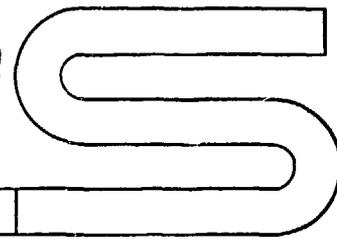


**INTERNATIONAL CONFERENCE  
ON NUCLEAR POWER AND ITS FUEL CYCLE**

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**NATIONAL ENERGY AND NUCLEAR POWER SYSTEM PLANS OF THE  
FEDERAL REPUBLIC OF GERMANY**

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The German nuclear energy programme, always exclusively devoted to peaceful uses of nuclear energy, was initiated early after the first Geneva Conference in 1955. The continuing extensive governmental support for nuclear R+D was based on the general concern that conventional energy resources will no longer be sufficient to meet the requirements of a continuously growing energy demand. Despite of all the discussions and controversies underway at the moment, the decision must still be regarded as having been far sighted and the results - today's availability of nuclear power plants as the only fully developed and sufficiently available energy source to replace fossil fuels - were beneficial. At present, it is practically impossible to imagine, how the energy problems of the world and, in particular, of the industrialized countries, could be solved without nuclear energy.

In the Federal Republic of Germany, the necessity of the development and utilization of nuclear energy became more and more apparent during the past 20 years. In the early fifties, the Federal Republic was, on the basis of its abundant domestic reserves of both hard coal and lignite, an energy-independent country. The economic development linked with a sharp increase of energy consumption on the one hand and the decrease in consumption of coal - due to the availability of extremely cheap oil - on the other, have resulted in a dependency on oil and gas imports to a level of approximately two-thirds of our total energy supply.

The continuous trend towards an ever-increasing share of mineral oil in the total energy supply and - at that time - the growing concern about this development led the Federal Government in 1973 to formulate a comprehensive energy policy, which half a year before the oil crisis made everybody aware of the inherent problems.

The main objectives of this policy were:

- sufficient and low-price energy supplies to consumers in all parts of the Federal Republic of Germany;

- a secured supply in the medium and long term;
- a supply of energy at favourable total costs to the economy in the long term;
- adequate and early consideration of the requirements for environmental protection, in order to link closely energy and environmental policy.

On this basis, the efforts were directed towards a reduction of import dependency on oil and natural gas and to a stabilization of indigenous coal utilization. Nuclear energy was supposed to meet most of the growing energy demand, at least for electricity generation.

When the oil crisis of 1973 made the world energy problems apparent to the general public and the sharp increase of oil prices enhanced the urgency of a reduction of mineral oil imports, the Energy Programme was reviewed. Without major changes of the objectives the revised 1974 Energy Programme called for

- a higher priority for securing mineral oil supplies with the aim to reduce the percentage of mineral oil in our overall energy supply from 55 % in 1975 to 44 % in 1985;
- an accelerated use of natural gas and lignite;
- a stabilization of hard-coal utilization on a level of about 100 Mio t per year;
- an improved long-term siting policy for energy installations; and
- greater efforts in energy conservation.

Particular importance was assigned to nuclear energy. The 1973 projection for 1985 foresaw an increase of the share of nuclear energy in the supply of primary energy from approximately 1 % in 1973 to 15 % in 1985. The figure corresponded to a 45 % share of nuclear energy of all electricity generated in 1985. To achieve this a total capacity of 45,000 to 50,000 MWe would have to be installed by 1985.

These figures were based on the assumption of a continued economic growth and continuous economic development following the trend of the last 20 years. The oil crisis of 1973 as well as the resulting worldwide economic recession of the past years made it necessary to review this forecast of the consumption of primary energy.

A new projection, taking into account the development of the last three years has been prepared and decided upon by the Federal Government on 23 March 1977. These guidelines come to the conclusion, that the consumption of primary energy in 1985 will be approximately 10 % lower than originally expected. The delays in building and operating nuclear power plants due to actions of interveners and delays in the preparation and construction of the necessary installations for the back end of the nuclear fuel cycle will not make it possible to reach the nuclear capacity originally foreseen.

The Federal Government pointed out, that a capacity of approximately 30,000 MWe would be considered necessary by 1985 to avoid shortages in electricity supplies.

This adjustment of figures, leading to a slower development of nuclear power, similar to the situation in many other industrialised countries, has often been interpreted as a dramatic set back of nuclear energy and a complete failure of most energy policies. It is true, that the worldwide economic recession led to a corresponding reduction both in energy growth and in large industrial investments. Uncertainties caused by the increasing local resistance of the public, in general initiated by antinuclear groups and environmentalists, also has influenced the planning of utilities. It is impossible, however, to assess accurately the impact of these events. The main reason for the uncertainties in nuclear power programmes still appears to be the early stage of nuclear energy itself.

We should not forget, that the commercial introduction of nuclear power into the electricity market started only less than twenty years ago and the delays we are facing at the moment amount to a period of two to three years, a comparatively small figure, taking into account the importance of this source of energy.

An important factor for the further application of nuclear energy will be the complete inclusion of all accompanying and necessary costs, in particular of the fuel cycle, in the price of the nuclear KWh. In the past, abundant services available in those countries which have developed a nuclear weapons capacity have not been an incentive to industries to build and operate the necessary installations for a completely closed fuel cycle.

The practice of the Federal Republic of Germany since the early years of nuclear energy in our country has been to fund the development only until the demonstration phase has been reached and then hand over responsibility to industry. This policy has been pursued successfully in the area of light water reactors and will now be followed for the back end of the nuclear fuel cycle. The Government has borne the costs for R+D and for the construction and operation of pilot plants. The next step, the construction and operation of reprocessing plants and related facilities will be a matter of industry. The government will have to supervise construction and operation of the plants and - according to a new amendment to our Atomic energy act - will take over responsibility for the final storage and disposal of radioactive wastes. The cost of the total back end of the fuel cycle (including waste management), however, will have to be borne by utilities operating nuclear plants.

During the past years the Government of the Federal Republic of Germany has developed a comprehensive concept for the complete back end of the nuclear fuel cycle. It assigns great importance to reprocessing, waste handling and storage as a guarantee for safety and environmental protection, and infact the solution of this problem was made a prerequisite for further licensing of new nuclear power plants. The densely populated territory of the Federal Republic of Germany does not allow long-term storage of irradiated fuel elements.

The technical solutions for the planned fuel cycle center comprising all stages of reprocessing, recycling and waste management, can draw on considerable efforts in research and development in this field and on a wide range of international cooperation, especially within the framework of

the Eurochemic and together with the respective French and British organisations with the United Reprocessors Company. Experience with the Eurochemic plant and with the WAK plant at Karlsruhe will be employed to build the first large reprocessing plant of 1500 t/a capacity which is expected to go into operation in the late eighties. The first step towards the realisation of this project will be the construction of large water ponds for irradiated fuel elements to be stored until they can be reprocessed.

For low and medium level waste technologies are already available and only little effort is necessary for further improvement. R+D activities for the conditioning of high level waste are concentrated on embedding of this material in glass ceramics and metal matrices. Disposal of radioactive wastes is to take place in underground salt formations which have been stable geologically during more than 100 million years.

For the Federal Republic of Germany the Fast Breeder Reactor System is one of the essential options for securing our energy supply on a longterm basis. Consequently the development of reprocessing and plutonium recycle technology is of vital importance for our country. Stretching the resources of nuclear fuels by the use of plutonium will also be of great importance for light water reactors in the near future, at least for those countries which do not have large indigenous deposits of uranium and limited sources of other primary energies. But in addition to securing the necessary energy supply there are also safety aspects which according to our judgement make reprocessing absolutely necessary, since an indefinite storage of spent fuel elements in water pools or other storage facilities can not be justified for a densely populated country like the Federal Republic of Germany. There is no other way to transform nuclear waste into materials, which can be finally disposed of safely without an unacceptable high degree of remaining risks.

The Government of the Federal Republic of Germany is fully aware of all the problems related to reprocessing and the large scale utilization of plutonium. It has carefully weighted all factors pro and contra which have been risen with respect to our concept of closing the back end of the fuel cycle. Taking into account all the circumstances specific to our country we have come to the conclusion, that there is no alternative to the continuation of our programme to build a large reprocessing plant without any delay. On the other hand the Government of the Federal Republic of Germany perfectly acknowledges that other countries with different conditions might for their part arrive at other conclusions.

An other important element for the commercial utilisation of nuclear energy, the enrichment of uranium has made considerable progress. In close cooperation with partners from the United Kingdom and the Netherlands the development of the Gas Centrifuge process has been very successful from the technical point of view. Pilot plants of approximately 70 tons of separative work are in continuous operation since some years at Almelo and Capenhurst. At the moment the construction of an additional capacity of 200 t SWU is well advanced. Several cascades are already in operation and the two plants will be terminated by the end of next year, to represent the first parts of a larger capacity of 2000 t SWU already committed through contracts with utilities.

This first 2000 t SWU programme will be executed with financial backing from the three Governments. Any additional capacity - at present a further enlargement by 1500 t UTA is being considered - will have to be built without direct financial involvement of the three Governments. Present predictions for the economical viability of the process show, that this will be possible, both technically and economically.

The Federal Republic of Germany shares the world wide concern about the danger of a proliferation of nuclear weapons or weapons material. Consequently the Federal Republic of Germany has renounced the production of nuclear weapons already in 1954 and has signed and ratified the Non Proliferation Treaty. Since 1958 she is subject to the international safeguards system of EURATOM. In addition the Federal Republic of Germany has at all possible occasions demonstrated her willingness to cooperate with other countries in the further development of an even more effective non-proliferation policy on the basis of the existing Non Proliferation Treaty. We are convinced that this treaty, which more than 100 nations have already joined, is the optimal political, legal and moral basis on which non-proliferation efforts can efficiently and successfully be developed in the future.

Nuclear power will not only be beneficial to industrialised nations but will be also important for the economic development and welfare of many other countries in this world. We, therefore, believe that on the basis of the terms of the Non Proliferation Treaty countries with a highly developed nuclear technology should continue to cooperate with recipient countries. We are convinced, that following the spirit of the Treaty a non-proliferation policy must not lead to a policy of technological denial, which according to our opinion will be detrimental in the long run and have adverse effects. Thus we are decided to follow a line of cooperation and effective non-proliferation safeguards, strongly supporting all efforts to strengthen the existing national and international mechanisms and continuously improving the respective technologies. We are therefore prepared to continue the discussions of this important issue with recipient and supplying countries.

Whereas the nuclear fuel cycle for the LWR can be regarded as entering the commercial phase, the development of advanced reactor systems has still a long way to go and will need Governmental funding for quite some time to come.

- In the area of the development of Fast Breeder Reactors, the construction of our SNR-300 demonstration plant, a result of the cooperation between German, Belgian and Netherlands groups is progressing at Kalkar. First operation of this plant is expected for the end of 1981.

In addition to this well established cooperation, progress has been made to coordinate activities with France. German utilities have agreed to participate in the construction of Superphenix, the first breeder reactor power plant of the 1000 MW range.

On the industrial side an integration of German and French industries, has been initiated, starting with a systems engineering and licencing company, with the aim to build a joint company for the construction of breeder

reactors, eventually. In addition to this, an agreement for cooperation in this area has also been concluded in 1976 with US-ERDA.

The other reactor system being developed in the Federal Republic of Germany at the moment, is the High Temperature Reactor (HTR). The HTR offers special promises with regard to the generation of nuclear process heat applicable in particular, to coal gasification. After a highly promising start, the HTR has suffered from the severe setback after the break down of the commercial activities of the General Atomic Company in the USA in 1975. Activities in the Federal Republic of Germany are, at present, concentrating at the establishment of a new comprehensive HTR programme comprising

- a single reactor concept (pebble bed principle) for all possible applications,
- a realignment of the capacities for manufacturing and planning in industry as well as research establishments, and
- organisational and financial involvement of the potential operators.

Special importance is being attributed to the establishment of a broad international cooperation, since the extremely high costs of the development and implementation of a new reactor system can hardly be borne by a single country.

This short review of the nuclear part of the Energy Research and Technology Programme of the Federal Republic of Germany tried to make it clear, that large efforts are still necessary for the economical implementation of nuclear technologies on a large scale basis.

