Japan’s current Nuclear Energy Policy

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1. Nuclear power’s energy output per amount of fuel is overwhelmingly large and it can continue producing power for several years only with domestic fuel stockpile. Nuclear power is an important base-load power source as a low carbon and quasi-domestic energy source, contributing to stability of energy supply-demand structure, on the major premise of ensuring of its safety, because of the perspectives; 1) superiority in stability of energy supply and efficiency, 2) low and stable operational cost and 3) free from GHG emissions during operation.

2. On the premise that safety comes before everything else and that every possible effort is made to resolve the people’s concerns, judgment as to whether nuclear power plants meet the new regulatory requirements will be left to the Nuclear Regulation Authority (NRA) and in case that the NRA confirms the conformity of nuclear power plants with the new regulatory requirements, which are of the most stringent level in the world, GOJ will follow NRA’s judgment and will proceed with the restart of the nuclear power plants. In that case, GOJ will make best efforts to obtain the understanding and cooperation of the host municipalities and other relevant parties.

3. Dependency on nuclear power generation will be lowered to the extent possible by energy saving and introducing renewable energy as well as improving the efficiency of thermal power generation, etc. Under this policy, GOJ will carefully examine a volume of electricity to be secured by nuclear power generation, taking Japan’s energy constraints into consideration, from the viewpoint of stable energy supply, cost reduction, global warming and maintaining nuclear technologies and human resources.
1. 20 units (in blue squares) are under review for restart by the Nuclear Regulation Authority (NRA) in accordance with its new safety regulations.

2. Two of the NPPs, Sendai 1st and 2\textsuperscript{nd} units, have got the first permissions in September towards their restart.
1. NRA’s Safety Review

- Kyushu Electric Power submitted its application to make changes to the reactor installment license of Sendai NPS Unit 1 and 2 in July 2013.

- **NRA compiled a draft evaluation report in 16th July 2014** which admits that Sendai NPPs satisfies new regulatory requirements.

- After the public comment process (until 15th August) and reviewing of the submitted opinions, **NRA granted a permission(changes to the reactor installment license) in 10th September** for the basic design and safety features of Sendai NPPs.

- Sendai NPPs can be restarted after i) **acquiring approval of the detailed design and construction of the nuclear reactors and ii) completing pre-service inspection of operational safety programs.**

2. Disaster prevention and evacuation plan

- A regional disaster prevention plan (including evacuation plan) against nuclear disaster should be formulated by local authorities based on the Regional Basic Act on Disaster Control Measures.

- Although formulation of regional disaster prevention plan is not a legal requirement for restart, the plan is important to ensure safety of local residents. The government will support local authorities to make a sufficient plan.

3. Local Consent of the restart of Sendai NPPs

- Kagoshima prefecture and Satsumasendai City, hosting Sendai NPPs, will play leading role in the local consent process for the NPPs.

- NRA and the Japanese government is now proceeding with local briefing sessions at all the municipalities in the 30km circle of Sendai NPPs.
1. Regarding the nuclear fuel cycle, it is important to take this situation seriously and solve the problems, including technical challenges that we face, one by one. GOJ will make efforts to reduce the volume and harmfulness of radioactive waste and create a nuclear fuel cycle that contributes to effective utilization of resources while adequately taking the past history into consideration and continuing to seek the understanding of relevant municipalities and the international community and will promote reprocessing and plutonium use in LWRs.

2. Specifically, GOJ will promote plutonium use in LWRs, and proceed with such measures as completion of the Rokkasho reprocessing plant, construction of a MOX fuel processing plant, and completion of the Mutsu interim storage facility on the underlying premise of ensuring safety. GOJ remains committed to the policy of not possessing reserves of plutonium without specified purposes. Also GOJ will promote R&D of fast reactors, etc., through international cooperation with the U.S. and France etc.

3. GOJ will position Monju as an international research center for technological development, such as reducing the amount and toxic level of radioactive waste and technologies related to nuclear nonproliferation. GOJ will take necessary measures for issues to be overcome, such as the re-establishment of systems to implement the above mentioned actions on its own responsibility.

4. Problems related to the nuclear fuel cycle are closely related to the estimation of the future operating volume of nuclear power plants, the amount of nuclear fuel, and quantity of spent fuel produced, they will be conducted while taking into consideration all of these factors and ensuring strategic flexibility in accordance with changes in the situation.
Management of spent fuels

【Expanding capacity of spent fuel storage】
1. The process to implement final disposal of high-level radioactive waste will take a long time. In the meantime, spent fuels produced by nuclear power generation must be safely managed. It is therefore necessary to expand the capacity for storing the spent fuels and is urgently important to broaden the range of choices for managing the spent fuels while ensuring safety.

2. It will make flexibility of policies and response, and contribute to medium-term energy security.

3. Based on this concept, the storage capacity of spent fuels will be expanded. Specifically, while studying a wide range of locations as possible sites, regardless of whether they are inside or outside the premises of a power plant, GOJ will strengthen its effort for facilitating construction and utilization of new intermediate storage facilities and dry storage facilities.

【Promotion of technology development on volume reduction and mitigation of degree of harmfulness of radioactive waste】
1. Regarding spent fuels, including those which have already been produced, appropriate measures must be taken with due consideration given to the following issues: 1) the fuels must be safely managed and appropriately processed and disposed of on a long-term basis; and 2) volume reduction and mitigation of degree of harmfulness of radioactive waste are important for lowering long-term risks.

2. Therefore, GOJ will promote technology development on volume reduction and mitigation of degree of harmfulness of radioactive waste. Specifically, development of technologies for decreasing the radiation dose remaining in radioactive waste over a long period of time and enhancing the safety of processing and disposal of radioactive waste, including nuclear transmutation technology using fast reactors and accelerators, will be promoted by utilizing global networks for cooperation. Also, while GOJ examines the situation of study and progress in terms of final disposal, it studies the feasibility of integrated implementation of the R&D for final disposal and reduction of volume, international research cooperation and a researcher resource development related to them.
(Ref) Reprocessing and spent fuel management

1. Reprocessing spent fuel in LWRs enables a 75% volume reduction of high-level radioactive waste, and shortens the period required to reduce the radioactive harmfulness level down to that of natural uranium to below 1/10th.

2. Implementation of the FR fuel cycle might be able to further reduce the long-term residual radiation dosage in high level radioactive waste, and substantially mitigate the environmental load per energy generated.

※ In case of direct disposal, fission products such as uranium and plutonium remain in the waste. On the other hand, in case of vitrified radioactive materials after reprocessing, uranium and plutonium are removed and they subsequently lower the degree of radiotoxicity.

※ In case of FR, since radioactive nuclides with extremely long half-lives can be used, further mitigation of the degree of radiotoxicity could be expected.

<table>
<thead>
<tr>
<th>Technical Option</th>
<th>Direct Disposal</th>
<th>Reprocessing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Comparison Items</strong></td>
<td><strong>Volume Ratio of Waste Generated</strong></td>
<td><strong>Reduction Period down to Natural Uranium Level</strong></td>
</tr>
<tr>
<td>Waste Image of Disposal</td>
<td>1</td>
<td>100,000 yrs</td>
</tr>
<tr>
<td></td>
<td>Reduction to about 1/4</td>
<td>Mitigation to about 1/12</td>
</tr>
<tr>
<td></td>
<td>Reduction to about 1/7</td>
<td>app. 8,000 yrs</td>
</tr>
<tr>
<td></td>
<td>app. 0.22</td>
<td>app. 300 yrs</td>
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※1 Based on the estimate by Japan Atomic Energy Agency. The figure shows the relative value compared to the canister for the direct disposal set as 1.

※2 Source: Nuclear Energy Policy Guideline. The upper column shows the period required to make equivalent to the potential harmfulness level of the volume of natural uranium necessary for the power generation of 1 GWy. The lower column shows the relative value compared to the harmfulness of the direct disposal set as 1.

※3 Provisional Estimate by Nuclear Regulation Authority (Nov. 2011) (Case of Discount Rate 3%) The figures of LWR disposal were calculated with two models, one with the current reprocessing & storage of used fuel, and the other with continuous reprocessing.
5.5~6.5tPu/y Plutonium usage by 16 to 18 MOX fuel load nuclear reactor
(Including 1.1tPu/y plutonium usage by Ohma Nuclear Power Plant)
RRP began Active Tests in March 2006 with actual spent fuels. The tests such as extracting plutonium and uranium process were finished successfully. Although it took time to resolve some problems with the HALW (High Active Liquid Waste) vitrification process, the last stage regarding its stable operation was finally accomplished in May 2013.

In January 2014, JNFL applied for a conformity assessment with the new regulatory requirements which were enforced in December 2013.

JNFL now plans to complete the RRP in March 2016.
(Ref) Current situation of MOX Fuel Fabrication Plant

- Although JNFL started construction work of MOX Fuel Fabrication Plant in October 2010, construction work was interrupted temporarily by the influence of the earthquake etc.
- In January 2014, JNFL applied for a conformity assessment with the new regulatory requirements which were enforced in December 2013.
- JNFL now plans to complete the MOX Fuel Fabrication Plant in October 2017.

<table>
<thead>
<tr>
<th>Maximum fabrication capacity</th>
<th>130 ton-HM / year</th>
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</thead>
<tbody>
<tr>
<td>Products</td>
<td>MOX fuel assembly for domestic Light Water Reactors (BWR and PWR)</td>
</tr>
<tr>
<td>Size of main building</td>
<td>85 m x 85 m</td>
</tr>
<tr>
<td></td>
<td>3 basements, 2 elevated</td>
</tr>
<tr>
<td>Location place</td>
<td>Neighborhood of Rokkasho Reprocessing Plant</td>
</tr>
<tr>
<td>Construction cost</td>
<td>210 billion yen</td>
</tr>
</tbody>
</table>

Progress of construction: 8.6% (September 2014)
OMA Full MOX-ABWR has the Policy-oriented roll in enhancing the flexibility of Japanese MOX utilization (*1)

- OMA acquired the Safety Establishment Permit in 2008 from uranium to full MOX core.
- Construction completed by 37.6% (2011/3/20)
- Turn over: to be fixed by construction progress with Fukushima countermeasures

Note  
(*)1 Reprocessing of spent fuel and reuse of reprocessed U and Pu  
(*)2 Ref: http://www.jpower.co.jp/bs/field/gensiryoku/project/construction/schedule/index.html
New Strategic Energy Plan (Apr.11, 2014)
- Monju is positioned as an international research center for radioactive waste reduction, non-proliferation technology

Activities toward Restart of Monju
- Actions for “orders of measures necessary for maintenance based on Article 36, Section 1 of the Act on the Regulation of Nuclear Source Material, Nuclear Fuel Material, and Nuclear Reactors”
- Countermeasures for external hazards and long-term SBO as one of the top safety priorities.
- Future issues are to improve design and operation procedure in accordance with a new regulation safety standard mainly on the severe accident on the basis of Fukushima Dai-ichi accident.
General arrangement

Implementing Arrangement
“IMPLEMENTING ARRANGEMENT ON THE ASTRID PROGRAM AND SODIUM FAST REACTOR COLLABORATION BETWEEN THE FRENCH COMMISSARIAT À L’ÉNERGIE ATOMIQUE ET AUX ÉNERGIES ALTERNATIVES, AREVA NP, JAPAN ATOMIC ENERGY AGENCY, MITSUBISHI HEAVY INDUSTRIES, LTD., AND MITSUBISHI FBR SYSTEMS, INC. ” was signed on August 8th, 2014 (Termination: Dec. 31st, 2019).

Japan and France are cooperating SFR development, including ASTRID program in the area of plant system design and R&Ds (Component and analysis code development, Measures for severe accident, Fuel).
ASTRID: Advanced Sodium Technological Reactor for Industrial Demonstration

Main Features:
- Pool-type Sodium cooled fast Reactor
- Output: 600 MWe
- Strategy for severe accident (Core catcher, etc.)
- DHRS (Decay Heat Removal System)
- Long-life nuclides transmutation (TRU burning) capability

Schedule:
- 2010～2012: Pre-Conceptual Design
- 2013～2015: Conceptual Design
- 2016～2019: Basic Design
- 2019: Decision to Build

Total Budget (2010～2017): 650 M€