

CONSIDERATIONS TO
LAUNCH A NUCLEAR POWER
PROGRAMME-THE JOURNEY
SO FAR

By

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Nuclear Safety, Physical Security
& Safeguards

PREAMBLE

- “ Energy is essential for development
- “ Nearly every aspect of development—from reducing poverty and raising living standards to improving health care & industrial & agricultural productivity require access to modern energy sources

Preamble Conto

“ The world’s economy literally runs on energy. To support continued economic progress for the world’s growing population, more energy will be needed. Even with significant improvements in energy efficiency, World marketed energy consumption is projected to increase by 50 percent from 2005 to 2030, according to a new report from the United States Energy Information.

Preamble Contd

- “ The vast majority of this demand increase will take place in developing countries (Nigeria is not an exception), where economies are growing most rapidly and modern energy supplies are still a precious commodity for millions of people. Meeting higher energy requirements poses many challenges including boosting efficiency, developing new supplies and managing environment risk.

Preamble Conto

“ The use of nuclear technology to meet the world's energy needs is no longer an option but the only way out of the quagmire without compromising the environment for the future generation. It is worthy to know that Nuclear power provides over 16% of the world's electricity, almost 24% of electricity in OECD countries, and 34% in the EU. Its use is increasing.

Preamble Contd

- “ NPP involves issues associated with nuclear material, ionizing radiation & related challenges.
- “ This is a major undertaking requiring careful planning, preparation & investment in a sustainable infrastructure that provides legal, regulatory, technological, human and industrial support to ensure that the NM is used for peaceful purposes & in safe and secure manner

Towards The Implementation of a Nuclear Power Programme

- “ Experience shows that the time btw an initial policy decision by a state to consider nuclear power up to operation of its 1st nuclear power plant (NPP) will be at least 10-15 yrs
- “ This period consists of 3 major phases and 19 issues to be addressed towards implementing nuclear power programme

Consideration before a decision to launch a nuclear power programme is taken

- “ Assess the implications of installing an NPP in the national grid network
- “ Recognizing that normally no single nuclear unit should account for more than 10% of the installed capacity of the entire network
- “ The key activities of the 1st phase include recognition of obligations and commitments associated with nuclear power programme which include:
 - . Develop comprehensive nuclear legal framework covering safety, security, safeguards, liability and commercial aspects related to the use of nuclear material;
 - . Establish & maintain an effective regulatory system;

Consideration Conto

- . Develop human resources for the state organizations & also for the operating organization required to effectively supervise and implement the nuclear programme;
- . Ensure adequate financial resources for the construction, sustained safe operation & decommissioning of the NPP, as well as radioactive waste mgt
- . Communicate in an open & transparent manner with the public and the neighbouring states about consideration behind the introduction of nuclear power

Preparatory work for the construction of an NPP after a policy decision has been taken

- “ Following a policy decision, the substantive work begins for ensuring that the necessary level of technical & institutional competence is achieved by the state & commercial organization
- “ During this phase it is expected that state would
 - . Enact all elements of the comprehensive legal framework mentioned earlier

- . Establish and ensure the competence of the regulatory body to develop a licensing system & to monitor & supervise compliance with safety standards & security guidelines consistent with IAEA standards;
- . Decide upon the financial & operational modalities for the ownership & implementation of an NPP (govt, private sector &/or foreign ownership)

Preparatory work Conto

- . Establish the long term financial arrangements for decommissioning and radioactive waste mgt
- . Ensure involvement & support for a nuclear programme of all relevant stakeholders;
- . Define the degree of national technical & industrial participation in the development of the future programme;

Preparatory work Conto

- ” In addition, it is expected that the state or the owner/operator would:
- . Perform a feasibility study in order to confirm the viability of the nuclear power programme
 - . Identify & justify a site for the NPP;
 - . Establish a long term policy for fuel procurement & spent fuel and nuclear waste mgt;
 - . Identify how human resources for the NPP would be developed and trained
 - . Establish an organization with the potential to act as a competent purchaser with the ability to assess design options, establish user requirements, prepare & evaluate bid documents

Preparatory work Contd

- “ Such preparatory work would held to provide confidence nationally & internationally (including to suppliers of nuclear technology) that the state concerned is ready to proceed with the implementation of the NPP project

Activities to implement a 1st NNP

- “ To complete & prepare for the operation of a specific NPP
- “ The main focus is to ensure that the project is implemented by the owner/operator in accordance with the agreed engineering & quality requirements, safety standards & security guides
- “ The owner/operator must achieve the competence necessary to operate, maintain & establish full responsibility for the NPP

Activities to implement Control

- “ This is the phase where the required commitment of financial & human resources is greatest
- “ This where the owner/operator needs to demonstrate the acceptance of the responsibility for the long term mgt of all issues associated with the NPP
- “ During this phase the continued supervision by the regulatory body will provide a framework within which the owner/operator can demonstrate in an open & transparent manner, that they possess the necessary safety culture to comply with the established safety standards & security guidelines

Activities to implement Conto

- “ It is also important to realize that NPP requires continuing international commitments & partnerships with other states.
- “ This would include gaining & maintaining the confidence & trust of neighbouring states in the peaceful, safe & secure operation of the NPP project

Factors for consideration

“ **Timescales**

- “ A decision to implement nuclear power programme requires long term commitments throughout the period of planning, operation, decommissioning & waste mgt
- “ For state with little developed technical base the implementation of 1st NPP would on average take about 15yrs
- “ state with strong technical base could reduced to 10 yrs if the state initiates a significant & concerted effort to achieve implementation in a rapid manner

Human Resources & Training

- “ Typically, the operating organization responsible for an NPP required a staff of 200-1000 persons
- “ They should collectively have a variety of scientific, engineering & other technical backgrounds in fields needed to effectively & safely operate & maintain the plant

Human Resources & Training

- “ They also need three or more yrs of specialized training & experience prior to the initial fuel loading of an NPP
- “ This specialized training & experience can be included as part of the contract with the supplier of the NPP technology
- “ Assistance to the nuclear safety regulator in developing the human resources capable of regulating & overseeing the safety of the plant & achieving an effective, competent & independent nuclear safety regulatory org. may be provided by the regulatory body in the country of origin of the supplier or other regulatory bodies.
- “ This can be complimented by the IAEA

Regulatory Aspect

- “ It is difficult to prescribe an organizational model & number of staff for a regulatory body
- “ Analysis of existing structures indicates that 30-50 staff would be necessary for starting the implementation of NPP programme
- “ As a minimum, the structure & size of the regulatory body should be sufficient for independently performing the main regulatory functions such as authorization, review & assessment, inspection & enforcement, development of national regulations & guides
- “ It is necessary to provide resources & competencies to implement some shared functions (e.g. emergency preparedness & response, national & international cooperation, dissemination of technical & scientific information, environmental assessment, & communication with the public & other stakeholder)

Regulatory Aspect Contd

- “ Regulatory bodies capabilities can be augmented with assistance & advice from other organizations (e.g. independent consultants, support organizations, research & educational institutions, other states or international organizations)

Available Technology

- “ Most of the reactors available for purchase & construction are H₂O cooled rxtors for which operational experience exists nationwide
- “ These are mainly pressurized light water rxtors (PWR), boiling water reactor (BWR) & heavy water rxtors (HWR)
- “ They are generally available in sizes of about 1000MW or greater electrical output
- “ Slightly smaller rxtors of 600-700MW output are also available using water rxtor technology

Available Technology Conto

- “ If a smaller unit is required due to the capacity of the national grid network, the available tech. is limited
- “ Although reactor of 200-400MW output are being operated & developed in some countries
- “ Several designs are being developed for future applications
- “ Major challenge is to achieve an economic design at a smaller size

Available Technology Conto

- “ HTGCR (160-270 MW) & several smaller WCR are being developed which may reach design approval over the next ten yrs
- “ Currently Barge mounted moveable 70MW output plant is under construction

“ Pebble Bed Modular Reactor Pty. Ltd. (PBMR) in [South Africa](#) may be the current technology leader. It is developing a modular pebble-bed reactor. On June 25, [2003](#), the South African Republic's Department of Environmental Affairs and Tourism approved a prototype 110 MW pebble-bed modular reactor for Eskom at [Koeberg](#), [South Africa](#)

“ The PBMR team is currently preparing for the building of a commercial-scale power reactor project at Koeberg, near Cape Town, where Africa's only nuclear power station is based, and a fuel plant at Pelindaba near Pretoria. The current schedule is to start construction in 2009 and for the first fuel to be loaded four years later. Construction of the first commercial PBMR modules is planned to start three years after the first fuel has been loaded into the demonstration reactor.

Cost

- “ The construction cost of new plants can vary widely
- “ A value of \$1.5-2 million per MW of electrical is indicative of current costs for an NPP (i.e. \$1.5-2 billion for a 1GW output NPP)
- “ These may be higher in some countries
- “ Effort are being made to reduce the capital cost from between \$1-1.5

Cost Cond

- “ Plants with larger electrical output are generally considered to have lower capital cost per unit of output
- “ To prepare for a NP programme required initial investment
- “ This investment is initially quite small, during the first phase of developing an understanding of the needs for NP programme
- “ But will increase as the need for providing technical & regulatory supervision & associated training of staff arises

Funding & Economics

- “ The capital investment in an NPP may be provided by govt, private utilities or a PPP
- “ The initial high capital cost is normally offset by low operating & fuel costs
- “ The sensitivity of the electricity generation cost to the price of fuel is much lower for Nuclear plants than for fossil fuelled power plants

Conto

” To finance the long term liabilities of decommissioning, fuel storage & waste mgt it is expected that financial arrangements for collecting funds during operation to cover such liabilities will be established

Fuel Supply Security

- “ Many states energy supply sources are mainly imported & this may be considered a source of risk to national fuel supply security
- “ Gas and coal supplies
- “ In contrast, nuclear fuel for a reactor can be stored to ensure that supply for up to 10 yrs will remain available
- “ Although most NPPs do not store fuel for long periods, recognizing that the market supply of fuel provides the necessary confidence in supply security

Technology Support & Organization

- “ For most commercially available designs of NPPs there are internationally experienced sources of technical support that could assist either the regulator or the operator
- “ These services are provided worldwide from many countries, either state owned orgs or private suppliers & consultancies
- “ In the long term, states & operating orgs would need to develop their own technical capabilities & to gradually reduce dependence on foreign support
- “ These can be achieved over a period with contractual arrangements for the transfer of technology, service & support contract, & training programmes supported by the suppliers

legislation

- “ Wide range of legislation is expected to be in place in a state that decided to implement a NP programme
- “ The key elements of such legislation being Nuclear safety, security, safeguards & liability for nuclear damage

Decommissioning

- “ Preparation for decommissioning of the NPP addressing the technological, regulatory & financing aspects should be included in the preparatory phases of the introduction of nuclear power
- “ An appropriate plan for the mgt of the decommissioning would be expected to be prepared

Used Fuel & waste Mgt

- “ After use in a reactor, fuel assemblies need to be managed safely & securely
- “ An initial period of storage at, or close to the NPP is appropriate
- “ After this period the fuel can be stored for long period
- “ There currently around 90 spent fuel storage facilities operating successfully worldwide
- “ Reprocessed to reduce radioactive waste
- “ Repository?
- “ Appropriate plan for mgt of used fuel& waste would be expected to be prepared

Public Information

- “ For the successful introduction of a NP programme it is important that the public is fully informed about the underlying rationale behind the introduction of NP
- “ The planned sitting of the NPP
- “ Measures in place to ensure compliance with national & international standards & conventions
- “ B4 final decisions are made it is suggested that programmes of public consultation are developed, involving local communities, politicians, non-govtal orgs & civil society stakeholders

IAEA assistance

- “ Under its status, the IAEA is authorized to assist any member state considering or has decided to introduce NP to meet energy needs (Article III)
- “ Can assist with training within available resources
- “ It is desirable that state & owner/operator obtain advice from around the world from regulators, operators, users of common technology & commercial suppliers

IAEA assistance cond

- “ By providing technical support
- “ Assistance is also provided in developing comprehensive national legal frameworks under its legislative assistance programme
- “ Specific IAEA support can also be sought in assisting the development of regulatory bodies to ensure they are effective & fully competent to oversee the licensing of the facility & by providing peer review services concerning all aspect of the nuclear power programme

Score sheet

- “ Regulatory body in place
- “ International instruments to be adopted when considering NP programme such
 - . Comprehensive Safeguards Agreement
 - . Additional protocol
 - . Convention on Early Notification of a Nuclear Accident
 - . Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency
 - . Joint Convention on the Safety of Spent Fuel Mgt & on the Safety of Radioactive Waste Mgt

Score sheet Conqd

- . Convention on Physical Protection of Nuclear Material
- . Vienna Convention on Civil Liability for Nuclear Damage
- . Joint protocol Relating to the Application of the Vienna and Paris Conventions
- . Protocol to amend the 1963 Vienna Convention on Civil Liability for Nuclear Damage and Convention on Supplementary Compensation for Nuclear Damage

Score Contol

- “ Draft Bill on Nuclear Safety, Security & Safeguards before National Assembly
- “ National Seminars on NPP programme
- “ Draft Regulation on Sitting of NPP
- “ Curriculum development for Nuclear scientists, engineers, technologists

Recommendations

- “ Funding and Financing-clear evidence that enough resources have been made available to the NEPIO
- “ Development of an adequate regulatory framework
- “ Development of Human Resources
- “ Stakeholder Involvement

Recommendation Conto

- “ Need to expedite the passage of the nuclear safety bill

Yes we can

- “ Impossible does not exist
- “ The moment you stop learning, you stop leading
- “ Think possible
- “ Say yes we can
- “ Thank you for your attention