AUSTRALIAN NUCLEAR SCIENCE
& TECHNOLOGY ORGANISATION

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NUCLEAR POWER AND THE NUCLEAR FUEL CYCLE

A quarterly review of overseas events

June 1988

1. NUCLEAR POWER

1.1 Percentage of Electricity Generated by Nuclear Power

According to the International Atomic Energy Agency (IAEA), nuclear power plants now produce over 16% of the world's electricity. Table 1 shows the percentage of electricity generated by nuclear energy in each of the twenty six countries that operated nuclear power plants in 1987.

TABLE 1. Electricity Supplied by Nuclear Power in 1987
(% of Total Generation)

France	69.8	United States	17.7
Belgium	66.0	United Kingdom	17.5
Korea R.O.	53.3	Canada	15.1
Taiwan	48.5*	Argentina	13.4
Sweden	45.3	USSR	11.2
Hungary	39.2	Germany D.R.	9.7*
Switzerland	38.3	Yugoslavia	5.6
Finland	36.6	Netherlands	5.2
Germany F.R.	31.3	South Africa	4.5
Spain	31.2	India	2.6
Japan	29.1	Pakistan	1.0*
Bulgaria	28.6	Brazil	0.5
Czechoslovakia	25.9	Italy	0.1

* IAEA estimate

1.2 Country Programs/Policy

Belgium - The new coalition government, formed in early May, has declared that expansion of the country's nuclear power program will be considered only if there are no other feasible options.

Comment: Belgium operates seven power reactors at Tihange (4) and Doel (3), and has a share in three units in operation and under construction at the Chooz Station in France. Power industry plans to construct Belgium's eighth power reactor, at Doel, have been stalled since 1983 by political problems and public reaction to the Chernobyl accident.

China/Germany FR - German firms and the Chinese Nuclear Bureau for Nuclear Industry have agreed co-operate in the planning and construction of modular high temperature gas cooled reactors (HTRs) in the People's Republic of China.

Comment: Last year the German HTR-100 development consortium signed an agreement with the Soviet State Committee for the Utilisation of Atomic Energy to develop and construct a twin 100 MWe (HTR-100) station in the USSR (see QR June 1987).

France - Cattenon 2 and Nogent 1, two pressurised water reactors (PWRs) of the French 1300 MWe series, began commercial operation in February. Another reactor of the same series, Belleville 2, achieved initial criticality in March. Chinon B4, the last of the country's thirty four 900 MWe units to enter service, began commercial operation in April.

The first stage of the licensing process for the Le Carnet nuclear power station has been initiated. The site is to hold two 1450 MWe PWRs of the N4 series. Construction of the first unit is scheduled to begin in 1990.

Germany FR - The second of the so-called convoy (konvoi) plants, Emsland (1300 MWe, PWR), achieved initial criticality and was connected to the grid in April.

Comment: Isar 2, the first convoy plant, was synchronised to the German grid in January (see QR March 1988) and began commercial operation in April. Both plants were constructed in under six years.

The German nuclear industry is to be completely restructured, and governmental supervision over the industry improved, following intense debate on all aspects of the nuclear fuel cycle as a result of the Nukem/Transnuklear affair reported last quarter.

The future of nuclear power in northern Germany is in doubt following elections in the state of Schleswig-Holstein in May. The official energy policy of the Social Democratic Party, which won the elections, includes the closure of all nuclear power plants within as short a time as possible.

Comment: About three quarters of the State's electricity is provided by three nuclear power stations, Brunsbuettel (770 MWe), Kruemmel (1260 MWe) and Brokdorf (1290 MWe). It has been estimated that the closure of the three stations would cost around DM 10 billion in lost investment, whilst five new coal-fired stations to provide replacement power would cost around DM 7 billion, resulting in a significant increase in the price of electricity in the State.

Greece - In a major energy policy statement the Energy & Industry Minister has declared that imported natural gas will be used to power additional generating plant in Greece for the rest of this century, rather than nuclear energy or coal.

India - The Government Planning Commission has reportedly acknowledged that the official target of installing 10,000 MW of nuclear generating capacity by the year 2000 will be delayed by at least five years. The Commission has accepted in principle a proposal to import Soviet PWRs and has agreed to allow advanced ordering on six indigeneously designed 235 MWe PHWR units in order to speed the implementation of the program.

Comment: The Indian Government has yet to make the final decision on whether to import the two VVER-1000 reactors offered by the Soviet Union on generous credit terms. Fuel for the reactors would be supplied by the Soviet Union and returned intact to the USSR.

Indonesia/Japan - A new 5-year agreement between the two countries covers the exchange of personnel and technological information in the fields of reactor physics, utilisation of research reactors, production and utilisation of radioisotopes, radioactive waste management, radiation protection and nuclear safety engineering.

Italy - The new Italian coalition government has decided not to complete the two 1000 MWe boiling water reactors (BWRs) being built at Montalto di Castro.

Comment: The decision leaves Italy with only two nuclear power plants, the 270 MWe Trino Vercellese PWR and the 870 MWe Caorso BWR. Both units have been closed for over a year.

Korea R.O. - The first unit (900 MWe, PWR) at the Buku-Ri (Uljin) station achieved initial criticality in February and produced its first electricity in April.

Spain - Vandellos 2 (1000 MWe, PWR) began commercial operation in March. Trillo 1 (1000 MWe, PWR) achieved initial criticality and was connected to the Spanish grid in May. The completion of Trillo 1 marks the end of active construction in Spain.

Comment: Construction of another five units was halted by the Spanish Government in 1983/4. Whether work will be resumed on any of those units may not be answered until 1989 or 1990 when the National Energy Plan is due to be revised. Although the Spanish Government has ordered technical and economic studies into the advisability of ending its moratorium on nuclear power plant construction, the final decision is likely to be political.

United Kingdom - The public hearing for the proposed Hinkley Point C PWR is scheduled to begin in October. Meanwhile, the Central Electricity Generating Board (CEGB) has announced that it intends to apply later this year for consent to build its third PWR at Wylfa. A fourth PWR could be built at Sizewell (where the first PWR is under construction), Trawsfynydd (Wales), Druridge (Northumberland), Winfrith (Dorset), or Dungeness (Kent). Druridge is the only site with no existing nuclear plant.

Comment: The CEGB is reportedly considering a plan to limit the number of Sizewell-type 1175 MWe PWRs to four units and introduce a 1400 MWe Mark II version in the mid 1990s, possibly built under license from France.

USA - South Texas 1 (1250 MWe, PWR) and Braidwood 2 (1120 MWe, PWR) achieved first criticality in March. Nine Mile Point (1000 MWe, PWR) began commercial operation in the same month.

USSR - Contrary to earlier reports the graphite-moderated channel-type boiling water concept may not be abandoned in the USSR. Soviet authorities have revealed that a reactor, designated UKR-1500 (Enhanced Channel Reactor, 1500 MWe), is being designed to counter the weaknesses of the RBMK (Chernobyl-type reactor) whilst preserving its advantages.

1.3 Fast Breeder Reactor (FBR) Programs

France - The publication of a joint policy study on FBRs by French nuclear organisations has been postponed pending further assessment of the potential of advanced light water reactor designs.

The cracked fuel storage drum of the Superphenix fast reactor could be repaired and operated as a transfer lock using argon gas as the coolant (rather than replacing it with a new drum in sodium for use as a fuel storage facility). If French safety authorities approve the different operating mode (operating Superphenix on long campaigns and discharging a full core every 3 -4 years) the reactor is expected to resume operation in October.

1.4 Research Reactors

Pakistan - The 5 MW pool type reactor at the Pakistan Institute of Nuclear Science & Technology is to be upgraded to 10 MW and its core converted from 90% enriched uranium to 20% enrichment.

Taiwan - Taiwan has advised the IAEA that the 40 MW heavy water moderated research reactor at the Institute for Nuclear Energy Research, near Lung Tan, has been permanently closed.

1.5 Non-Proliferation/Safeguards

Germany F.R. - Safeguards inspectors of Euratom, the nuclear agency of the EEC, have found no evidence that the German fuel company Nukem, or its transport subsidiary Transnuklear, have violated the Non-Proliferation Treaty. The IAEA has reached a similar conclusion from its own special investigations of Nukem and Transnuklear.

2. NUCLEAR FUEL CYCLE

2.1 Uranium Mining

Canada - Urangesellschaft Canada Ltd is conducting a feasibility study with a view to mining its Kiggavik property in the Baker Lake area of Northwest Territories (100 miles south of the Arctic Circle and 150 miles west of Hudson Bay). The study is due to be completed next year. Mining could begin in 1993/4.

2.2 Enrichment

Argentina - It has been reported that the gas diffusion enrichment plant at Pilcaniyeu will begin production of 20% U235 before the end of this year. The capacity of the plant is said to be 20t SWU/year.

Brazil - The gas centrifuge enrichment plant at the Aramar Experimental Centre, at Ipero in the State of San Paulo, has started operating. The capacity of the plant has not been revealed. The plant is reportedly enriching to 5% and will enrich to sufficient levels for research reactors by the end of this year.

Comment: Lack of fuel is said to have restricted the operation of Brazil's research reactors, forcing the country to import radioisotopes for medical use. The U.S. stopped supplying enriched uranium after Brazil refused to accept full scope safeguards on all of its nuclear facilities.

France - Cogema is not planning to construct an industrial scale AVLIS (Atomic Vapour Laser Isotope Separation) facility until about the year 2000, when a 1,000t - 2,000t SWU/year plant could be built for the enrichment of reprocessed uranium (REPU) from the UP3 and UP2-800 reprocessing plants at La Hague.

Comment: The UP3 and UP2-800 reprocessing plants, which are scheduled to start-up in 1989 and 1992 respectively, will produce large amounts of REPU. In addition to AVLIS's potential for reducing production costs, the process is expected to allow for re-enrichment that produces much lower levels of the non-fissile isotopes U232, U234, and U236.

Japan - A 100t SWU/year demonstration gas-centrifuge enrichment facility (DOP-1) was commissioned at Ningyo Toge in April. A second unit of the same size (DOP-2) is scheduled to start operating at the site in 1989.

Comment: Construction of a commercial size (1,500t SWU/year) enrichment plant is to begin later this year at Rokkashomura. The first section (150t SWU/year) is scheduled to be in operation by April 1991. The capacity of the plant will be increased by 150t SWU/year annually to reach 600t SWU/year by 1994.

USA - The Supreme Court has reversed the Federal Appeals Court decision in the uranium producers lawsuit against the Department of Energy (see QR September 1987). The Supreme Court held that section 161 (v) of the Atomic Energy Act does not require the Department of Energy to restrict the enrichment of foreign uranium where such restriction would not achieve the statutory goal of assuring the maintenance of a viable domestic uranium industry. The case has been remanded back to the District Court for further fact finding. If the uranium miners decide to pursue the case the District Court will have to develop a factual record and decide whether restrictions would bring about viability.

2.3 Reprocessing

Argentina - A pilot reprocessing plant being built at Ezeiza, near Buenos Aires, is expected to be ready for testing with radioactive materials early next year. The plant will not, however, be able to start recovering plutonium and uranium from spent reactor fuel until 1990 when the shears (which are used to cut up fuel assemblies) are installed.

2.4 Waste Management

Sweden - The first Swedish final repository (SFR-1) began operations in April. The sub-seabed complex is designed to accommodate 60,000 cu ft of low and medium level radwaste.

Nuclear Services Section
Nuclear Technology

STATUS SUMMARY NO. 1 - 30 JUNE 1988

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GENERALIZED STATUS SUMMARY FOR ALL POWER REACTORS > 30 MWEN
PREPARED FROM THE NUCLEAR POWER REACTOR DATA FILES OF ANSTO

Classification Explanation

Planned = Relatively Firm Plans + Letters of Intent Sent + Options
Ordered = Firm Order Placed Building = Under Contruction
Operating = In Commercial Operation

	PLANTS-MWE NET									
	PLANNED		ORDERED		BUILDING		OPERATING		TOTAL	
TOTAL WORLD	115	113185	19	16950	131	115569	405	296369	670	542073
WESTERN WORLD	64	65389	10	9471	71	65128	334	254889	479	394877
ARGENTINA	2	700	0	0	1	698	2	935	5	2333
BELGIUM	1	1450	0	0	0	0	7	5449	8	6899
BRAZIL	2	2600	0	0	2	2490	1	626	5	5716
BULGARIA	0	0	2	1906	4	3812	4	1640	10	7358
CANADA	1	300	0	0	4	3443	18	11689	23	15432
CHINA	4	1450	2	1800	1	300	0	0	7	3550
CUBA	2	820	0	0	2	820	0	0	4	1640
CZECHOSLOVAKIA	4	4000	0	0	8	5640	8	3280	20	12920
EGYPT	2	1800	0	0	0	0	0	0	2	1800
FINLAND	1	953	0	0	0	0	4	2160	5	3113
FRANCE	5	7200	0	0	12	15760	51	47600	68	70560
GERMANY DR	2	2000	0	0	5	3230	6	2125	13	7355
GERMANY FR	8	10156	2	2468	3	2756	20	20161	33	35541
HUNGARY	2	2000	2	2000	0	0	4	1640	8	5640
INDIA	2	440	0	0	8	1760	6	1224	16	3424
INDONESIA	1	600	0	0	0	0	0	0	1	600
IRAQ	1	410	0	0	0	0	0	0	1	410
ISRAEL	1	900	0	0	0	0	0	0	1	900
ITALY	0	0	0	0	1	40	2	1098	3	1138
JAPAN	14	14943	4	2903	13	11745	36	26914	67	56505
KOREA DPR	1	410	0	0	0	0	0	0	1	410
KOREA RO	2	2400	2	1800	2	1800	7	5534	13	11534
LIBYA	1	410	0	0	0	0	0	0	1	410
MEXICO	2	2000	0	0	2	1308	0	0	4	3308
NETHERLANDS	3	3000	0	0	0	0	2	502	5	3502
PAKISTAN	1	937	0	0	0	0	1	125	2	1062
POLAND	4	4000	2	820	2	820	0	0	8	5640
ROMANIA	4	3459	0	0	4	2400	0	0	8	5859
SOUTH AFRICA	0	0	0	0	0	0	2	1844	2	1844
SPAIN	0	0	0	0	1	1000	9	6541	10	7541
SWEDEN	0	0	0	0	0	0	12	9629	12	9629
SWITZERLAND	1	1140	0	0	0	0	5	2971	6	4111
TAIWAN	4	4120	0	0	0	0	6	4960	10	9080
TURKEY	2	1500	0	0	0	0	0	0	2	1500
UNITED KINGDOM	2	2430	0	0	6	4154	37	11162	45	17746
USA	0	0	2	2300	16	18174	105	93133	123	113607
USSR	28	29657	1	953	34	33419	49	32795	112	96824
YUGOSLAVIA	5	5000	0	0	0	0	1	632	6	5632