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Addendum

(Pakistan)*

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PAKISTAN

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SECTION I :

CURRENT AND PROJECTED USES OF NUCLEAR ENERGY FOR ECONOMIC AND SOCIAL DEVELOPMENT

The Pakistan Atomic Energy Commission (PAEC) was established in 1956 to promote the use of nuclear energy for the purpose of economic and social development of the country. The specific objectives of the PAEC programme are :-

i) Nuclear Power for economic development

ii) Nuclear technology to support the nuclear power programme

iii) Application of atomic energy in agriculture, health, hydrology and industry.

Nuclear Power Generation

Pakistan is short of indigenous energy resources and needs large energy inputs for meeting its development needs. The country's total proven fossil fuel resources are 362 million Tons of Oil Equivalent (TOE), comprising of OIL: 250 million barrels (34 million TOE), Gas: 16 trillion cft (290 million TOE) and Coal: 85 million tons (38 million TOE). On per capita basis, the estimated fossil fuel resources of Pakistan are 4 TOE, as compared with the world average of about 130 TOE, per head. Pakistan has one of the lowest levels of per capita annual consumption of electricity (230 KWh) and commercial energy (0.2 TOE) in the world. It is one-tenth of the world average, one-half of the average for developing countries and one-seventieth (1/70) of the North American consumption level.

During the last ten years Pakistan experienced an annual economic growth rate of 5.8% while the electricity demand increased at about 10% per annum. For maintaining the country's rate of economic growth at 6% over the next 15 years, the supply of electricity will need to be increased at about 7.8% p.a., calling for an installed power generation capacity of 22,000 MW in the year 2000 as compared to 6,400 MW now. (The 6,400 MW installed capacity in early 1986 was about 10% short of the requirements necessitating load-shedding during peak hours).

Hydro-electricity generation presently constitutes about 50% of the total power generation capacity. The installed hydro capacity of Pakistan at present is about 2,900 MW. Another 7,000 MW is planned to be added over the next 15 years; this will raise the hydro capacity to about 10,000 MW by the end of century.

As for the use of indigenous fossil fuels for power generation, upper limits may be set on the basis of sizes of the existing proven reserves, keeping in view the requirements of these fuels for alternate uses, e.g. use of gas in fertiliser industry. It is thus estimated that not more than 2,500 MW capacity based on natural gas and 1,000 MW capacity based on coal may be envisaged until such time that sizeable new reserves are discovered.

Pakistan expects to support, by the year 2000, a maximum of 13,500 MW capacity based on hydro and indigenous fossil fuels as against an envisaged capacity requirement of 22,000 MW. This will leave a gap of about 8,500 MW which will have to be met

either by building thermal power plants based on imported fossil fuels (oil or coal) or through the use of nuclear power. In the light of recent studies it is envisaged to install five nuclear power plants of about 1000 MW each, by the year 2000.

Pakistan imported 6.6 million tons of oil in 1984 and this figure is expected to rise still further. The Government is stepping up its efforts in the exploration of oil. However, to reach self-sufficiency in oil by the year 2000, the indigenous production of crude oil will have to be increased tenfold, a task that will require persistent effort with very large investments. The current supply situation at home and the uncertain prices of oil in the international market, do not thus favour the use of oil-fired plants for meeting the near and long term electric power needs of the country.

The generation of electricity through a nuclear power plant is much cheaper than from the conventional oil-fired plant. The higher initial investment in the nuclear power station will be offset in 3 to 4 years by recurring annual savings due to the much lower fuelling costs for a nuclear plant as compared to the oil-fired plant.

Pakistan made a modest start in this direction in mid-1960s and started its first nuclear power plant viz. Karachi ıclear Power Plant (KANUPP)in 1972. This plant is being operated fully maintained by Pakistani nuclear scientists, engineers and ians for the last ten years without any outside help. s being run under full IAEA Safeguards. The support

provided by the local industry in the manufacture of spare parts needed for KANUPP points to the industrial infrastructure which already exists in the country and can be further developed and expanded to facilitate the implementation of an extended nuclear power programme in Pakistan. The Government of Pakistan has given approval for the construction of a 937 MW nuclear power plant to be built at Chashma.

Pakistan is watching with interest the technical developments taking place in the utilisation of other types of energy sources like solar, wind, biogas, etc. However, on economic and technical considerations, it is envisaged that the use of solar energy for power generation on an industrial scale could only be expected after the year 2000. In Pakistan's case, the overall electricity demand will have to be satisfied overwhelmingly through an optimal mix of hydro and nuclear power generation.

Food and Agriculture

The PAEC has established three centres for agricultural research in the country where nuclear techniques are employed to improve agricultural output. These centres are :

1) Atomic EnergyAgricultural Research Centre (AEARC), Tandojam (Sind);

2) Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad (Punjab);

3) Nuclear Institute for Food and Agriculture (NIFA), Peshawar (North-West Frontier Province).

Research is being carried out at these centres to evolve high yielding and disease-resistant varieties of main crops and also on commercial storage of foodgrains, vegetables and fruits through disinfestation by nuclear irradiation. Studies are being undertaken at these centres for the efficient utilisation of water and fertilisers.

A new variety of rice evolved by NIAB called Kashmir Basmati is now being cultivated over a large area in the Northern Region particularly Swat, Malakand and Hazara Districts of NWFP. The variety had shown good results in Northern areas where its yield was 30% higher than the local varieties. The triticale (cross of wheat and rye) has been modified at NIAB to incorporate bread making property. Triticale is being developed as a crop suitable for 'barani' (rain-fed) areas where it has given a 10-15% higher yield and has higher protein content than wheat. A new wheat variety called Jauhar-79 evolved by AEARC, Tandojam has been approved by the Government for cultivation in Hyderabad region of Sind Province where its performance has been very good. Another hign-yielding and disease-resistant wheat variety Sind-81, evolved by AEARC has been released by the Government for cultivation. Mutants of Cotton (NIAB-78), Mung Bean (NIAB Mung-28) and Chickpea (CM-72) evolved by NIAB have been approved as varieties by the Government for general cultivation.

Some of the rice soils have been found deficient in Zinc. Using radioactive zinc, Pakistani scientists have already found the best methods for application of zinc in rice soils.

NIAB, Faisalabad has been able to demonstrate a method of utilisation of saline and saline sodic lands. It is based on plant succession system starting with a highly salt-resistant grass called kaller grass.

Nuclear Medicine and Radiotherapy

The eight nuclear medical centres set up by PAEC in different parts of the country are providing diagnostic and treatment facilities to the patients suffering from various malignant and other non-conventional diseases. The Nuclear Medicine, Oncology and Radiotherapy Institute (NORI), Islamabad, started functioning in March 1983. It is the most modern and largest nuclear medical centre in Pakistan having latest facilities for diagnosis and treatment including facilities for indoor treatment. Another similar medical centre, Institute of Nuclear Medicine and Oncology (INMOL) had started working in early 1984 at Lahore. Still another medical centre has been planned for Quetta, Baluchistan. About 115,000 patients were treated at these centres during the year 1984-85.

The PAEC Medical Centres are well-equipped and their facilities include :

Cobalt-60 and Caesium-137 teletherapy units; Linear Accelerator and Simulator; Deep and Superficial X-ray therapy.

Strontium-90 and Cobalt-60 sealed sources for irradiation of small areas; Caesium-137 sources in sealed tubes and needles for treatment of cancer tongue, cervix, skin; Ultrasonic equipment for diagnosis, localisation and follow-up management of patients with cancer and other diseases; Gama cameras and Scanners for rapid scanning of the location and movement of an injected radioisotope in the human body; Thyroid and kidney uptake systems, Renography equipment; Facilities for Radioimmunoassay for the accurate measurement of minute quantities of important compounds and harmones in the body and facilities for the storage, handling and administration of various radioisotopes. Research and training are also being carried out at all the centres of the Commission.

Production of Radioisotopes

The Commission has facilities for production of certain radioisotopes at its Research Reactor at the Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad. The Radioisotope Production Laboratory meets a substantial fraction of the requirement of nuclear medical centres for a variety of isotopes like Cr-51, Au-198, Br-82Hg-197, Hg-203, Tc-99 generator, I-131, P-32, Co-58 and Cu-64. Synthesis of certain labelled compounds like Neohyrin and Hippuran are also being produced to meet the demand of the medical centres. The balance of the requirement for various isotopes and labelled compounds is met through imports.

Mineral Prospecting

The programme for prospecting, exploration and mining of uranium has been stepped up and new areas with promising anamolies have been discovered and primary drilling work has been done. The existence of economic and exploitable deposits have been confirmed at some locations. The available facilities for processing and refining have also been improved. A primary concentration plant has been successfully started. Geological mapping and detailed radiometric checking of potential areas is continuing and some more areas have been selected for test drilling.

Manpower Training

Pakistan needs trained manpower to maintain and run its nuclear establishments in power, agriculture and medicine sectors. The Commission has established a Centre for Nuclear studies (CNS) to partly meet this demand. It gives post-graduate training to graduate engineers and scientists in various nuclear engineering subjects. A Nuclear Power Training Centre at Karachi is training the technicians and operators in plant maintenance and operation. In addition, the Commission has been holding courses for various industrial workers in latest industrial techniques such as industrial radiography, ultrasonic testing, medical physics, basic physics and non-destructive testing techniques for quality assurance etc.

Industrial Liaison

PAEC has maintained close collaboration with the local

industry in private and public sectors for the indigenous production of spare parts, components and equipment for its different projects. The effort is directed at upgrading the industrial capability of the country through introducing the concepts of precision engineering and quality assurance etc.

Safety and Environment

A programme of radiation monitoring has ensured that no radiation worker in any PAEC establishment received doses in extess of permissible limits. An environmental sampling programme is also persued. The Pakistan Nuclear Safety and Radiation Protection Ordinance has been promulgated in 1984.

International Collaboration

The Commission has so far arranged ten International Summer Colleges (Seminars) on "Physics and Contemporary Needs" with the cooperation of International Centre for Theoretical Physics (ICTP), Trieste, Italy. Scientists of international repute have attended these colleges. Seventh Working Group Meeting of the Regional Cooperative Agreement (RCA) of the IAEA was hosted at Lahore from March 25-28, 1985.

SECTION II

CONSTRAINTS IN THE DEVELOPMENT OF PEACEFUL USES OF NUCLEAR ENERGY

Restrictive Supplier Policies

Unjustified and all-encompassing restrictions have been placed on transfer of peaceful nuclear technology to the less developed countries. This has served to widen the technology gap between the developed and the developing countries, and thereby retard socio-economic development in the Third World.

Pakistan's peaceful nuclear programme has suffered specially as a result of the restrictive supplier policies in the flow of technology, materials, equipment, training facilities and information. These restrictive policies adversely affect the operation of the 5-MW research reactor at Islamabad and the 137-MWe power reactor at Karachi both of which are covered by IAEA safeguards and may have implications for their continued safe operation.

Discrimination in IAEA Technical Assistance

There appears to be a trend in the IAEA to classify its Member States, for purposes of technical assistance, on the basis of accession to the NPT, even though such a division is clearly contrary to the Statute (Particularly Article III A.1-4) of the Agency. Assistance is denied for technically and

economically sound projects just because the prospective recipient countries do not subscribe to NPT. Sometimes funds are provided to the Agency under the condition that these will be disbursed solely to NPT signatories. There is no justification for such discrimination in the grant of technical assistance to Member States for the peaceful application of nuclear technology.

Unilateral Abrogation of Agreements

Some of the supplier States have unilaterally broken their solemn agreements and commitments with other countries. Pakistan's peaceful nuclear programme was severely affected by such unilateral decisions of certain supplier states. These contracts and agreements related to plants under full international safeguards. This necessitated a policy of self-reliance through indigenous efforts. Pakistani scientists and technicians have been able to develop the necessary expertise for efficient application of nuclear technology for peaceful purposes.

SECTION III

PROMOTION OF INTERNATIONAL COOPERATION IN THE PEACEFUL USES OF NUCLEAR TECHNOLOGY

Pakistan believes that the principles governing the peaceful application of nuclear technology should be elaborated on the basis of those already approved in General Assembly resolution 32/50 and in the relevant paragraphs of the Final Document of the tenth Special Session of the General Assembly devoted to disarmament. Among these principles, the following propositions should be reflected

i) The use of nuclear energy for peaceful purposes is of great importance for the economic and social development of many countries;

ii) All States have the right, in accordance with the principle of sovereign equality, to develop their programme for the peaceful uses of nuclear technology for economic and social development, in conformity with their priorities, interests and needs;

iii) All States, without discrimination, should have access to and should be free to acquire technology, equipment and materials for the peaceful use of nuclear energy;

iv) All States as well as the international organisations concerned should respect and observe the aforementioned principles.

v) International cooperation in the peaceful uses of nuclear energy should be promoted on an equitable and non-discriminatory basis;

vi) A separate international convention or protocol should be adopted to prohibit attacks against all nuclear facilities;

vii) Any interruptions or arbitrary and unilateral changes in nuclear supply agreements and contracts, or their application, has adverse consequences for the developing countries. Such countries are entitled to specific performance of the agreement or adequate compensation.

viii) The developing countries have same rights and incentives as other nations to make the most effective use of the nuclear fuel at their disposal and to obtain independence in the nuclear fuel cycle.

ix) Existing multilateral and international mechanism have had a limited effectiveness in meeting the special needs of the developing countries and the programmes and policies of these institutions should be adapted for this purpose. The developing countries require arrangements of a broad scope

covering supply of technology and equipment for manpower training, research and financing to develop their peaceful nuclear programmes.

The UN Conference on the promotion of international cooperation in the peaceful uses of nuclear energy should adopt a Programme of Action which could cover the following main elements :-

a) An assessment of the growing demand for nuclear energy in the next few decades and the policy actions required to meet this demand, especially as concerns the developing countries.

b) The international assurances of supply of technology, fuel, heavy water and services. The policies and objectives of supplier States should be realigned to conform to the agreed principles and goals of promoting nuclear energy for peaceful purposes.

c) Unhindered transfer of technology, equipment and material for the peaceful uses of nuclear energy, especially to the developing countries. Such transfers should be promoted through commercial markets and at the governmental level. It is important that the various administrative, legislative and other impediments which a number

of supplier governments have unilaterally or jointly imposed on the transfer of nuclear technology, equipment and materials should be eliminated or rationalised to conform with internationally agreed criteria between supplier and recipient States.

d) Special needs of developing countries. The developing countries require special measures and arrangements to assist them in the development of nuclear energy programmes. These include: international arrangements for assured fuel and heavy water supplies; increased exploration and exploitation of uranium resources; participation in bilateral or multilateral fuel cycle activities; increased specialised training programmes for the development of manpower; increased technical assistance especially in projects dealing with major applications of nuclear technology; and the increased availability of resources for nuclear energy programmes from international financial organisations and from other resources.

e) Cooperation among developing countries, at the bilateral, regional or inter-regional level, for the peaceful uses of nuclear energy. Efforts of developing countries in pooling arrangements related to the regular and reliable supply of nuclear fuel,

equipment technology and services should be supported by international organisations especially the IAEA.

f) Establishment of new institutional machinery and improvement of existing institutions to promote peaceful uses of nuclear energy. These measures could include :-

i) establishment of an international fund to finance the implementation of the Programme of Action;

ii) decisions by international financial institutions, such as the IBRD and UNDP, to increase resources for nuclear energy programme in the developing countries;

iii) establishment of an International Technology Centre to provide practical training and access to expert advice for developing countries; and review and improvements in the operation of the IAEA, specially by :-

a) increasing funds for IAEA's technical assistance programme (to at least the same level as expenditures on safeguard activities) and creation of a Special Fund for technical assistance;

b) eliminating discrimination in IAEA's assistance programmes between parties and non-parties to NPT; and

c) ensuring adequate representation on the IAEA Governing Board of under-represented regions.