Preparatory Committee for the 2015 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons

29 April 2013

Original: English

Second session
Geneva, 22 April-3 May 2013

Peaceful uses: growth in nuclear energy and the demand for specialist skills

Working paper submitted by the United Kingdom of Great Britain and Northern Ireland

Synopsis

1. Pursuing the safe and peaceful uses of nuclear energy is a fundamental tenet of the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), as set out in article IV. For those States seeking to do so, the issue of skills — securing the right people with the right expertise and experience — presents a major challenge. The present paper outlines the demand for skills and explores some issues to help satisfy that demand, including the possibilities afforded by greater cooperation — one of the actions of the action plan adopted by the 2010 Review Conference of the Parties to the Treaty on the Non-Proliferation of Nuclear Weapons.

Background

2. Global interest, both in terms of overall energy security of supply and the contribution of nuclear energy as a significant and reliable low-carbon energy source, is rising, despite the nuclear accident at the Fukushima-Daiichi nuclear plant in May 2011. While some States have taken the decision to phase out existing nuclear power, others have continued with plans to introduce or expand such nuclear programmes.

3. It is clear that the worldwide demand for energy is set to rise inexorably over the coming decades, especially in developing countries: the International Atomic Energy Agency (IAEA) estimates that the global electricity demand will effectively double to require a minimum of 9.6 GWe installed generating capacity by 2030. Given that many electricity generating stations around the world are rapidly reaching the end of their operational life or are major carbon emitters, the challenge is considerable. For many countries, nuclear energy will become, or remain, a major and growing means of meeting their energy needs, not least helping to balance the demand for electricity with commitments to minimize climate change and carbon emissions.

13-31680 (E) 300413

4. A key issue is that of skills: to successfully plan, build, operate and decommission a nuclear power plant, the right number of people, with the right skills, will need to be planned for and deployed at the right time. There is the need to fulfil a primary function, such as ability to undertake the legal work to establish a regulatory body or the technical capability to operate a nuclear reactor. Equally, there is the need to act as an intelligent customer, to ensure that goods or services provided are fit for purpose. In both these cases, expertise does not have to reside in a national authority. But Governments will be called to account if there are failures resulting from too little such domestic (home-grown) nuclear-related knowledge or expertise.

5. On timing, the skills associated with pre-project planning and investment will be brought in and largely released by the time the final investment decision is taken. In contrast, the development and ongoing training (to a high level) of a locally employed operational workforce is a longer-term consideration.

Skills demand

Planning

6. Embarking on a new nuclear energy programme is a major undertaking that inevitably requires Government support in some form. Any such decision requires sound answers to fundamental questions, including the long-term role, support and commitment of the State as a whole to such a move; desirability and public acceptability; risks and long-term economic viability; ability to procure local and international expertise for planning, regulation, operation and training. While these may be the same as for many other major infrastructure projects, there are distinct differences for nuclear energy. The scale of the sunk costs, timescales and regulatory practices often warrant a unique approach. Moreover, the generating size of most power units, dictated by economic terms, means existing infrastructure may need to be reworked. Although not essential, a new nuclear country does have an advantage if it is able to draw on experience in running a national research reactor — the basic skills to assist the development and implementation of a safe operating environment (by that country's nuclear energy programme implementing organization). In this regard, the IAEA Milestones[1] are a key resource, providing a three-stage framework of analysis for:

(a) A country ready to make a knowledgeable commitment to a nuclear energy programme — 19 "issues";

(b) Necessary accomplishments in relevant areas of each issue prior to inviting bids for a nuclear power plant;

(c) Necessary accomplishments in all areas to be ready to commission and operate a first nuclear power plant.

7. An individual State also needs to consider the extent to which it will seek to master the various elements of the fuel cycle. While the rights to do so, for example to pursue enrichment and reprocessing, are enshrined under article IV of the NPT, most countries look to the commercial market to satisfy their demands for fuel, including enrichment services. Moreover, the economic, business and technical case

[1] International Atomic Energy Agency (IAEA), "Milestones in the Development of a National Infrastructure for Nuclear Power", IAEA Nuclear Energy Series No. NG-G-3.1 (Vienna, 2007).

for spent fuel reprocessing/long-term deposition by one State with a limited number of planned facilities is invariably tenuous, requiring that basic decisions about long-term waste deposition usually default to above-ground storage solutions. Countries with significant reserves of uranium may also choose to add value through conversion, fuel fabrication or bartering with potential nuclear facility vendors to provide these additional services rather than trading the raw material.

8. The skills required to fully plan a nuclear power station project cannot be underestimated. As mentioned above, many of the elements will be common to other, large-scale infrastructure projects, but experience will be needed (either embedded or brought in specifically to address a certain issue) for the nuclear-specific elements. It would not be unusual to see a variety of experts brought together at this stage, each with a distinct or unique area of expertise and experience, who could guide the project during the critical early stages and ensure that all aspects of planning are considered and fully understood. Costly delays later in the process can potentially be avoided or mitigated during this phase.

Financing

9. Political expediency and political will are the bedrock for the success of any infrastructure project, especially in the case of introducing nuclear power stations. Governments can establish the economic and policy conditions that set the levels of financial risk and thereby govern the likelihood of successful external/commercial investment decisions. It is certainly likely that private sector funding, of various complexities, will increase in the years ahead over traditional government funding (either directly or through utility companies). Governments also establish regulatory practices and policies and so have some control over uncertainties and risk, and may be able to mitigate certain risks in some way. Steps can include risk-sharing or loan guarantees, agreeing threshold prices for electricity supply,[2] or assuming obligations to maintain certain infrastructure.

10. For the financing element of the project planning, the skills required may well be transferable from any large-scale project that requires a high proportion of up-front capital. However, negotiating skills and funding options will be key to success in this area.

Project tendering/appraisal/selection

11. Investment in major project appraisal and assessment needs to be significant well before any final investment decision is made: typically 6 per cent of envisaged project costs. This is particularly the case for a nuclear programme, where massive up-front costs, a limited number of suppliers (namely, reactor vendors), opportunity costs and reduced flexibility apply. Above all, risk analysis, from financial loss to long-term operational reliability and performance, and not least safety and security, will be key. For a “new nuclear” country, much of this expertise will inevitably need to be sourced from international suppliers, either commercial providers or through arrangements that draw on the experience and knowledge of national or regional regulatory bodies. As with the planning stage, it would not be unusual to bring

[2] The United Kingdom is currently engaged in discussions with industry on the basis of a “strike price” for nuclear-generated electricity that will underpin private investment in new nuclear capacity.

together a variety of experts looking at different areas and all contributing to the overall assessment of the options for moving forward with the project.

Regulation

12. Establishing and operating an independent regulatory function to cover all areas of planning and operation of a nuclear power station (and associated services) is a fundamental priority. This places a premium on securing highly qualified staff early on with the right skills who are able to oversee plans for the programme (as they are being established), and who are sufficiently independent to ensure proper standard-setting, arrangements (such as safeguards implementation) and regulatory culture.

Construction/operation

13. Effective project management is a particular and fundamental requirement for a nuclear project and is the centre of huge risk. Mitigating risk is often difficult, not least owing to the strict and precise quality requirements for nuclear build and operation, from basic construction to failsafe systems, which can place additional demands on cross-disciplinary teams working together for the first time. While there may well be more standardization of nuclear facilities in the future, largely owing to costs and the desire to reduce them, so that transferable experience can be built up and exchanged more quickly, each plant will still require significant time to commission and commence operation. As with all major projects, the success of the construction phase is dependent on the quality of the information obtained in the planning stage. All additional regulatory requirements specific to a nuclear project need to be fully understood and planned for (in addition to the required building standards being met), to allow the commissioning to be completed and the necessary approvals obtained.

Meeting and managing the skills demand

14. Many of the skills needs for the nuclear sector per se, for example, legal, financial, construction, are reasonably well-served by the international market, where global firms retain mobile experts able to provide the quality of advice and access to other resources (such as capital), albeit at significant cost.

15. However, the question of skills for the nuclear sector leads to the inevitable focus on technical expertise — how best to secure professionals able to commission, operate, manage and regulate a nuclear plant. It is unrealistic, especially for smaller countries, to expect to be able to meet the demand for skills on all aspects of a new nuclear project “indigenously”, namely, from nationals based in their own country. And even if this were possible, it would be prudent to take advantage of the experience and know-how in the international marketplace or from other countries who already have a nuclear programme in place. Often, this experience is not just about how to do something, but also what not to do. The ability to benefit from lessons learned in other countries or from other projects is invaluable, especially when budgets are tight and delays costly.

Some features of the ways in which this demand will be managed are:

Flexibility

16. Higher (tertiary) education and training will continue to become more flexible, with cross-border provision, higher levels of teaching from outside (namely, non-academic) experts and information-sharing/collaborations across academic and professional institutions. In this regard, efforts by such bodies as, the World Nuclear University,[3] the United States Nuclear Energy Institute or the International Institute of Nuclear Energy (I2EN, France) to reach out will become increasingly important, owing to their flexibility to meet local, regional or international requests for nuclear science and engineering education. The role of bodies such as the European Safeguards Research and Development Association[4] and the Institute of Nuclear Materials Management (for safeguards) as primary networks for advice and support will also continue to strengthen.

17. Moreover, innovation will be increasingly apparent in teaching. This will be seen not only through greater innovation in the courses available, but also the way in which they are delivered: for example, through more remote/web-based teaching, more modular and bespoke courses; greater access to simulators; and improved access to research reactors. There will also be increasing regional and international cooperation between education and training providers. There will also be a premium on the possibilities for people with highly relevant skills, for example, in other branches of engineering, to make use of these transferable skills by retraining as nuclear engineers.

18. There are many opportunities at all levels. For example, technician-level qualifications and skills need to be transportable and mutually recognized. This will also help to attract people of the right calibre. As an example, the United Kingdom's National Skills Academy (Nuclear) has taken steps to introduce a nuclear skills "passport" that allows experience and training to be recognized across the industry, facilitating flexibility to allow individuals to change jobs, have access to more effective and efficient training, and better career progression.

Promoting common standards and best practice

19. The resources made available through IAEA and the Nuclear Energy Agency are already well-respected and will inevitably become increasingly valuable. From practical guidance documents to IAEA expert missions and reviews, their roles will grow. For example, more IAEA member States are likely to seek the in-depth expert review as provided via an integrated regulatory review service mission or an integrated nuclear infrastructure review mission. And more is being done under the auspices of a new steering group to advise the Agency on how best to support member States' training programmes on regulatory competence.

Greater bilateral cooperation

20. While, not surprisingly, most States will be keen to ensure that as much of the high-value activity for the new nuclear plant will be supplied by national suppliers

[3] Supported by the World Nuclear Association, the World Association of Nuclear Operators, IAEA and the Nuclear Energy Agency of the Organization for Economic Cooperation and Development.

[4] The European Safeguards Research and Development Association comprises European organizations actively involved in the research and development of nuclear safeguards.

as much as possible, such States will also look to strengthen bilateral cooperation as they embark on a new nuclear programme. The opportunity to learn from like-minded countries and share information, resources and know-how will provide reassurance and help with confidence-building and risk management and possibly lead to the standardization of nuclear power station projects that offer better value for money solutions owing to lower costs. Legally binding agreements also highlight the importance of adherence to commitments and international standards in safeguards, safety and security.

Conclusion

21. Global interest in nuclear power will continue to grow, based on the pressure to meet growing and major demands for reliable, low-carbon energy. NPT States parties reaffirmed, through the 2010 action plan, their support to a range of measures to promote peaceful use of nuclear energy. This included "… the right to participate in the fullest possible exchange of equipment, materials and scientific and technological information …" (action 48); "… cooperation with other States parties or international organizations in the further development ..." (action 49) and the encouragement of "… national, bilateral and international efforts to train the necessary skilled workforce needed ..." (action 56).

22. Inevitably, the focus will be on technical skills. While a new nuclear plant is likely to employ at least 5,000 people at peak during the construction phase, 1,000 or so will still be needed during subsequent operation, on site and in related research and development off site. And it is in this particular segment that the gap will be highest. The current workforce is ageing — rapidly — with the vast majority of workers aged over 47. And besides operations, there is an even greater need for such skills in regulation and non-proliferation. To better determine supply/demand information over the life of any nuclear new build programme, having robust labour market intelligence will be at a premium. This will help to identify both the skills gaps by resource type and the potential timing of any intervention required. In the United Kingdom we are developing the nuclear workforce model in conjunction with industry and the skills bodies. The first results are due out in mid-2013.

23. Unquestionably, the demand will, in the short term, place a premium on supply. Timing is also propitious. The time to agree, plan, resource, build and commission a nuclear reactor is such that training provision can grow to anticipate and meet demand. But compliance with the 2010 action plan, to promote cooperation and sharing of expertise, backed up with increasing provision of relevant and appropriate education and training, and increasing innovation and flexibility, will help to ensure that the full value of nuclear energy, for peaceful purposes, is not limited by the paucity of relevant skills.