PWR | 1000 | 1994 | STENDAL 2 | PWR | 1000 1996 |

Total = 6 Units 3640 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| STENDAL 3 | PWR | 1000 | 0 | | STENDAL 4 | PWR | 1000 0 |

Total = 2 Units 2000 MWeN

* Connected to grid

LISTING FOR COUNTRY = HUNGARY

In Commercial Operation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| PAKS 1 | PWR | 410 | 1983 | | PAKS 2 | PWR | 410 1984 |
| PAKS 3 | PWR | 410 | 1986 | | PAKS 4 | PWR | 410 1987 |

Total = 4 Units 1640 MWeN

LISTING FOR COUNTRY = POLAND

Under Construction

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ZARNOWEIC 1 | PWR | 410 | 1992 | ZARNOWEIC 2 | PWR | 410 | 1993 |

Total = 2 Units 820 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| ZARNOWEIC 3 | PWR | 410 | 1994 | ZARNOWEIC 4 | PWR | 410 | 1995 |
| KLEPIEZ (WARTA) 1 | PWR | 1000 | 1996 | KLEPIEZ (WARTA) 2 | PWR | 1000 | 1998 |
| KLEPIEZ (WARTA) 4 | PWR | 1000 | 2002 | KLEPIEZ (WARTA) 4 | PWR | 1000 | 2000 |

Total = 6 Units 4820 MWeN

LISTING FOR COUNTRY = ROMANIA

Under Construction

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|---|---|---|---|---|---|---|---|
| CERNAVODA 1 | HWR | 600 | 1993 | CERNAVODA 2 | HWR | 600 | 1995 |
| CERNAVODA 3 | HWR | 600 | 1997 | CERNAVODA 4 | HWR | 600 | 1998 |
| CERNAVODA 5 | HWR | 600 | 1999 | | | | |

Total = 5 Units 3000 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| MOLDAVIA 1 | PWR | 953 | 0 | MOLDAVIA 2 | PWR | 953 | 0 |
| MOLDAVIA 3 | PWR | 953 | 0 | | | | |

Total = 3 Units 2859 MWeN

LISTING FOR COUNTRY = USSR

In Commercial Operation

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BALAKOVO 1 | PWR | 953 | 1986 | BALAKOVO 2 | PWR | 953 | 1987 |
| BN 350 | FBR | 135 | 1973 | BN 600 | FBR | 560 | 1980 |
| CHERNOBYL 1 | BWR | 950 | 1978 | CHERNOBYL 2 | BWR | 950 | 1979 |
| CHERNOBYL 3 | BWR | 950 | 1982 | IGNALINA 1 | BWR | 1450 | 1985 |
| IGNALINA 2 | BWR | 1450 | 1987 | KALININ 1 | PWR | 953 | 1985 |
| KALININ 2 | PWR | 953 | 1987 | KHMELNITSKY 1 | PWR | 953 | 1985 |
| KOLA 1 | PWR | 410 | 1973 | KOLA 2 | PWR | 410 | 1974 |
| KOLA 3 | PWR | 410 | 1981 | KOLA 4 | PWR | 410 | 1984 |
| KURSK 1 | BWR | 950 | 1976 | KURSK 2 | BWR | 950 | 1979 |
| KURSK 3 | BWR | 950 | 1984 | KURSK 4 | BWR | 950 | 1986 |
| LENINGRAD 1 | BWR | 950 | 1974 | LENINGRAD 2 | BWR | 950 | 1975 |
| LENINGRAD 3 | BWR | 950 | 1980 | LENINGRAD 4 | BWR | 950 | 1981 |
| NIKOLAYEV 1 | PWR | 953 | 1983 | NIKOLAYEV 2 | PWR | 953 | 1985 |
| NOVO MELEKES (VK 50) | BWR | 65 | 1966 | NOVO VORONEZH 2 | PWR | 338 | 1970 |
| NOVO VORONEZH 3 | PWR | 410 | 1972 | NOVO VORONEZH 4 | PWR | 410 | 1973 |
| NOVO VORONEZH 5 | PWR | 953 | 1981 | ROVNO 1 | PWR | 410 | 1981 |
| ROVNO 2 | PWR | 410 | 1982 | ROVNO 3 | PWR | 953 | 1987 |
| SMOLENSK 1 | BWR | 950 | 1983 | SMOLENSK 2 | BWR | 950 | 1985 |
| TROITSK 1 | MIS | 90 | 1958 | TROITSK 2 | MIS | 90 | 1959 |
| TROITSK 3 | MIS | 90 | 1960 | TROITSK 4 | MIS | 90 | 1961 |
| TROITSK 5 | MIS | 90 | 1962 | TROITSK 6 | MIS | 90 | 1963 |
| ZAPOROZHE 1 | PWR | 953 | 1985 | ZAPOROZHE 2 | PWR | 953 | 1985 |
| ZAPOROZHE 3 | PWR | 953 | 1987 | ZAPOROZHE 4 | PWR | 953 | 1988 |

Total = 46 Units 32557 MWeN

Under Construction

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| BALAKOVO 3 | * | PWR | 953 | 1989 | BALAKOVO 4 | | PWR | 953 | 1990 |
| BASHKIR 1 | | PWR | 953 | 1989 | BASHKIR 2 | | PWR | 953 | 1990 |
| BN 800 | | FBR | 750 | 1993 | KHMELNITSKY 2 | | PWR | 953 | 1990 |
| KHMELNITSKY 3 | | PWR | 953 | 1990 | KURSK 5 | | BWR | 950 | 1991 |
| NIKOLAYEV 3 | | PWR | 953 | 1989 | NIKOLAYEV 4 | | PWR | 953 | 1990 |
| ROSTOV ON DON 1 | | PWR | 953 | 1990 | ROSTOV ON DON 2 | | PWR | 953 | 1990 |
| ROSTOV ON DON 3 | | PWR | 953 | 1991 | ROSTOV ON DON 4 | | PWR | 953 | 1992 |
| ROVNO 4 | | PWR | 953 | 1989 | SMOLENSK 3 | * | BWR | 950 | 1990 |
| TATAR 1 | | PWR | 953 | 1990 | ZAPOROZHE 5 | * | PWR | 953 | 1990 |
| ZAPOROZHE 6 | | PWR | 953 | 1991 | | | | | |

Total = 19 Units 17898 MWeN

Firm Plans

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| KHMELNITSKY 4 | PWR | 953 | 0 | BALAKOVO 5 | PWR | 953 | 0 |
| BALAKOVO 6 | PWR | 953 | 0 | BASHKIR 3 | PWR | 953 | 0 |
| BASHKIR 4 | PWR | 953 | 0 | BASHKIR 5 | PWR | 953 | 0 |
| BASHKIR 6 | PWR | 953 | 0 | BN 1600 | FBR | 1500 | 1995 |
| IGNALINA 3 | BWR | 1450 | 0 | KALININ 3 | PWR | 953 | 0 |
| KALININ 4 | PWR | 953 | 0 | KHMELNITSKY 5 | PWR | 953 | 0 |
| KOLA 5 | PWR | 953 | 0 | KOLA 6 | PWR | 953 | 0 |
| KOSTROMA 1 | PWR | 953 | 0 | KOSTROMA 2 | PWR | 953 | 0 |
| KOSTROMA 3 | PWR | 953 | 0 | KOSTROMA 4 | PWR | 953 | 0 |
| PRIVOLZHESKAYA 1 | PWR | 953 | 0 | PRIVOLZHESKAYA 2 | PWR | 953 | 0 |
| PRIVOLZHESKAYA 3 | PWR | 953 | 0 | PRIVOLZHESKAYA 4 | PWR | 953 | 0 |
| ROVNO 5 | PWR | 953 | 0 | ROVNO 6 | PWR | 953 | 0 |
| SMOLENSK 5 | PWR | 953 | 0 | SMOLENSK 6 | PWR | 953 | 0 |
| TATAR 2 | PWR | 953 | 1991 | TATAR 3 | PWR | 953 | 1992 |
| TATAR 4 | PWR | 953 | 1993 | | | | |

Total = 29 Units 28681 MWeN

* Connected to grid

LISTING FOR COUNTRY = YUGOSLAVIA

In Commercial Operation

| | | | |
|---|---|---|---|
| VIDEM KRSKO | PWR | 632 | 1983 |

Total for all countries listed above :
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| | | |
|---|---|---|
| In Operation | 69 Units | 42417 MWeN |
| Under Construction | 41 Units | 31857 MWeN |
| Planned | 46 Units | 44266 MWeN |