

Challenges that the Global Nuclear Community Should Confront for the Further Promotion of Nuclear Energy Utilization

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Invitation to “Cool Earth 50”



What The Global Nuclear Community Should Do?

- ◆ Achieving this target would require an expansion of use of renewable, nuclear, carbon-sequestration and energy conservation technologies much beyond any realistic scenarios proposed in the past.
- ◆ The global nuclear community should live up to the expectations and energetically confront various challenges to obtain and maintain public confidence in nuclear technology at strategic, programmatic and operational levels.

Challenges at Strategic Level

- obtain public confidence in nuclear energy -

Nurture the public understanding about the characteristics of nuclear energy in the three dimensions of sustainable development :

Economic dimension:

energy cost, supply stability etc.

Environmental dimension:

low health impact, small waste amount, rarity of severe accident with land contamination etc.

Social dimension:

low neighbor disturbance, nonproliferation of nuclear weapons, long-term safety of radioactive waste disposal etc.

Strategic level

Programmatic level

Operational level

Challenges at Programmatic Level

- Demonstrate and maintain through R,D&D that nuclear energy technology systems have the aforementioned characteristics of sustainable development.
- Develop and maintain trustworthy nuclear infrastructure* to achieve a viable nuclear program.

*Nuclear Infrastructure

Safety regulation system
Financial arrangement
Human resource
Manufacturing capability
Fuel supply capability
Management of backend of fuel cycle
Nuclear nonproliferation regime

Operational level

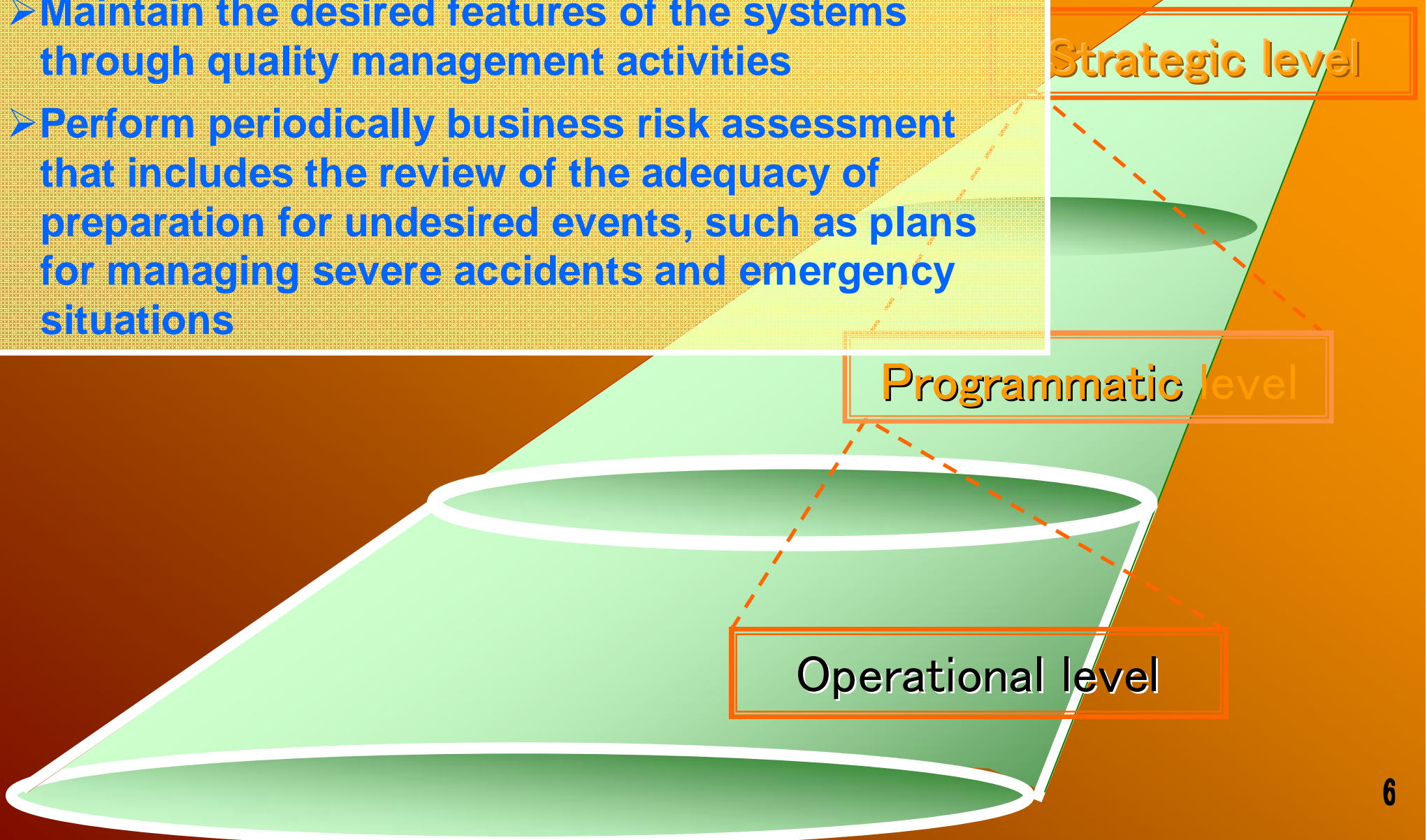
Programmatic level

Strategic level

Challenges at Operational Level

- The devil is in the details. —

- Maintain the desired features of the systems through quality management activities
- Perform periodically business risk assessment that includes the review of the adequacy of preparation for undesired events, such as plans for managing severe accidents and emergency situations



JAECC's Framework for Nuclear Energy Policy Established in 2005

- Objectives of Nuclear Energy Policy
 - Increase the contribution of nuclear energy to the stable supply of energy as well as to the reduction in CO₂ emissions with the basic goal of making the share of nuclear power in electricity generation after the year 2030 similar to or greater than the current level of 30 to 40%
- Prerequisites
- Actions of the Government and industries in three different time-frames, short-term, mid-term and long-term

Prerequisite:

Cultivate the Basis for the Promotion of Nuclear Activities

- ✦ Strict limitation of them to peaceful purposes under the IAEA safeguards
- ✦ Public trust and confidence in the management of safety and security
- ✦ Assurance of opportunity for public participation in policy making processes
- ✦ Diverse opportunities for the public to learn about nuclear energy and its benefits and risks in particular, securing of necessary number and quality of talents
- ✦ Steady progress in the safe disposal of all categories of radioactive waste
- ✦ Mutual understanding of the roles between central and local governments, acknowledging the public service of local communities where nuclear facilities are located through subsidization to their efforts for sustainable development

Maintain the Public Trust

- ◆ The public trust in both the plant operator's safety management and the effectiveness of regulator's activities should be restored, as it has been damaged in recent years due to the high-level attention of the mass media to the publication of the past misconducts and reportable events hidden in operating organizations, going back to 30 yrs.
- ◆ The Commission asked operators to review the establishment of safety culture in their organization to deter the occurrence of safety-related misconducts.
- ◆ The Commission asked the regulators and operators to promote open and transparent risk communication with the public as an essential element of business risk management activities.

The 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP of TEPCO

- ◆ Although the earthquake significantly exceeded the level of the seismic input taken into account in the design of the plant, the operating units were automatically shutdown and all plants behaved in a safe manner, during and after earthquake.
- ◆ Though the inspection are still to be continued, so far there has been no report of significant damage of safety-related structures, systems and components of the plants.
- ◆ Non-safety related structures, systems and components were affected by anchorage failures and oil leakages due to significant soil deformation.

The 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP of TEPCO(2)

- ◆ A fire of the Unit 3 in-house electrical transformer was induced as one of the consequences of the earthquake. As the fire was televised for two hours without detailed explanation of the situation except that the transformer was not directly related to nuclear safety, it has caused public concern about the seismic safety of NPP.
- ◆ As the release of radioactivity to the sea attracted much attention from the mass media, many tourists cancelled their planned summer visit to the Chuetsu coast and the tourist industry on the coast was damaged severely as the summer is the high season for the industry.

The 16 July 2007 Earthquake at Kashiwazaki-Kariwa NPP of TEPCO(3)

- ✦ To restart plant operation TEPCO needs the permission of the regulatory authority, submitting a re-evaluation of the seismic safety of the plant in accordance with new seismic design guidelines of the Nuclear Safety Commission issued in September 2006.
- ✦ The total capacity of seven units at K-K NPP is 8.2 GWe, which represents about 47 % of the TEPCO's nuclear power generating capacity that generate more than 40% of electricity that the company sells in regular years.
- ✦ The expected suspension of their operation for some time caused public concern about the effectiveness of nuclear power plants to the stable supply of electricity as well as to reduce the emission of CO₂ in the future.

Lessons Learned for Both Operators and Regulators

- ◆ Explain the fact and its evaluation quickly and precisely at the occasion of incidents at NPP, taking into consideration the lesson that no explanation under high level mass media attention to the situation is bad news.
- ◆ Take the risk arising from earthquakes into business risk management seriously and prepare themselves to the crisis as appropriate, by periodically performing risk assessment at the level of strategy, system and operation that takes into consideration of the feedback from operating experiences and developments in science and technology and seismology, in particular.

Near-term Actions

- ◆ As nuclear power will be utilized as a long-term and major method of power generation on a scale of more than 50 GWe, Japan is pursuing the recycling of nuclear fuel materials through reprocessing of spent fuel.
- ◆ Several operators have started the preparation for the use of the plutonium in their LWRs that was recovered in Europe and, later, that will be recovered at the Rokkasho commercial reprocessing plant that is now in the final stage of "active test".
- ◆ An important item for self-assessment at present is the fact that no mayor of municipalities has successfully applied to the invitation to the preliminary suitability study of their area for locating a high level radioactive waste disposal facility.

How to Promote the Siting of a HLW Disposal Facility

PROBLEM:

- ✦ Even the announcement of a mayor to study the merit and demerit of the application paralyzed the administrative affairs of the municipal office due to the intense media attention and rallies and demonstrations organized by activists to protest the announcement.

The AEC proposes;

- ✦ Limit the role of Mayors and governors to an intermediate one at first.
- ✦ Strengthen public information activities at both national and municipal levels, including the promotion of working session to develop a plan for the sustainable development of the municipalities that host the facility.
- ✦ Promote not only relevant R&Ds but also relevant utilization of their results and facilities for public information.

Mid-term Actions

- ◆ Pursue Gen III+ LWR or innovative LWR designs in order to make nuclear power competitive in the social and economic conditions in 20-30 years, taking revolutionary changes in science and technology into consideration.
 - Reduction of spent fuel generated
 - Standardization of plant design through the extensive application of seismic isolation technology
 - Reduction of occupational exposure through the fusion of new material development and advances in water chemistry
 - Reduction of construction period through highly advanced construction technologies
 - Optimal combination of active and passive safety features for reliability and economy
 - Reduction of human errors and off-line inspection through the use of advanced information technology

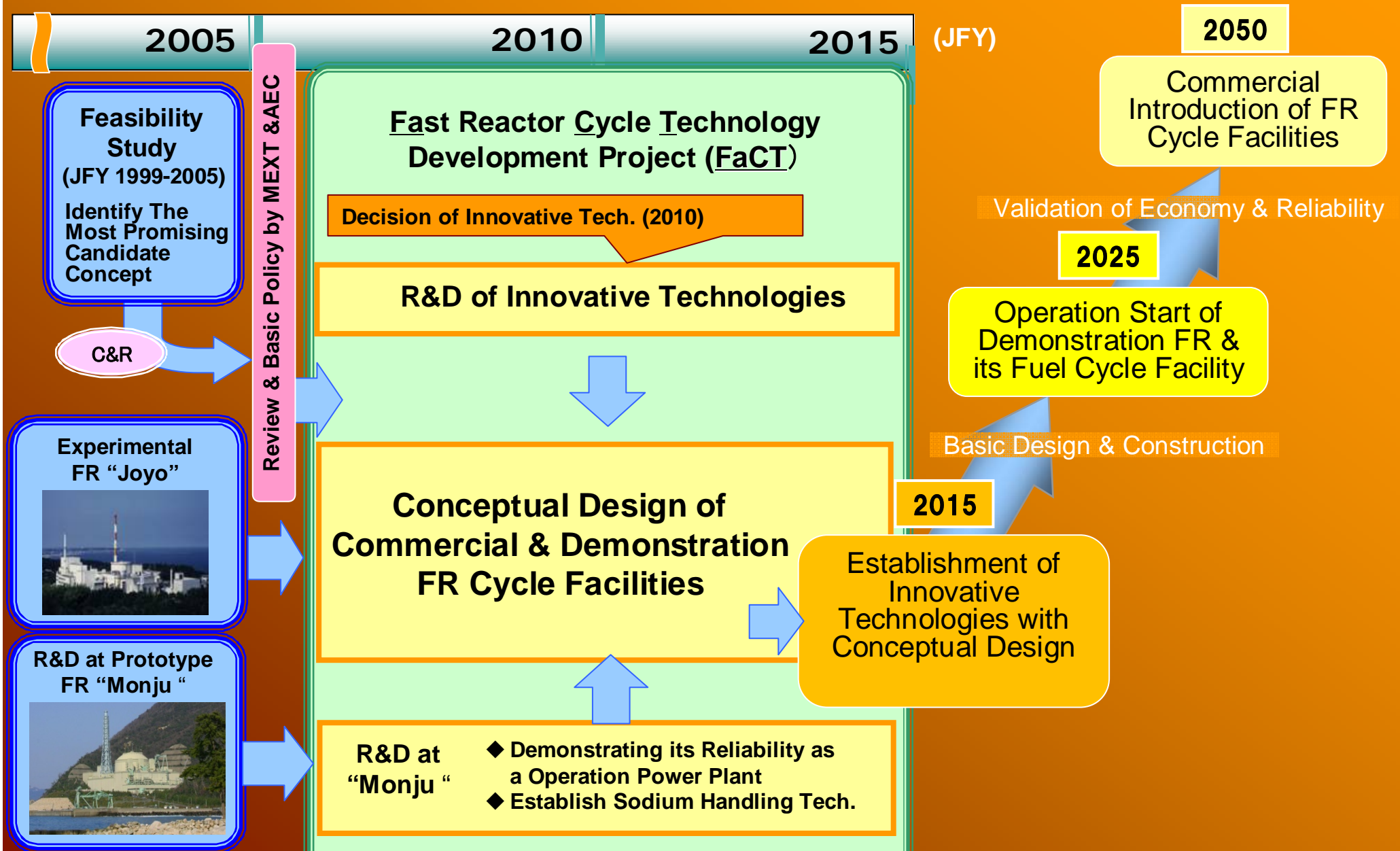
Long-term Actions

- ◆ Start the Fast Reactor Cycle Technology Development Project, aiming at commercial introduction of the technology in around 2050.
- ◆ The reference design concept is the TRU-recycling, mixed-oxide fuel sodium-cooled fast reactor and the aqueous reprocessing process. The R&D aims to produce by 2015 the conceptual design that can satisfy performance goals regarding safety, economy, reliability, fuel utilization, environmental burden, nuclear proliferation resistance, etc.
- ◆ Activities of exploration and the proof-of principle on innovative concepts for realizing alternative FBR cycle technologies will also be promoted.

FaCT Project

- ✿ To materialize the design concept that satisfies the development target, the JAEA identified a total of thirteen new innovative technologies and is now promoting their R&D in order to judge whether or not it is feasible to adopt them in actual plant designs.
- ✿ The completion of the conceptual design study of commercial and demonstration LMFBRs is targeted toward 2015, which should include the program plan of R&Ds beyond 2015.
- ✿ In 2010 the Government will review the progress and the validity of the continuation of the project to the technology demonstration phase that will require a significant increase in the budget.

FR Cycle Development Program in JAPAN



International Cooperation

- ◆ International nuclear nonproliferation regime
 - Japan is positively examining how it can contribute to the strengthening of international nuclear nonproliferation regime.
 - Japan proposed to establish multilateral frameworks as a so-called safety net mechanism to back up the fuel supply market in the event of disruption due to non-commercial reasons, which could reduce unnecessary incentive for states to have national small scale enrichment facilities that is uneconomical from the viewpoint of the economy of scale.

International cooperation (2)

◆ R&D Cooperation

- As nuclear technologies can generally be changed only slowly and at considerable cost, the coordination of research activities beyond national prestige to reduce the duplication of efforts at the world level must be an absolute priority.
- Japan will contribute to this kind of efforts as well as to their coordination, which are needed to realize the required technological innovations in a timely manner, as already has been doing so through bi-lateral and multilateral frameworks such as GIF, INPRO and GNEP in recent years.

Conclusion

- ◆ To live up to the call to expand the use of nuclear energy much beyond any realistic scenarios proposed in the past, the global nuclear community should energetically promote a thoughtful mix of near-term, mid-term and long-term actions to gain and maintain the public confidence in nuclear energy not only at strategic level but also at programmatic and operational levels.
- ◆ Japanese nuclear community is in the midst of difficulties due to the occurrence of an earthquake at Kashiwazaki-Kariwa NPP and unsuccessful call to municipalities for applying the suitability survey for the location of a HLW disposal facility.

Conclusion(2)

- ◆ At the same time, however, Japan decided to start the program of innovating LWR designs as a major mid-term action and also the project of R&D of fast reactor and its fuel cycle technologies, as a major long-term action.
- ◆ Sharing of lessons learned from difficulties and cooperating in the areas of nuclear nonproliferation and technology development among the global nuclear community are essential to the successful promotion of global nuclear energy utilization.