Provisional Translation

Nuclear Fuel Cycle Policy Options

June 21, 2012

Japan Atomic Energy Commission

The Japan Atomic Energy Commission ("JAEC") was asked to present potential nuclear fuel cycle policy options by the Energy and Environment Council, and instructed its Technical Subcommittee on Nuclear Power, Nuclear Fuel Cycle, etc. ("technical subcommittee"), established in September last year, to identify these options according to the various share of nuclear energy supply in future.

The technical subcommittee identified three nuclear fuel cycle policy options for treating spent fuel generated in nuclear power plants. These included reprocessing of all spent fuel (full reprocessing), efforts of coexisting of both reprocessing and direct disposal concurrently (coexistence of reprocessing and direct disposal), and directly disposing of all spent fuel (full direct disposal).

To date, the technical subcommittee has held 15 meetings to discuss these options in detail from seven evaluation viewpoints and focusing on four options for various share of nuclear energy supply in 2030, i.e. 1) zero nuclear power, 2) approx. 15%, 3) approx. 20 to 25%, and 4) approx. 35%, shown by the Fundamental Issues Subcommittee of the Advisory Committee on Energy and Natural Resources. The technical subcommittee also evaluated the option to postpone any decision on nuclear fuel cycle policy at present (i.e. "wait and see" option). The JAEC received a report summarizing the discussion from the chairman of the technical subcommittee on June 5, 2012.

After the JAEC had received the report, the Energy and Environment Council announced three options for nuclear energy reliance in 2030 as follows as interim compilation on June 8: (a) zero nuclear power (as promptly as possible), (b) decrease to approx. 15%, and (c) decrease to approx. 20 to 25% (lower than before but maintaining a certain level). Based on this decision, the JAEC discussed future nuclear fuel cycle options, and concluded the following (see appendix):

1) If the option (a) would be selected as zero nuclear power by 2030 without expansion and replacement of nuclear plants, the fuel cycle policy adopting "full direct disposal" is appropriate.

2) If the option (b) would be selected as decreasing to approximately 15% for a rate of nuclear energy supply in 2030 based on basic policy "reduction of nuclear energy reliance", the fuel cycle policy adopting "coexistence of reprocessing and direct disposal"

is appropriate.

3) If the option (c) would be selected, namely, decreasing nuclear energy supply for a period but maintaining approximately 20 to 25% in 2030 by expansion and replacement of nuclear power plants later, the fuel cycle policy adopting "full reprocessing" isa likely option. The advantage of "full reprocessing" is considered greater under option (c) than under the option (b). But the policy of “coexistence of reprocessing and direct disposal” may also yield equivalent profits. Meanwhile, the policy of “coexistence of reprocessing and direct disposal” is a likely option if ensuring flexibility is considered important given an uncertain future.

Given that the R&D options for fast breeder reactors (FBRs) responding to various policy options, as presented by the Ministry of Education, Culture, Sports, Science and Technology at the meeting of the JAEC on June 12, seem generally appropriate, the JAEC recommended three options: Option (a) would involve suspending R&D based on the prototype FBR “Monju”, summarizing the results of previous R&D, and only continuing with basic R&D. For option (b), “Monju” should be subject to complete performance tests and a few cycle operations at rated power (in around five years), and there should be simultaneous R&D to determine the potential for commercialization. For option (c), R&D of “Monju” for commercialization should be conducted to obtain the intended operational goal in around a decade, and similar to option (b), R&D to determine the potential for commercialization should also be conducted.

Despite future uncertainty, the disadvantage of having an interregnum in action would also be very considerable, and policies should always be executed on a check-and-review basis (assessment). To emphasize the importance of these matters, the suspension (“wait and see”) option is excluded from the scope of discussion.

As recommended by the technical subcommittee, regardless of the policy choice, it is vital to build a system ready to cope with future policy changes. The government is entirely responsible for decisions taken on policy changes, and should wholeheartedly strive to settle related problems by adopting all possible measures to mitigate the difficulty. This should be done through straightforward communications with prefectures, cities, towns, villages and local residents, in cooperation with related utilities, to maintain reliable relationships with municipalities housing nuclear power plants nationwide, especially those which have cooperated with the government in conducting nuclear fuel cycle policies for many years by accepting related facilities.

If the present policy is abolished in favor of another, various arrangements must be made to promote the new policy, including financing the necessary actions. The issues concerning policy changes and the associated costs covered in the report of the technical

subcommittee are estimated using a model for the costs required to resolve potential issues in promoting the new policy, and this should be considered as a suggestion for the scale of efforts to be made to promote the new policy.

The report of the technical subcommittee also identified several critical issues in promoting the nuclear fuel cycle policy. Based on this, the JAEC recommends that the government commence discussions to settle them as follows:

1. Regardless of the chosen nuclear fuel cycle option, the government should exercise stronger leadership than before in striving to expand the storage capacity of spent fuel on-site and off-site of nuclear power plants, including dry storage with the safety of cooling systems in mind, and find a final disposal site for high-level radioactive waste. The choice of this site should reflect the need to provide a facility for the direct disposal of spent fuel, considering the spent fuel already generated from research reactors and Fukushima Dai-ichi NPS. The government should therefore start discussing the development of technology enabling such direct disposal and the required measures and regulations.

2. Except when the "full direct disposal" policy is selected, it is reasonable to proceed its plan towards the full-scale operation of the Rokkasho reprocessing plant by Japan Nuclear Fuel Limited. However, it should be done considering such important factors as the performance of plant operation, the progress of plutonium utilization and an international perspective. In addition, comprehensive assessment of the nuclear fuel cycle business operation by Japan Nuclear Fuel Limited and other organizations such as the Japan Atomic Energy Agency should be conducted by the government within several years.

3. R&D of FBRs will be continued unless "full direct disposal" option is chosen, but FBRs remain far from commercialization, despite years of development effort and vast expenditure. At present, we are waiting for the review of feasibility of commercialization of FBRs recommended by JAEC. Since it is possible that check-and-review in past had not been effective enough, the efforts to establish a system to ensure effective check-and-review are needed from now on.
   The period required to commercialize FBRs goes beyond the ordinary period of investment by private utilities. For this reason, it is important that the government establish an R&D system to produce innovative and competitive advanced reactors while allowing national research organizations to maintain sufficient human resources on a long term basis to continue and reinforce technology platforms.
   Based on a potentially reduced reliance on nuclear power in Japan, shrinking

budgets and changes in the priority of the budget, the government should not insist on finalizing the domestic R&D of the FBR cycle in Japan, but should start discussing more effective and efficient R&D through more active participation in international cooperation programs than before. At the same time, the government should examine fast reactors (FRs) as radioactive waste treatment technology, and compare this technology with other potential 4th generation reactors etc. When the direct disposal policy is selected, it is important, as the technical subcommittee recommends, to continue engaging in basic R&D into advanced reprocessing and FR technologies in order to remain flexible for an uncertain future.

4. A global perspective is crucial when considering nuclear fuel cycle policies. The international circumstances surrounding the nuclear fuel cycle have entered a new phase, with increasing demand from developing countries, newly viable countries, and a consensus among countries for reinforcing nuclear nonproliferation and nuclear security. Future discussions are also required to solve many policy issues, including the advantages and disadvantages of bilateral cooperation suitable for the new era, the possession of sensitive nuclear fuel cycle facilities in the country, and multilateral cooperation on nuclear fuel cycle, while considering the past efforts and processes of Japan-U.S. nuclear agreements. The government should establish a nuclear fuel cycle policy which takes sufficient account of the increased safety of nuclear power generation worldwide, reducing the risk of nuclear nonproliferation and the nuclear security risk.

5. The nuclear fuel cycle policy has been considered the cornerstone of national nuclear policies, and research bodies and private utilities have responsibly cooperated with the government in conducting nuclear policies based on their capacity and in cooperation with related municipalities. In future, although the government will decide on policy, it is vital to define a more explicit assignment of responsibilities to the government and private utilities when implementing policy. As ensuring public trust is crucial for implementing nuclear energy policies, including the nuclear fuel cycle, related parties should strive to retain and enhance trust by communicating sincerely with people and ensuring transparency based on their respective responsibilities.

A review team for the technical subcommittee was formed and the team is reviewing its preparation processes. This decision will be reexamined if the team deems it necessary.

Appendix

Nuclear fuel cycle policy options [Outline]

Option for nuclear energy reliance [*1]	Nuclear fuel cycle policy options		
	Basic policy of spent fuel treatment	Present policy promotion	FBR/FR[*2]
Option (a) Promptly establish zero nuclear power without building new or expanding existing nuclear plants (0% in 2030)	"Full direct disposal" is appropriate.	Decommissioning of Rokkasho Reprocessing Plant Long-term storage of spent fuel Commencement of work for direct disposal	Suspend R&D of "Monju", present the R&D results, and promote only basic R&D.
Option (b) Reduce nuclear reliance to 15% in 2030 in principle.	"Coexistence of reprocessing and direct disposal" is appropriate.	Proceed its plan to operation of Rokkasho Reprocessing Plant, etc. Spent fuel exceeding reprocessing is stored. Efforts for reprocessing and directly disposing of stored spent fuel should be both pursued.	Do not go to the demonstration reactor phase, and conduct R&D required to determine the potential for commercialization. Conduct performance tests and rated operation for "Monju" to ensure feasibility (in around five years).
Option (c) Lower than before but maintain certain level and reduce reliance to 20 - 25% in 2030.	"Coexistence of reprocessing and direct disposal" is a likely option. (if ensuring flexibility is important given its uncertainty)	Proceed its plan to operation of Rokkasho Reprocessing Plant, etc. Spent fuel exceeding reprocessing is stored. Efforts for reprocessing and directly disposing of stored spent fuel should be both pursued.	Do not go to the demonstration reactor phase, and conduct R&D required to determine the potential for commercialization. Conduct performance tests and rated operation for "Monju" to ensure feasibility (in around five years).
	"Full reprocessing" is appropriate likely option. (merit is greater under the option © than under the option (b))	Proceed its plan to full operation of Rokkasho Reprocessing Plant, etc. Spent fuel exceedin reprocessing is stored until further reprocsssing. Efforts for preparation of future reprocessing plants.	Conduct R&D for commercialization, and go to the demonstration reactor phase. Achieve the intended goal for "Monju" by operation in around a decade.

Key issues for promotion

○ As recommended by the technical subcommittee, preparations for future uncertainty are vital, regardless of the chosen option.

○ The government should be responsible for policy changes, and take appropriate measures to maintain reliable relationships with municipalities nationwide, especially those which have cooperated in the national nuclear fuel cycle policies for a long period and accepted the related facilities.

○ Various arrangements and related costs are required to change the present policies and promote other policies.

○ The following issues should be discussed based on the recommendations of the technical subcommittee:

1. Expansion of the storage capacity of spent fuel on-site and off-site of nuclear power plants, including dry storage, finding final disposal site for high-level radioactive waste, the discussing the development of technology enabling direct disposal and the required measures and regulations.
2. A comprehensive assessment of nuclear fuel cycle business operations focused on the performance of plant operation at the Rokkasho Reprocessing Plant, progress of plutonium utilization and international perspective (in several years).
3. Construction of an effective check-and-review system for R&D of FBRs, an R&D system to produce innovative and competitive advanced reactors, and effective and efficient R&D utilizing international cooperation without insisting on finalizing the domestic R&D. Despite opting for a direct disposal policy, continuation of basic R&D into advanced reprocessing and FR technology, etc. is important.
4. Establishment of nuclear fuel cycle policy which takes sufficient account of the increased safety of nuclear power generation worldwide, reducing nuclear nonproliferation and the nuclear security risk.
5. The government is responsible for deciding nuclear policies, with the more explicit assignment of responsibilities to government and private utilities, and enhanced trust via sincere communications with people, and ensuring transparency.

*1: "Interim Compilation for Options" Energy and Environment Council

*2: "Fast Breeder/Fast Reactor R&D Options" Ministry of Education, Culture, Sports, Science and Technology