Assessing New Reactor Technologies

The accident at Fukushima revealed the importance of having reactor technologies which are safe, reliable and able to withstand extreme external events. MNB Editor Judith Perera asked Thomas Koshy, head of the IAEA’s Nuclear Power Technology Development Section, how the Agency is helping states select new technologies which meet these criteria.

JP: What are the main tasks of your Section?

TK: Our section looks at existing and new technologies, seeks solutions to existing problems, and helps industry to adopt a new technology if it is appropriate. Our work is divided into four areas:

1. Advanced reactors, especially small and medium-size reactors;
2. Non-electricity applications such as hydrogen, which is much more easily stored than electricity;
3. Desalination — the use of energy from a nuclear plant to purify seawater for consumption as well as to produce electricity. This could be especially useful for the Middle East and other areas short of water;

JP: How have the events in Japan affected your work?

TK: The events in Japan mean we have had to realign our resources. Fukushima has caused a delay in the growth of nuclear power for energy needs in certain countries but did not reverse it. We now see that the problems which led to the events can be addressed effectively and efficiently. The nuclear industry has advanced remarkably through finding solutions that were revealed through plant events with other comparable technologies in aerospace and the petrochemical industry. Similarly, the vulnerabilities now identified because of the Fukushima accident can all be resolved. The capability to design a system that can withstand flooding has been used in other applications and it is within the technical capabilities that exist now.

JP: What are the main lessons of Fukushima?

TK: Nature presents us with challenges. As far as nuclear plants are concerned, we have been successful in dealing with very severe earthquakes but we need to advance our capabilities to overcome the effects of tsunamis of large magnitude. So now we know we have to be able to keep a reactor cooled, despite flooding. Our group is gathering the collective wisdom from the member states to share some short term solutions to address such problems for the existing fleet of reactors. Also we plan to work with member states to make available some toolkits – technical guidance...
and mitigating measures – to more effectively deal with future comparable scenarios.

**JP: What are the priorities for technology development?**

**TK:** We need to explore some possibilities to improve the performance of safety systems when faced with severe external events. Looking to the future we will also review the designs of new reactors to assess their resilience in the face of Fukushima-type events. In the long term we hope to facilitate designs which are fully resistant to such problems. We will be looking, for example at passive cooling systems and increasing the robustness of emergency cooling systems.

**JP: Do advanced reactors offer solutions to these problems?**

**TK:** There are advanced reactor designs in large and small units. The design of this category has selectively utilised passive cooling systems, optimised the safety systems to improve its performance, and expanded diversity and redundancy to achieve a greater level of nuclear safety.

Advanced small and medium-sized reactors (SMRs) at a power rating of less than 300MWe are not yet commercially available although several countries are moving in this direction: for example, Argentina is starting the site excavation for the CAREM reactor in the country; in China, two modules of gas-cooled reactors, called HTR-PM, are under construction for domestic use; SMART in the Republic of Korea is in the final stage of design approval; in Russia, two KLT-40S floating nuclear power plants are under construction and excavation for the SVBR-100 reactor is starting; and in the US, at least two advanced SMR designs have been prioritised for design review by the Nuclear Regulatory Commission. One of the tasks of the Agency’s Nuclear Power Technology Development Section is to review advanced reactors again in the light of Fukushima.

**JP: Are fast reactors an option for the future?**

**TK:** Fast reactors are more convenient for countries with a strong technical and nuclear base and where the technology can be tested and proven. Their use should begin in countries such as France, India, Russia and the US. Once the early operational challenges are solved, it would be ready for newcomer countries.

**JP: How do you support member states in their choices?**

**TK:** A new document will be available for technology assessment. This document would help a newcomer country to ask for the required details in going out for bids and it would further help member states to more effectively evaluate the capabilities of the design and to judge their suitability to particular conditions. We offer training and assistance to newcomer countries to make the most appropriate decision. For instance, we are now looking to see how we can use less water to operate a nuclear plant for cooling, by improving the efficiency of the equipment and improving the heat removal capability.

**JP: What other services are offered from your group for newcomers?**

**TK:** We are advancing our services to see to the needs of countries considering introducing nuclear power in their energy mix. We assist the governmental organisations to supplement technical expertise to build their level of confidence in proceeding with the nuclear power option. Our experts are available to provide technical assistance for an independent review of the feasibility study that is conducted in the initial phases of launching into nuclear power production.

Another important service that we offer is the sharing of technical information through data bases. One of the frequently accessed IAEA databases is the Advanced Reactor Information System (ARIS, http://aris.iaea.org/ARIS/aris.cgi). It provides a good overview of all reactor types in one standard format.

**JP: Are there any other services for operating reactors?**

**TK:** We work with member states by facilitating working groups to address technical challenges. We have a few more databases providing insights into material issues, ageing management, research work and some others, for preserving the lessons the industry has learned. Such information forms a repository of knowledge available to new organisations and young professionals entering in the field to get a head start in addressing their plant specific issues.

**JP: What do you see as the key issues here?**

**TK:** It is important to re-establish public confidence in pursuing the nuclear option. We can offer technology but it is also important to protect the health and safety of the public. We need to improve public understanding of nuclear power and build confidence in people that Fukushima type problems can be adequately addressed. We will be exploring other potentially challenging scenarios and providing guidance for preserving nuclear safety and thus protecting the health and safety of the public.
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