

Nuclear Energy Policy of Japan

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The Atomic Energy Commission

- It is composed of five commissioners appointed by Prime Minister with the Diet's consent for three-year term. One of them is appointed as the Chairman.
- Its role is to plan, deliberate, and decide on the basic policies to promote the research, development and utilization of nuclear energy, except those to regulate their safety, which are assigned to the Nuclear Safety Commission.
- It has no authority to request the budgets for specific activities to implement the policies.

Goals of Nuclear energy Policy

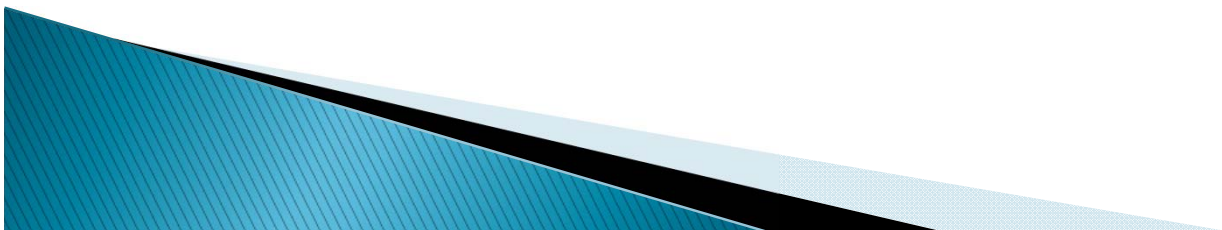
1. Maintain systems to limit the utilization of nuclear energy to peaceful purposes domestically and internationally (in Non Nuclear Weapon countries) and to assure its safety and security, maintaining the public confidence in the systems.
2. Promote the construction as well as efficient operation of nuclear power plants that contribute to energy security and GHG emissions reduction.
3. Store and reprocess used fuel from LWRs and utilize fissile material recovered from them by reprocessing in the form of MOX fuel in LWRs. And dispose vitrified high-level radioactive waste from the reprocessing process into geological repositories after cooling it at storage facility for some time.

Goals of Nuclear Energy Policy (cont'd)

4. Promote utilization of various kinds of ionizing radiation in science, medicine, industry and agriculture, assuring the safety.
5. Promote the research and development (R&D) of nuclear energy technology to strengthen its competitiveness and/or expand its uses, devoting major efforts to the R&D of fast breeder reactor and its fuel cycle technology that contribute to better utilization of resources, high temperature gas cooled reactors for hydrogen production, fusion energy and so on.
6. Promote international cooperation for the utilization of nuclear science and technology that contribute to the welfare of mankind. Prepare a level playing field for Japanese nuclear industry to contribute to nuclear energy utilization in the world.

Limitation to Peaceful Purposes

- ▶ Observing the Treaty on Nonproliferation of Nuclear Weapons (NPT), put every nuclear activities under the IAEA safeguards.
- ▶ Maintaining a national nuclear safeguards system, promote nuclear activities openly, maintaining their transparency to the public so as to maintain and enhance the public's confidence,
- ▶ Having Accepted the Additional Protocol that strengthens the verification capability of the IAEA, encourage other countries to accept it.
- ▶ Establish a system to assure nuclear security based on relevant IAEA guidelines.



Nuclear Safety

▶ Goal:

- Prevent excessive radiation exposure of the general public as well as workers due to nuclear facilities.

▶ Strategy: defense-in-depth

- Design facilities conservatively so as to assure a low probability of abnormal occurrences.
- Provide measures to prevent the fuel failure in the case of abnormal occurrences.
- Provide measures to prevent the large-scale radioactivity release in the case of fuel failure.
- Provide accident management measures and emergency preparedness to make the probability of occurrence of significant public consequences extremely low.

Nuclear Safety (cont'd)

▶ Key Point

- Assure high quality of such defense measures.
- Reflect lessons learned from the experiences all over the world under high-quality risk management activities.
- Promote such activities openly, maintaining their transparency to the public so as to maintain and enhance the public's confidence.



The 16 July 2007 Earthquake at TEPCO's Kashiwazaki-Kariwa NPP

◆ Lessons Learned

- Need for considering the inclination of a nearby fault toward the plant as seismic energy is released anisotropically.
- Need for considering the effects of underground geological structure (irregularity) around the site in evaluating the propagation of seismic wave.
- Need for reviewing the appropriateness of aseismic design of non-safety grade systems, structures and components from the viewpoint of business continuity risk.

◆ Where We Are at Present

- Taking these lessons learned into consideration, all of NPP owners are preparing the seismic safety review of their plants to be submitted to regulatory authority. The submission will be completed in 2010.
- K-7 and K-6 restarted operation after the review of the report by the authority.



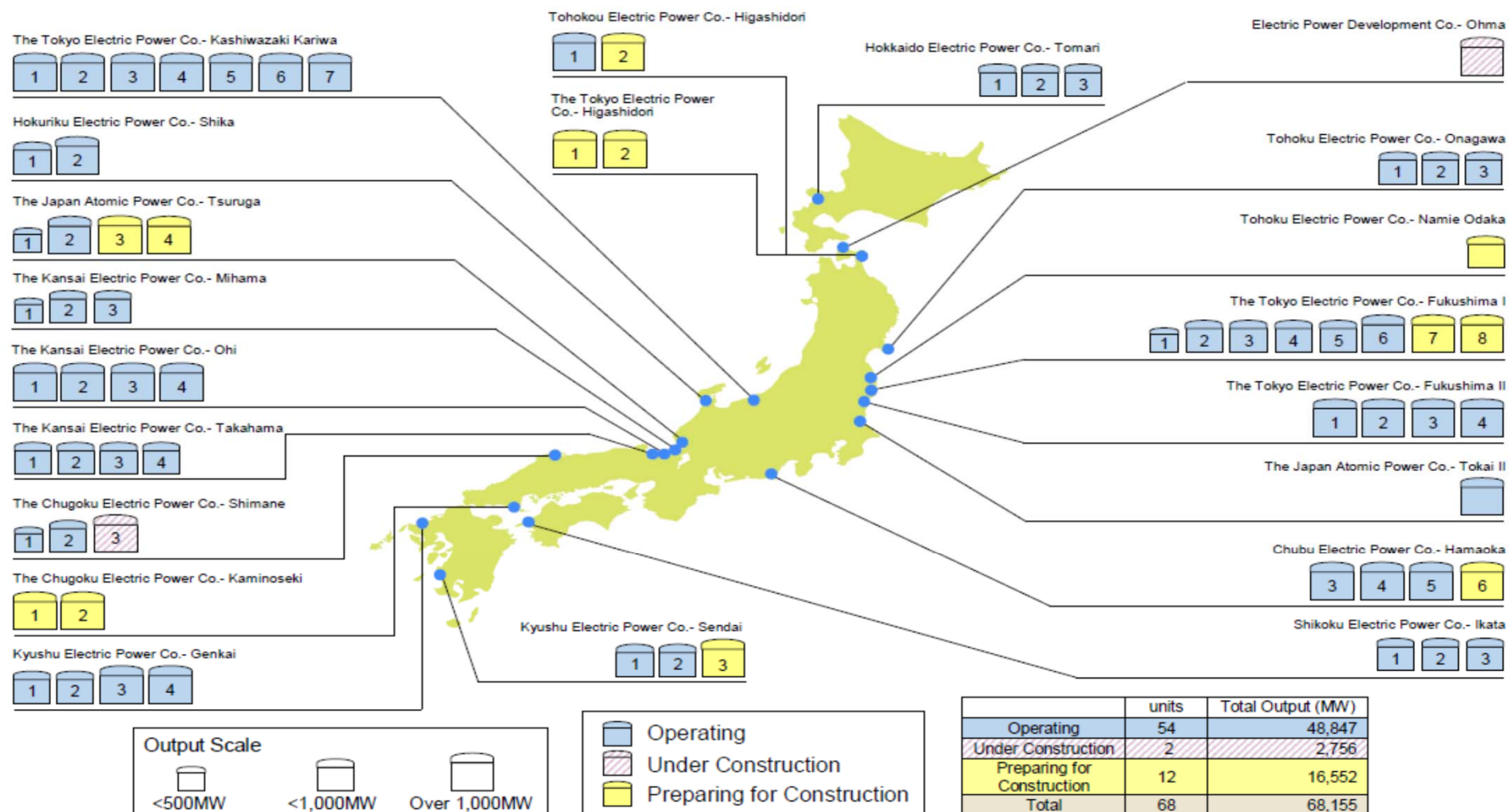
Nuclear Power Generation

- 10 utilities are operating 54 LWRs (48GWe) that supply about 30% of electricity and, if the nuclear power is categorized as an indigenous energy source, contribute to the increase in energy self-supply ratio from 4% to 16% and to the reduction of the 300 Mt CO₂ emission yearly by reducing the use of coal.
- 2 units are under construction and 3 applications to construction permit are in the final stage of regulatory review.
- Current goals are to sustain safe, reliable and efficient operation of existing plants, improving capacity factors by performing rigorous ageing management, and to add new units: electric utilities have announced that they would start operation of 8 more plants in ten years.
- The share of nuclear power in power generation in 2030 will be 49% (470TWh in 965TWh) if aggressive measures to combat global warming are taken.

Nuclear Power Plants in Japan

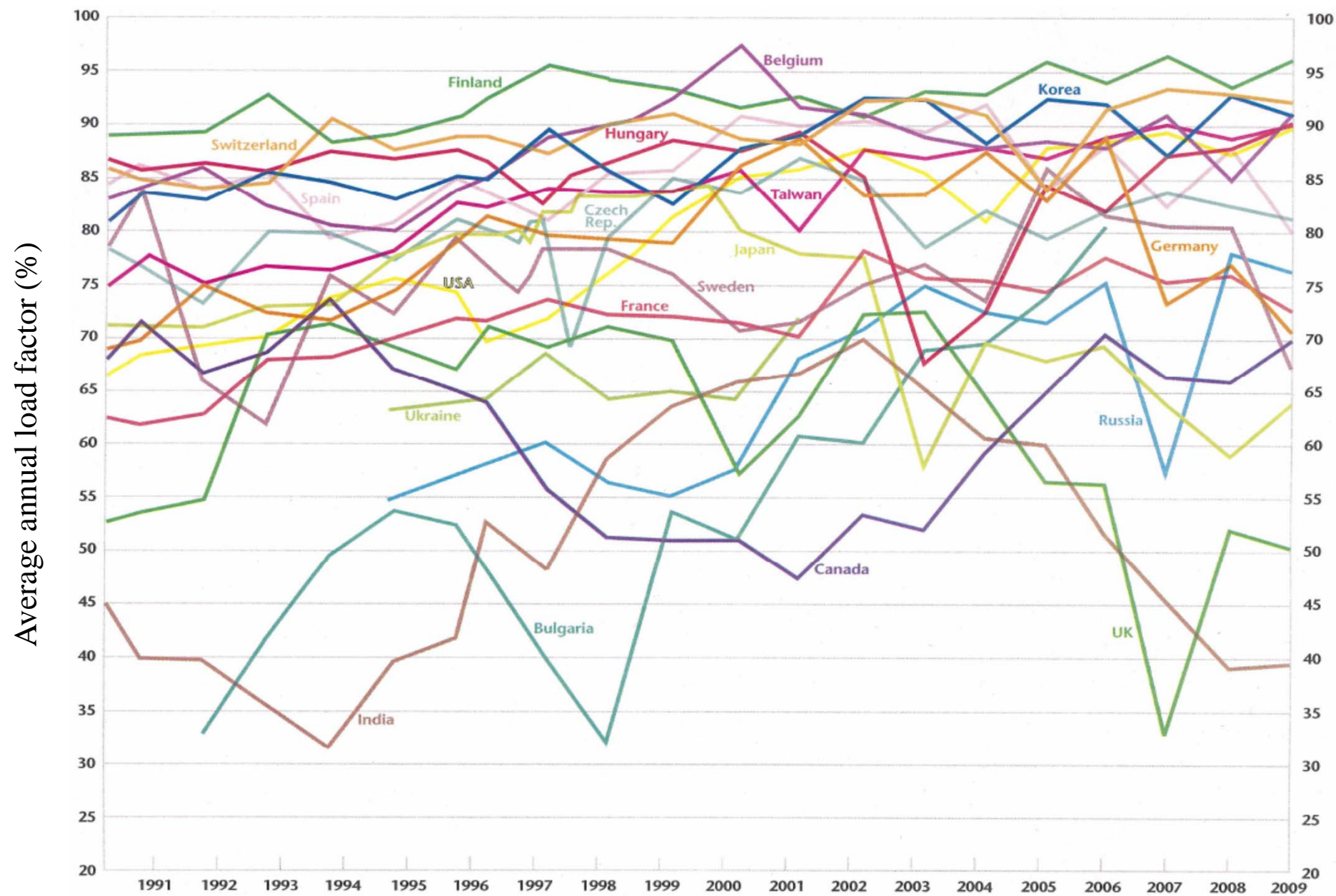
■ Currently 54 units (30 BWR, 24 PWR) are operating and 14 are scheduled to be built (including 3 under construction).

(as of the end of 2009)



(Note) End of Operation: The Japan Atomic Power Co.- Tokai (March 31, 1998) / Chubu Electric Power Co.- Hamaoka reactors 1 and 2 (January 30, 2009)

Source: The Federation of Electric Power Companies of Japan HP



Source: Nuclear Engineering, Feb 2010

Nuclear energy is essential to combat climate change

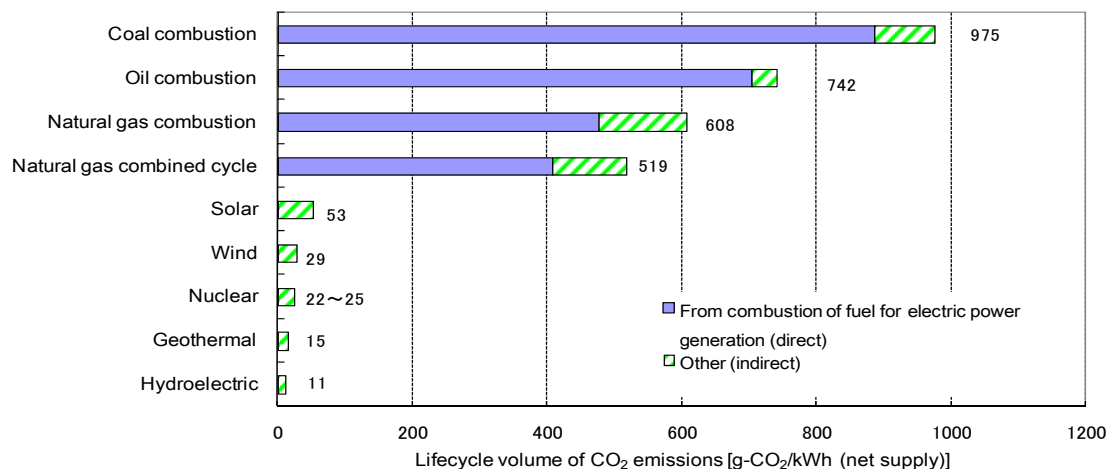
No CO₂ emissions in the power generation process.

Greenhouse gas emissions (CO₂ equivalent) per power generated

CO₂ reduction
(example)

Less
More

Volume of Emissions Green house effect gas per Unit of Electric Power by Various Power Sources (convert CO₂)



Sources: Central Research Institute of the Electric Power Industry

- Replacing an average thermal power plant with one 1,350 MW nuclear power plant can cut CO₂ emissions by around 6 million tons a year.
- 6 million tons of CO₂ is 0.5% of Japan's total CO₂ emissions in 1990.



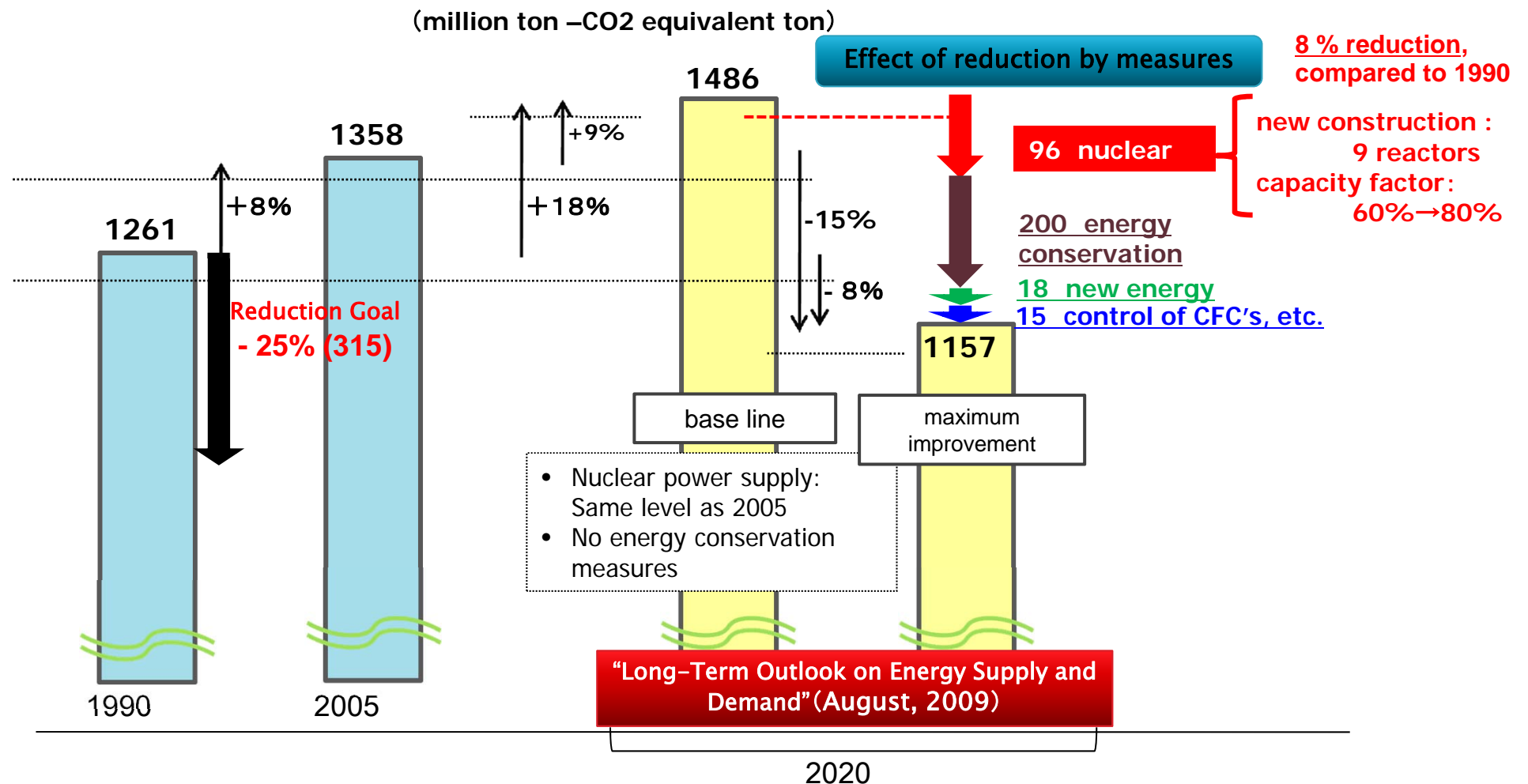
Avg. thermal power plant



1,350 MW nuclear plant

Replacing with one nuclear power plant can cut Japan's total CO₂ emissions by 0.5%.

GHG in Japan: record and prospect

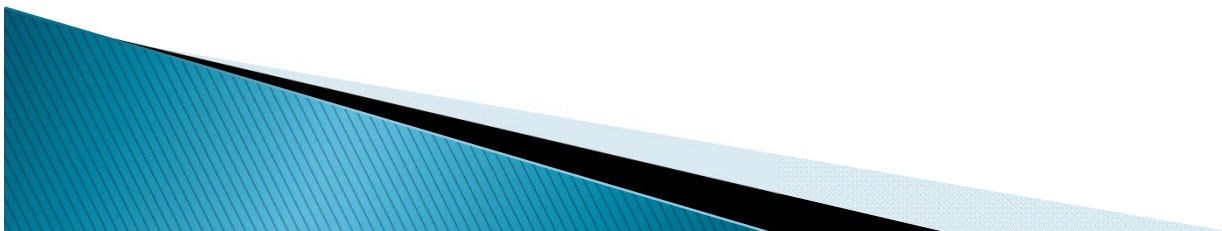


Results of Pubic Opinion Survey

▶ Promotion or phase out	2005	2009
◦ Positively promote	8.0%	9.7%
◦ Cautiously promote	47.1%	49.8%
◦ Maintain status quo	20.2%	18.3%
▶ Feel easy or feel uneasy		
◦ Feel Easy	4.4%	6.1%
◦ Feel easy on balance	20.4%	35.7%
◦ Feel uneasy on balance	48.1%	43.4%
◦ Feel uneasy	17.8%	10.5%
▶ Causes		
◦ Feel easy: safe operating record; defense-in depth in safety design: reliable orgs.		
◦ Feel uneasy: accident is probable: Japan is a country with frequent earthquakes: severe accident occurred.		

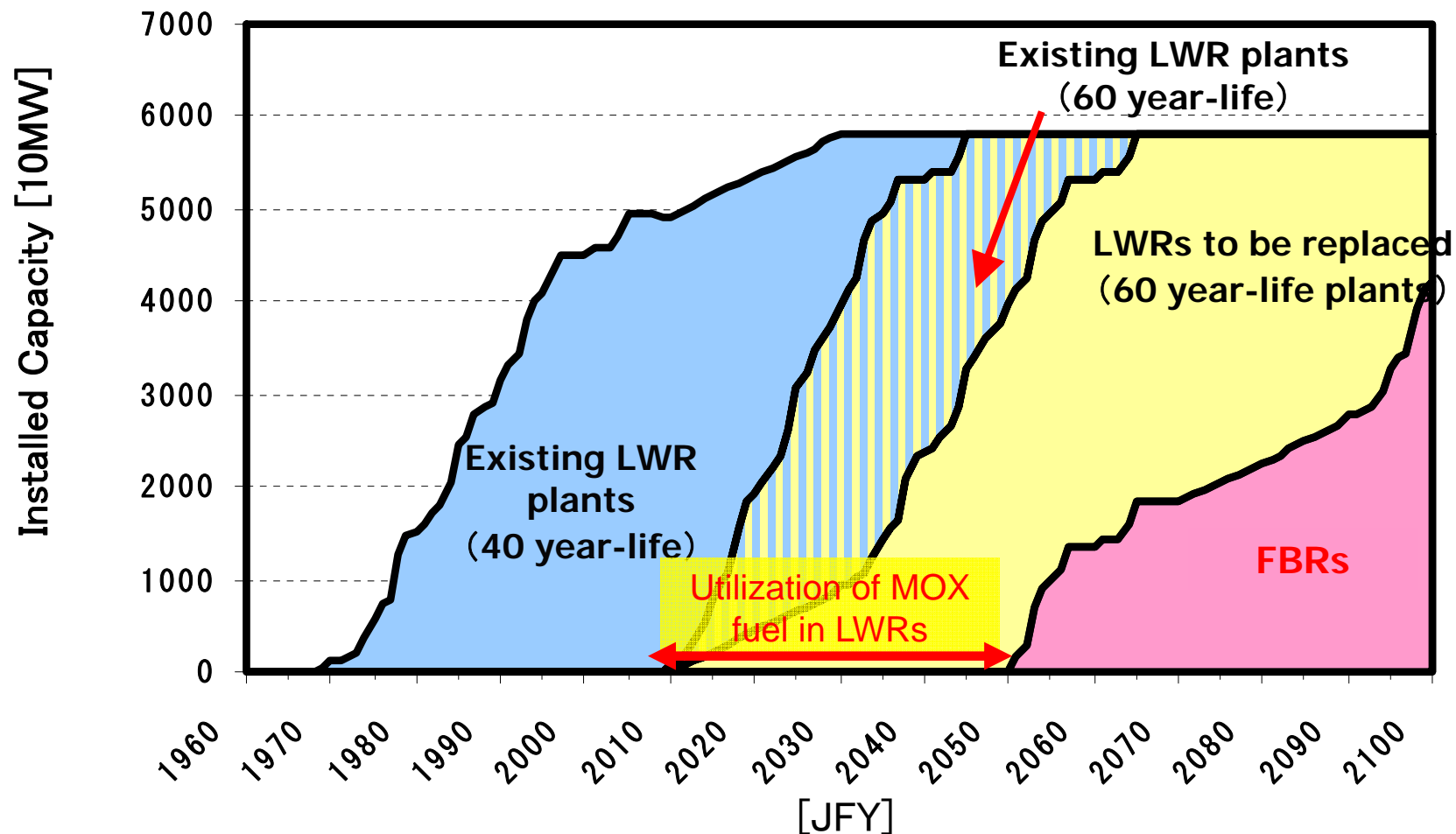
Important Actions

- ▶ Assure sincere communication with the general public, transparency and public participation in the policy making process.
- ▶ Support municipalities that accept nuclear facility publicly from the viewpoint of equity of benefit.
- ▶ Develop human resource for high quality manufacturing, construction, operation and maintenance activities.

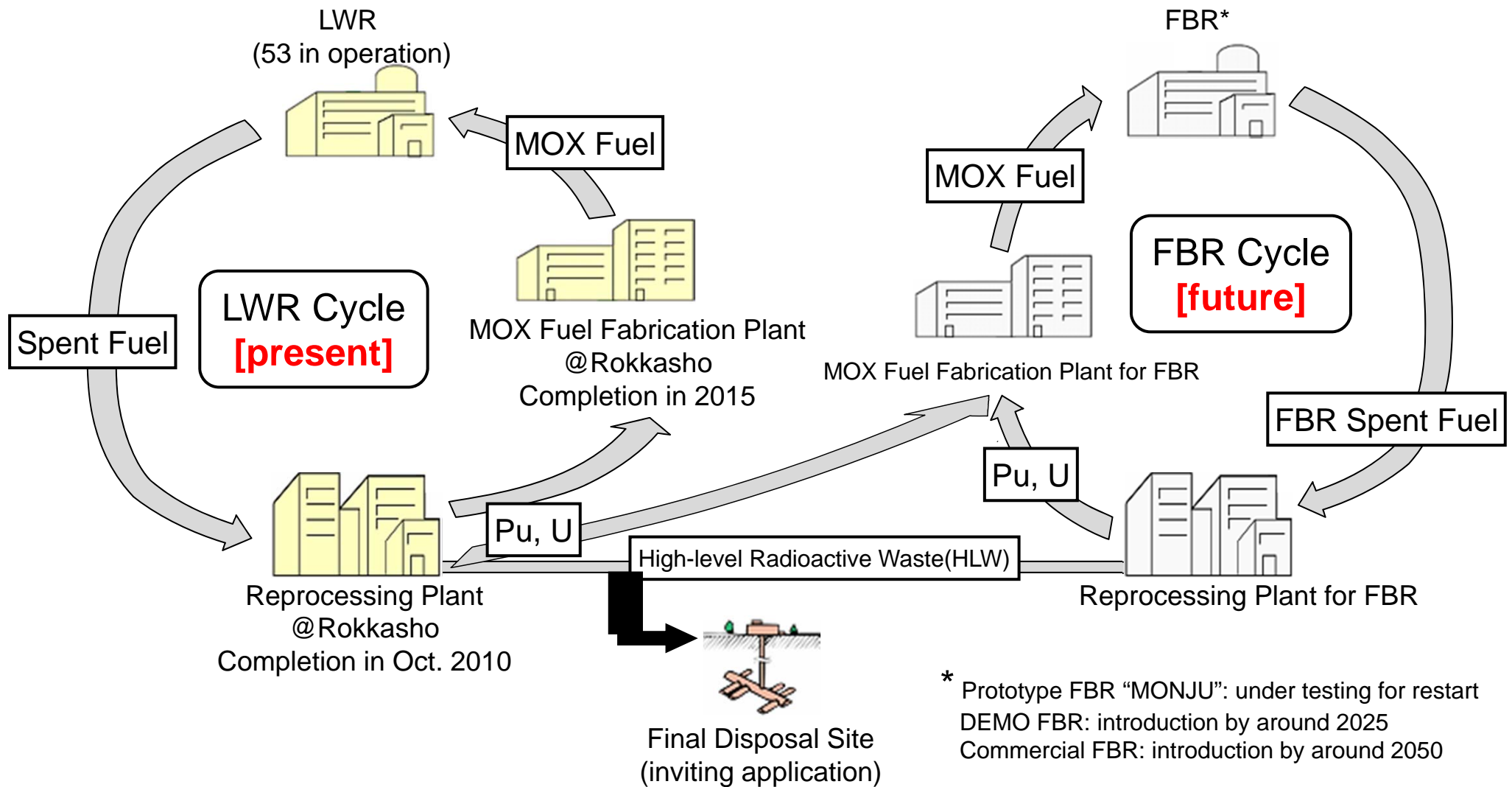


Transition of the Generation of Nuclear Power Plants

The installed capacity is assumed
to saturate at 58GW for illustrative purpose.



Nuclear Fuel Cycle Image in Japan



Front-End of Fuel Cycle

- ▶ Secure uranium
 - Establish long-term supply contract with various suppliers in diverse areas.
 - Participate in mining projects (Canada, Kazakhstan).
- ▶ Conversion and enrichment
 - Establish long-term contract with major suppliers.
 - As for domestic enrichment capacity, aim at improving the economy and expanding the capacity up to 30% share by introducing the next generation centrifuge machine now under demonstration stage.
- ▶ Fuel Fabrication
 - Purchase mainly from domestic fabricators.

Used Fuel Management

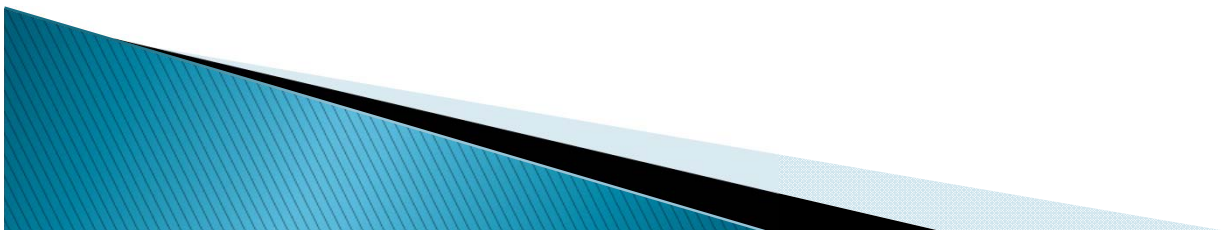
- 23,600 tons generated during 1966 – 2008:
 - ✓ 2,900 tons were reprocessed in France, 4,200 tons in UK and 1,000 tons in JAEA's Tokai Reprocessing Facility.
 - ✓ 15,500 tons will be reprocessed in Rokkasho Reprocessing Plant (RRP) that is under construction.
- 40,000 tons will be generated during 2009 – 2046:
 - ✓ 16,000 tons will be reprocessed in RRP.
 - ✓ 24,000 tons will be stored at spent fuel storage facilities at reactor or interim storage facilities away-from-reactor for the time being and will be reprocessed at the second commercial reprocessing plant in the future.

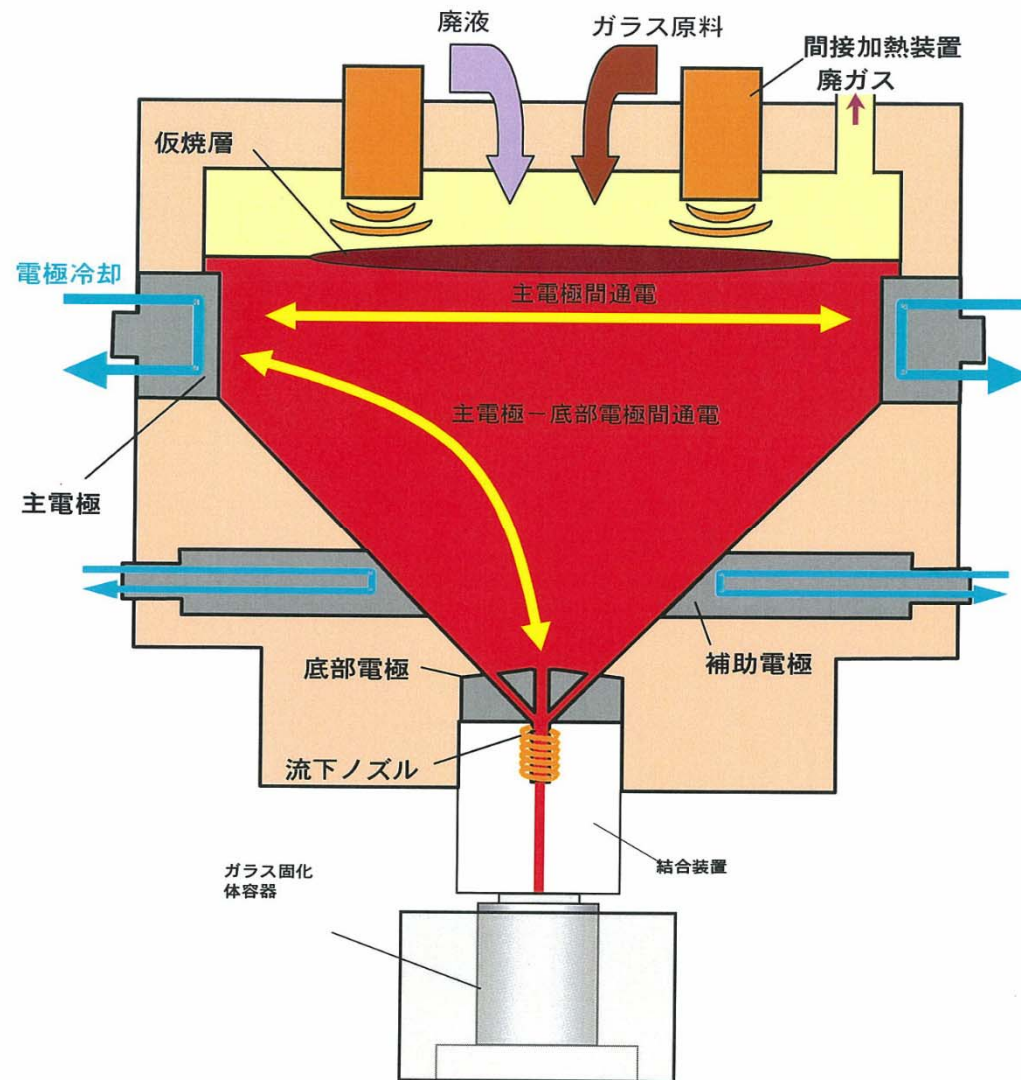
Use of MOX Fuel

- Loading experiences (* FAs: fuel assemblies)
 - 772 FAs* in Fugen, prototype ATR
 - 585 FAs in Joyo FBR and 198 FAs in Monju FBR
 - 6 lead FAs in one BWR and one PWR
- Current status and future plan
 - 7 LWRs (including Ohma ABWR of which core will be fully loaded with MOX fuel) were licensed to load MOX fuel and two LWRs are under regulatory review for the loading.
 - Genkai 3 and Ikata 3 have been operating with a few tens MOX Fuel.
 - Rokkasho MOX fuel fabrication plant is to start operation in 2015.
 - The operation of Monju will be restarted in 2010.
 - Spent MOX fuel shall be stored until fast reactors will be introduced.

Rokkasho Reprocessing Plant

- Delay in the completion of commissioning test due to a series of trouble in establishing operational procedure of the joule-heating ceramic glass-melter in the high-level waste vitrification line.
- JAEC is recommending the JNFL, the operator to go steadily, overcoming the difficulties that come from insufficient understanding of the effect of insoluble electricity conducting impurity added in the melter during its operation.
- The JNFL recently announced that they would complete the test in October 2010.





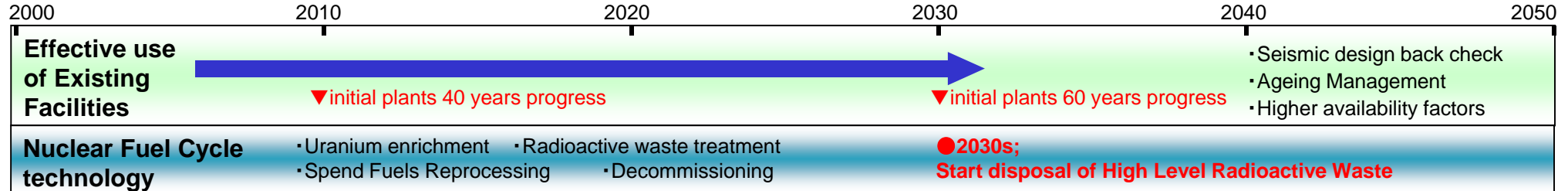
Joule-heated Ceramic Melter

Siting of a HLW Disposal Facility

- In 2000, the AEC decided that activities related with the disposal of HLW should be promoted in an open and transparent way and the site of the disposal facilities should be determined based on the application from municipalities.
- In 2004, the NUMO, an organization that was authorized to promote the disposal activity, started to invite mayors of municipalities to apply for site suitability investigation.
- So far no mayor has successfully applied: when a mayor announce to study the merit and demerit of the application, the administrative affairs of the municipal office has been paralyzed due to rallies and demonstrations to protest it as well as the intense media attention.
- The Government and the NUMO have started to strengthen public information activities on the safety and the importance of the disposal facility and the merit of entertaining the siting that can be expected from the principle of equity of benefit at both national and municipal levels.

Nuclear Energy Technology Development Roadmap

(1) Short-term R&D

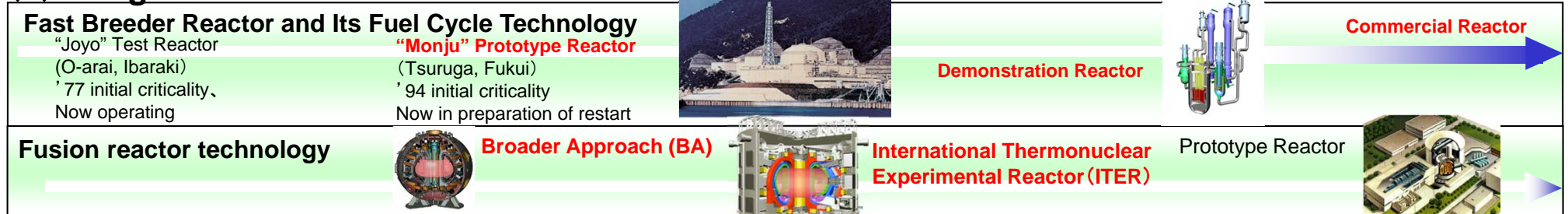


(2) Medium-term R&D

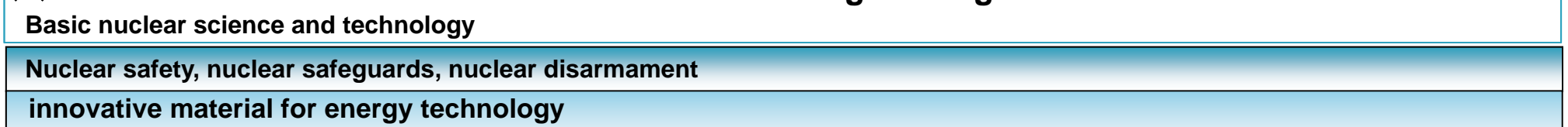


HTTR: High Temperature Engineering Test Reactor

(3) Long-term R&D



(4) Generic R&D : Innovation in nuclear science & engineering



R&D of Fast Reactor & Its Fuel Cycle Technology

▶ Goal:

- To make nuclear technology competitive and sustainable in the energy supply market of the latter half of the 21st century

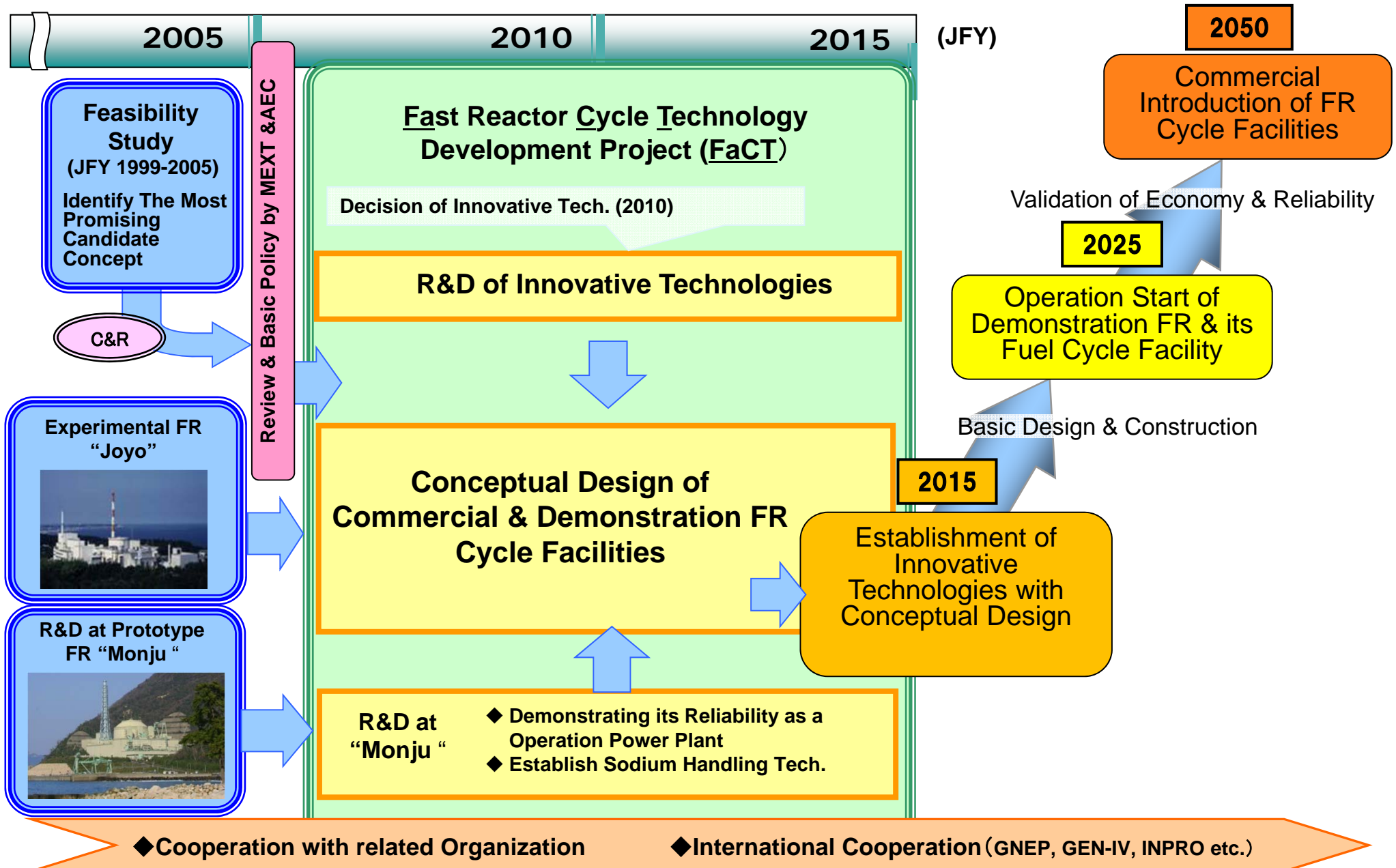
▶ Schedule

- Establish the technology base of sodium cooled fast reactor through the operation of prototype reactor MONJU that should be restarted in a few months.
- Produce by 2015 a conceptual design of a fast reactor and its fuel cycle system that will satisfy the design requirement.
- Operate a demonstration plant at around 2025.

▶ Design Requirement

- Enhanced safety, economy, reliability, proliferation resistance and fuel utilization
- Low heat generation rate of radioactive waste to be disposed of.

FR Cycle Development Program in JAPAN



International Cooperation

- ▶ Contribute to the development of nuclear infrastructure in countries that want to enjoy the benefit of nuclear power generation in the near future.
 - IAEA, FNCA, Bilateral relations
- ▶ Cooperate for facilitating the R&D of innovative nuclear energy technology.
 - ITER, GIF
- ▶ Cooperate to the environment-shaping for the promotion of safe, secure and proliferation-resistant utilization of nuclear energy.
 - Activities of the IAEA, UNSC, GNEP to strengthen nuclear safety, security and nonproliferation regime
- ▶ Pursue to establish a level-playing field for Japanese industry to compete in international market for nuclear power plant.

Challenge 4: Expansion of Peaceful Use of Nuclear Energy

European countries: From “no nuclear energy” to “reevaluation of nuclear energy”

- UK, Italy, Sweden etc.; Negative stance on nuclear energy since Chernobyl (1986) -> reevaluate nuclear energy

China and India are planning to introduce a large number of nuclear power plants.

- China: 11 units/ 9 GW, India: 17 units/ 4 GW, Russia: 31 units/ 22 GW (as of 2008)
- > Each country has a plan to introduce 20 to 40 units

• JAPAN: 53 units/ 46GW

US will have new plants after 30-year absence

- US :104 units/ 100 GW
- Have a plan to introduce around 30 units after 30 year absence.

• Increase countries which have a plan to introduce nuclear energy

• Especially, Middle East and Southeast Asian countries have concrete plans. (UAE, Vietnam, etc.)

Countries or regions which have plans to introduce new plants.

Countries or region which have already had nuclear power plants

Nuclear Energy Industry

1980s

Firms operating independently in each country

4 European firms

Brown Boveri, Asea,
Framatome, Siemens

4 U.S. firms

WH, GE, Combustion
Engineering, Babcock & Wilcox

3 Japanese firms

(MHI**, Hitachi, Toshiba)

Current Status

Emergence of global alliances for supply

TOSHIBA ——— WH*
(Japan ——— US)

Hitachi ——— GE
(Japan ——— US)

MHI - - - AREVA***
(Japan - - - France)

Atomenergoprom
(restructuring of Russia's
nuclear energy industry)

Korean model: Alliance of manufacturer, constructor and operator for building, operating and transferring

*: Westinghouse

** : Mitsubishi Heavy Industries

***: Joint development of reactors in certain regions

Thank you

