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Nuclear

by R. Ian Facer

It takes at least 10 years for a nuclear power project to be completed successfully. Along the way, much needs to be considered ... and done.

As Dr. Mohamed ElBaradei, Director General of the IAEA, has said: “It is important to consider the global energy imbalance. The developed countries consume electricity at a rate 17 times the African average and up to 170 times higher than some African countries.”

It is well understood that any nation’s standard of living is closely related to its access to energy. Many countries with the lowest standards of living are those with the lowest use of energy. This is one reason why countries are looking to increase their access to new sources of energy.

Increased access to energy can be achieved through importing fossil fuels, particularly oil, coal and gas. Many countries will have to follow this option in the short term, irrespective of the risk in the long-term to their national economy. However, experts are beginning to realise that fossil fuel prices are unlikely to come down and dependence upon imports can reduce national security of energy supply. These are among the emerging reasons to investigate nuclear power. An additional reason is the effect on the environment of growing fossil fuel use.

While the reasons may be easy to identify, it is not so straightforward to define what it takes to attain the nuclear option. It is not sufficient to announce the intention to build a nuclear programme for that programme to be achieved. As Dr. ElBaradei said: “As a sophisticated technology, nuclear power requires a correspondingly sophisticated infrastructure.”

In response to this comment the IAEA has prepared a guidance document that can be used by decision makers when they consider introducing nuclear power. This

document was presented to the IAEA’s March 2007 Board of Governors and has subsequently been issued as a brochure.

This brochure *Considerations to Launch a Nuclear Power Programme*, was developed by a team representing the IAEA. This Group, known as the ‘Nuclear Power Support Group’, developed the initial concept as a short note to inform Ministers and other high level delegations visiting the IAEA. This short note developed into an agreed IAEA concept that forms the foundation of the support for any country considering a nuclear project or programme.

The period from the initial idea that nuclear power may be an option to the start of operation of a nuclear power plant can be split into three phases. These are:

- ① Considerations before a decision to launch a nuclear power programme is taken;
- ② Preparatory work for the construction of the plant after a policy decision has been taken; and
- ③ Activities to implement the first nuclear power programme.

The work that would need to be done during each of these phases is briefly summarised below.

Phase 1

The key activities of this first phase include recognition of the obligations and commitments associated with a nuclear



It can take at least ten years to initiate a nuclear power programme. Japan's Tomari nuclear power plant under construction. Photo: Mitsubishi Heavy Industries, Ltd.

power programme, both at a national and international level. These include the need to:

- ◆ Develop a comprehensive nuclear legal framework covering all aspects of the peaceful uses of nuclear energy, i.e., safety, security, safeguards, and liability, in addition to the commercial aspects related to the use of nuclear material;
- ◆ Establish and maintain an effective regulatory system;
- ◆ Develop the human resources for the State organizations and also for the operating organizations required to effectively supervise and implement the nuclear programme;
- ◆ Ensure adequate financial resources for the construction, sustained safe operation and decommissioning of the plant, as well as radioactive waste management;
- ◆ Develop a programme for all aspects of operation, decommissioning and radioactive waste management;
- ◆ Manage nuclear materials for the long term; and
- ◆ Communicate in an open and transparent manner with the public and the neighbouring States about the considerations behind the introduction of nuclear power.

Phase 2

Following a policy decision, the substantive work begins for ensuring that the necessary level of technical and institutional competence is achieved by the State and commercial organizations (e.g., utility and operating company). This phase requires a significant and continuing commitment from both the State and the commercial organizations.

During this phase it is expected that the State would:

- ◆ Enact all the elements of the comprehensive legal framework mentioned above;
- ◆ Establish and ensure the competence of the regulatory body to develop a licensing system and to monitor and supervise compliance with safety standards and security guidelines consistent with IAEA standards;
- ◆ Decide upon the financial and operational modalities for the programme's ownership and implementation (government, private sector and/or foreign ownership);
- ◆ Establish the long-term financial arrangements for decommissioning and radioactive waste management as well as the associated liabilities;
- ◆ Ensure involvement and support for a nuclear programme of all relevant stakeholders;

- ◆ Define the degree of national technical and industrial participation in the development of the future programme;
- ◆ Assess where national technical capability needs to be enhanced and develop a policy for national participation; and
- ◆ Identify requirements and make arrangements for emergency preparedness, security measures and environmental protection.

In addition, it is expected that the State or the owner/operator would:

- ◆ Perform a feasibility study in order to confirm the programme's viability;
- ◆ Identify and justify a site for the plant;
- ◆ Establish a long-term policy for fuel procurement and spent fuel and nuclear waste management;
- ◆ Identify how the human resources for the programme would be developed and trained; and
- ◆ Establish an organization with the potential to act as a competent purchaser with the ability to assess design options, establish user requirements, and prepare and evaluate bid documents.

Phase 3

To complete and prepare for the operation of a specific nuclear power programme, the main focus is to ensure that the project is implemented by the owner/operator in accordance with the agreed engineering and quality requirements, safety standards and security guides. The owner/operator must achieve the competence necessary to operate, maintain and establish full responsibility. This is the phase where the required commitment of financial and human resources is greatest, and where the owner/operator needs to demonstrate the acceptance of the responsibility for the long-term management of all of the issues associated with the nuclear power programme.

From generation to generation

Several specific factors need to be taken into consideration when a country makes a decision to adopt nuclear power.

Among the key factors is the timescale over which the preparation of an effective infrastructure can be developed, which is unlikely to be less than ten years, if the country is starting from a low base. It is also important to recognise that a decision to introduce nuclear power will lead to

obligations for the safety and security of the facilities for many decades.

As an indication of this timescale, it is likely that it would be the grandchildren of the people who operate a modern nuclear plant at the beginning who would be of an age to operate the plant at its closure. Furthermore it would be the grandchildren's grandchildren who would need to take responsibility for the management of the nuclear material arising from operation of the nuclear plant.

Nuclear power can bring significant long-term benefits in terms of increased access to energy, and security of energy supply. But these benefits cannot be obtained without a significant commitment to establish a sustainable infrastructure.

A further issue is the availability of appropriate technology for all countries. For many small, or isolated, countries, current large-scale nuclear power plants (appropriate for North America, Europe or China) may not be acceptable in their limited electricity supply network. The development of technologies which have smaller power output are easier to construct, license and operate would assist several countries that are showing an interest. Innovative institutional arrangements that simplify the issues of fuel supply and spent fuel management will also need to be addressed to achieve wider access to nuclear power technology.

It is clear that nuclear power can bring significant long-term benefits in terms of increased access to energy, and security of energy supply. But these benefits cannot be obtained without a significant commitment to establish a sustainable infrastructure. For any country considering the introduction of nuclear power, it should be recognised that it is important to provide sufficient time to make comprehensive preparations to achieve the effective and successful implementation of a nuclear industry.

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