PowerLine JAPAN
The Federation of Electric Power Companies of Japan
Vol.33 March 2009

Japan's Commitment to the Closed Nuclear Fuel Cycle and the Peaceful Use of Nuclear Energy

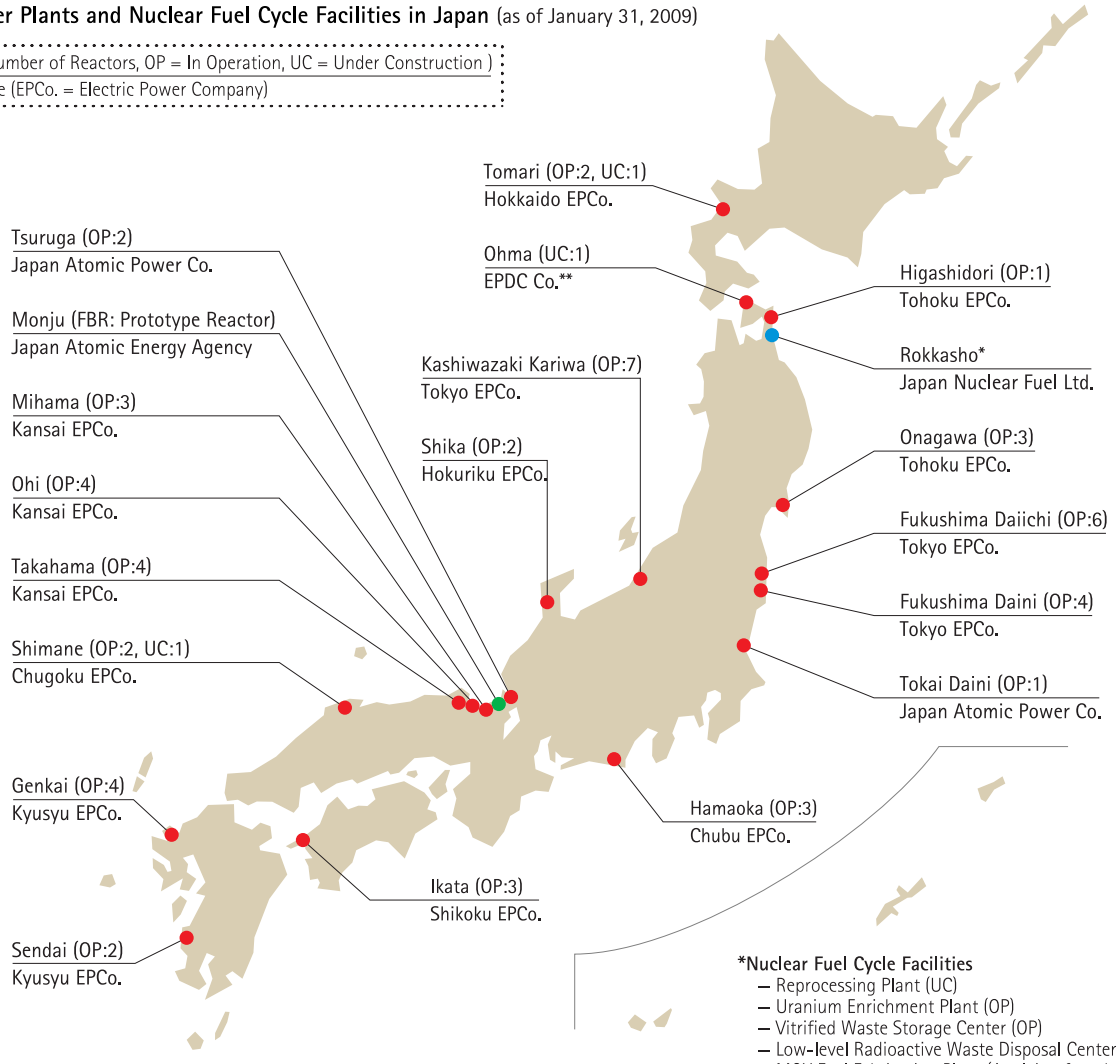
Japan, with its limited natural resources, has relied on nuclear power generation to play a crucial role in helping the nation achieve energy security and prevent global warming. Based on a robust long-term vision, Japan has pressed ahead steadily with nuclear power generation while also working to establish a closed domestic nuclear fuel cycle through harmonized cooperation between government and private sectors.

At the same time, Japan has a solid, long-term record of adhering to its policy of peaceful nuclear energy use. This stance has been nurtured by factors including Japan's history, political and legal systems, energy security needs, and relations within the international community.

Japan continues to strive toward the realization of its long-term vision for nuclear power development, and its experience and technology are expected to contribute greatly to the growing global use of nuclear energy for peaceful purposes.

Nuclear Power Plants and Nuclear Fuel Cycle Facilities in Japan (as of January 31, 2009)

Plant Name (Number of Reactors, OP = In Operation, UC = Under Construction)
Company Name (EPCo. = Electric Power Company)



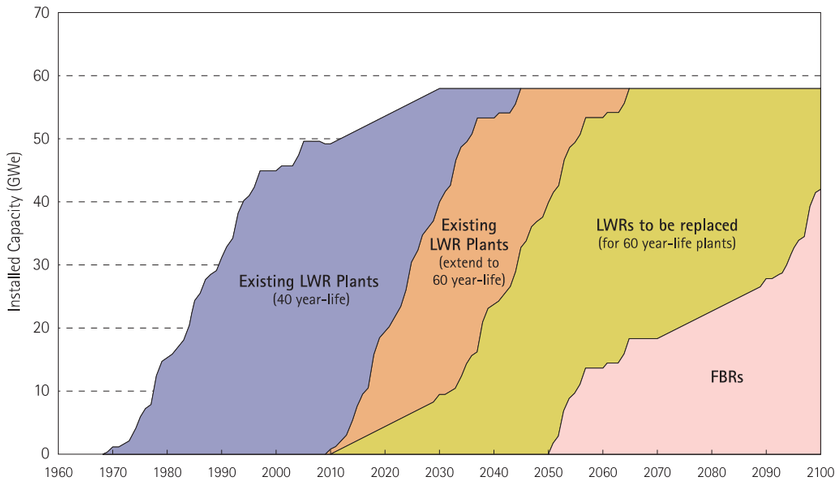
The first nuclear power plant in Japan began commercial operations in 1966; presently, 53 reactors are operating with a total generation capacity of 47,935 MW. Eventually these reactors will cease operations in order to be replaced by next-generation light water reactors (LWRs).

The government states that Japan should work to ensure that nuclear power will continue to constitute 30 percent to 40 percent of total power generation by 2030 and thereafter.

Thus Japan is committed to the development of next-generation LWRs as a national project integrating the efforts of government, electric power companies, and manufacturers.

As Japan is dependent on imports for most of its energy supply, in addition to promoting nuclear power generation, the recycling of spent nuclear fuel is critical to Japan's energy security. The Japanese government has adopted a policy to reprocess and recycle all spent fuel.

Long Term Framework for Nuclear Energy in Japan (Basic Projection as a Visual Image)

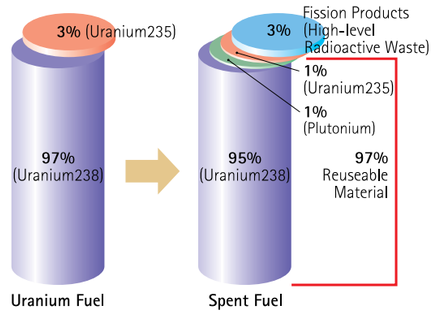


* The installed capacity is assumed to reach saturation at 58GW, for illustrative purpose.
Source: METI "Japan's Nuclear Energy National Plan"

Dependence on Energy Imports by Major Countries (2006)

Note-1) Nuclear Power is not included in the imported energy sources.
Note-2) Minus figures indicate net exports. Source: IEA Energy Balances of OECD Countries (2008 Edition)

Recycle of Nuclear Fuel



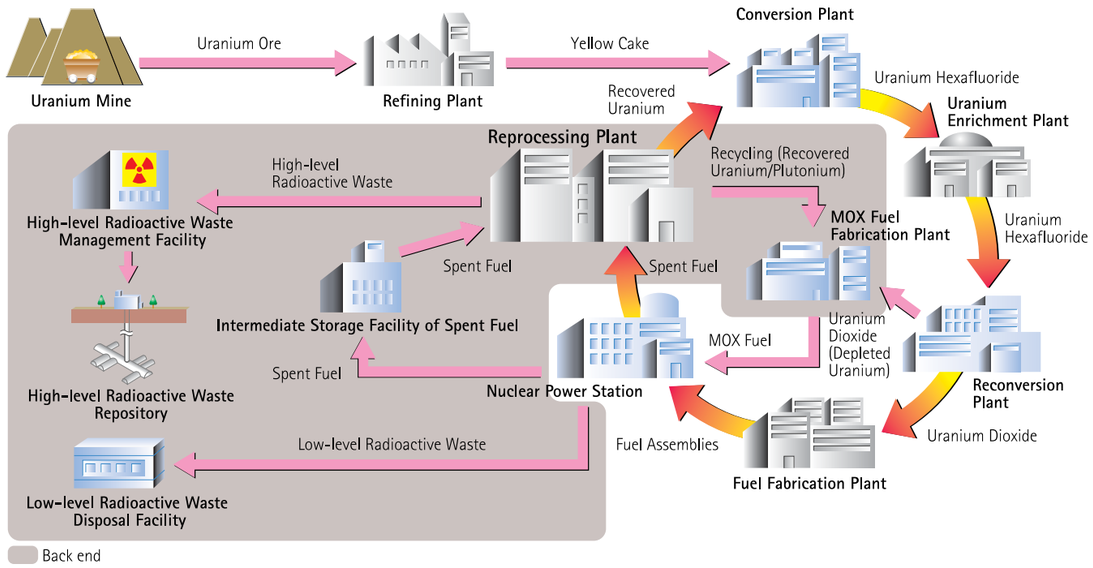
JNFL's MOX Fuel Plant (Conceptual Drawing)

Japan Nuclear Fuel Limited's (JNFL's) Rokkasho Reprocessing Plant forms the core of the country's nuclear fuel cycle operations and is undergoing final tests to begin full operations. Reprocessing plants recover uranium and plutonium from spent nuclear fuel to produce MOX (a mixture of uranium and plutonium oxides) powder. MOX powder, which is proliferation resistant, is fabricated into new fuel at a MOX fabrication plant.

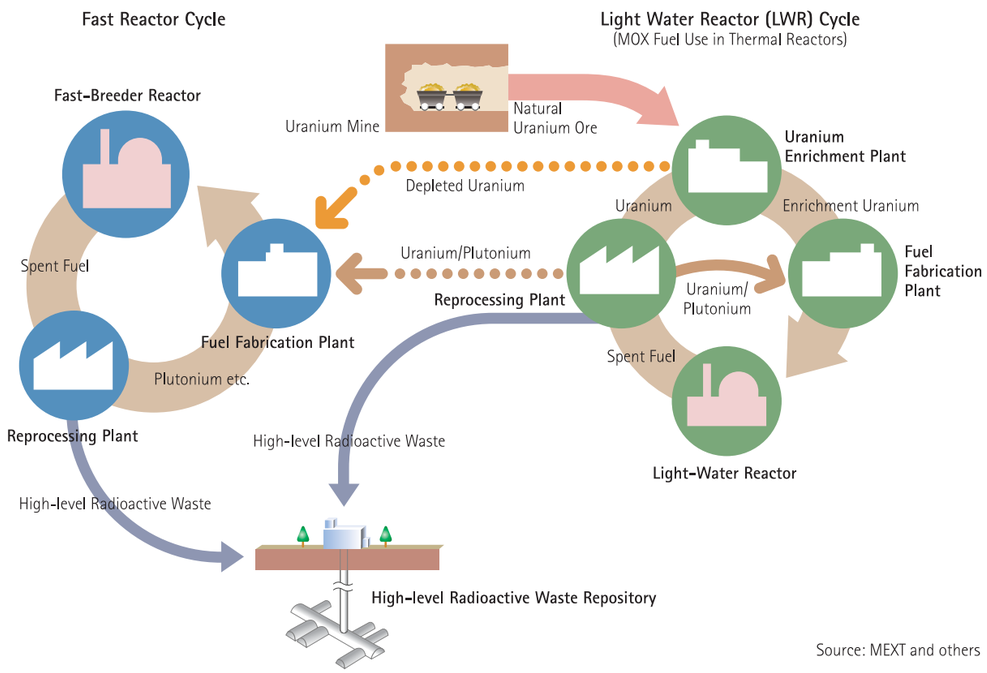
The Japanese electric power industry endeavors to achieve its goal of using MOX fuel in sixteen to eighteen LWRs by fiscal 2010. Using plutonium recovered from overseas reprocessing, the fabrication of MOX fuel is currently contracted to overseas manufacturers.

JNFL is applying for a license to fabricate MOX fuel domestically, and once it commences operations, plutonium recovered at Rokkasho Reprocessing Plant will be used in due course.

The Nuclear Fuel Cycle



The Nuclear Fuel Cycle (including Fast Reactor Cycle)



Source: MEXT and others

While working to close the LWR fuel cycle, Japan is proceeding with research on the fast reactor cycle. A fast-breeder reactor (FBR) dramatically improves uranium resource-use efficiency and can reduce the amount of nuclear waste and radioactive toxicity by burning spent fuel's minor actinides* as fuel.

Moreover, the use of fuel in which minor actinides are mixed with plutonium will increase proliferation resistance because the increased radioactivity renders diversion more difficult. Thus the fast reactor cycle contributes not only to the long-term stable supply of energy, but also to the reduction of nuclear waste and nuclear non-proliferation. On the premise that FBRs come into commercial use by 2050, system start-up tests of the Monju FBR prototype reactor** in Fukui Prefecture are under preparation, following refurbishment.

Monju FBR Reactor

***Minor actinides**
The generic term for those elements other than plutonium that are heavier than uranium; e.g. neptunium, americium and curium. These elements in spent fuel have long half-lives and emit radiation over long periods of time.

****Monju FBR reactor**
This reactor reached first criticality in 1994, and operations have been suspended since 1995 owing to leakage of secondary-system sodium.

Japan has a solid, well-established record of nuclear energy use for strictly peaceful purposes. It is this reputation upon which all nuclear activities in Japan are founded.

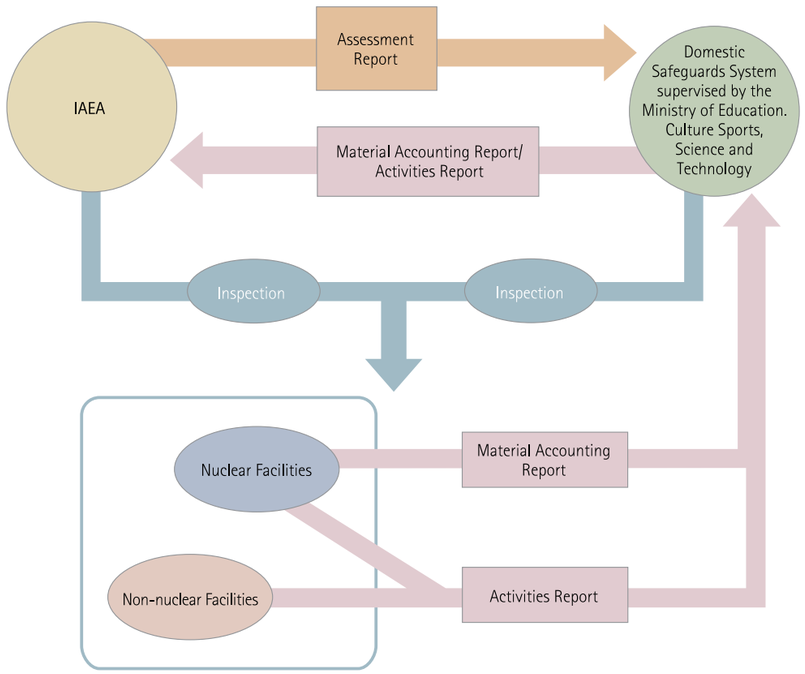
The 1955 Atomic Energy Basic Law, which outlines the country's fundamental nuclear energy policy, states that "the research, development, and utilization of atomic energy shall be limited to peaceful purposes, aimed at ensuring safety, and performed independently under democratic management; the results therefrom shall be made public to contribute to international cooperation."

Japan, the only country ever to have been attacked by nuclear weapons, has sought the abolition of these weapons together with the peaceful use of nuclear energy. Successive governments of Japan have expressed their intention to firmly adhere to the three non-nuclear principles of "not possessing, producing, or permitting nuclear weapons in the country."

Should Japan deviate from the peaceful use of nuclear energy, it is conceivable that the country would face isolation from the international community. This would have a severe impact upon Japan's economic activities as well as upon the lives of its citizens. In other words, the peaceful use of nuclear energy is an essential condition for the continued success of Japan's economy.

Japan has concluded bilateral nuclear cooperation agreements with the United States, Britain, Canada, Australia, France, China, and the European Atomic Energy Community. Each of these agreements stipulates that nuclear energy should be used only for peaceful purposes. Furthermore, Japan ratified the Nuclear Non-proliferation Treaty (NPT) and thereby obligated itself to a national policy not to produce or acquire nuclear weapons. In order to ensure the application of more extensive safeguards, Japan signed the IAEA Additional Protocol in 1998, which allows the IAEA to carry out a range of additional inspection measures.

The Safeguards Program



JNFL's Rokkasho Reprocessing Plant

The Rokkasho reprocessing plant will be the first large-scale reprocessing plant to be run by a non-nuclear weapon state. Because it is essential for the plant to run under more effective and efficient safeguards than ever before, the Large Scale Reprocessing (LASCAR) safeguards forum was held from 1988 to 1992; with the involvement of the IAEA and countries with reprocessing technology, the forum studied how best to safeguard a civilian facility on the scale of Rokkasho. The international forum's recommendations were incorporated into the design of the reprocessing plant.

The IAEA was deeply involved with the Rokkasho reprocessing plant from the design stage.
Design information on the plant was consistently provided to the IAEA, which in turn monitored and verified the construction process. Rokkasho's safeguards systems, most of which were developed in collaboration with the US national laboratories, fully reflect the mandate of the IAEA. This process was the foundation for the high level of transparency and accountability of the Rokkasho facility, which now serves as a valuable model for the peaceful use of nuclear energy and nuclear non-proliferation.

The results of each of these Japanese initiatives were reflected in the IAEA's conclusions in June 2004, which stated that all nuclear materials in Japan are protected under IAEA safeguards and are not being diverted to the manufacture of nuclear weapons.

Image of IAEA's Inspection (Credits: Dean Calma/IAEA)

In recent years, several countries have expressed their intention to introduce nuclear power generation, as there are growing concerns over energy security owing to the worldwide increase in energy demand. Nuclear energy is also being reevaluated as an effective way to combat global warming.

The G8 Hokkaido Toyako Summit in July 2008 stated that nuclear non-proliferation safeguards, nuclear safety, and nuclear security (3S) are fundamental principles for the peaceful use of nuclear energy. Japan has proposed to launch an international initiative on the 3S-based nuclear energy infrastructure.

The Japanese government, electric power companies, and manufacturers will work together toward the realization of the country's long-term vision for nuclear power development; in the process, it hopes to contribute to human capital development, international technological development, and nuclear non-proliferation.

Current Nuclear Energy Updates: June 2008 – January 2009

Advancement of MOX Fuel Use in Light Water Reactors

On October 28, 2008, the Ministry of Economy, Trade and Industry (METI) approved the license filed by Chugoku Electric Power Company for the use of MOX fuel (a mixture of uranium and plutonium oxides) in the Shimane-2 nuclear power reactor (BWR, 820MW).

Shimane Nuclear Power Plant

On November 5, 2008, Tohoku Electric Power Company proposed to the Miyagi prefectural government and two local municipalities to enter into consultation regarding the potential use of MOX fuel in its Onagawa-3 reactor (BWR, 825MW); on the following day, it filed an application to METI for a license amendment for loading MOX fuel.

New Reactor Construction Plans

On December 22, 2008, Chubu Electric Power Company announced its decision to terminate operations at reactor nos. 1 and 2 (BWRs; 540MW and 840MW, respectively) for economic reasons. Instead, Chubu Electric Power Company plans to build the new reactor no. 6 (ABWR, 1,400MW class) on the east side of the power station site, with operations to start in 2018 or thereafter.

On January 8, 2009, Kyushu Electric Power Company proposed to the Kagoshima prefectural government and Satsuma-Sendai City (the local municipality) to construct the Sendai-3 reactor (APWR, 1,590MW).