

Fast Reactor development in Japan

Masakazu Ichimiya

Director, FBR Plant Engineering Center, Japan Atomic Energy Agency

Fast Breeder Reactor (referred to as “FBR” hereafter) drastically improves uranium resource utilization efficiency to allow many thousands of years of utilization of nuclear energy and enhance security of energy supply in Japan with limited resources by means of building up nuclear fuel recycling systems (FBR cycle). FBR cycle enables to contain long-lived nuclides in spent fuels such as plutonium to decrease the amount of high-level radioactive waste by recovering and combusting as shown in Fig. 1.

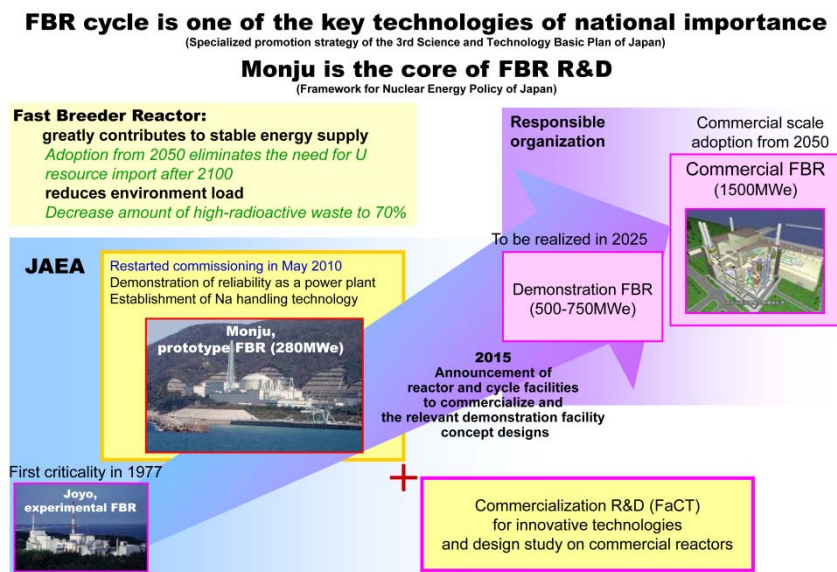


Fig. 1 Toward the FBR commercialization

Monju, as the Japanese prototype reactor for the purpose of FBR commercialization, has an important role to provide indispensable technical information for design, operation and maintenance of demonstration and commercialized FBRs, implying that the demonstration and commercialized FBRs are on the extension of the Monju plant concept. Japan is currently conducting research and development toward the commercialization of FBR cycle program, utilizing Monju, various R&D facilities for nuclear fuel cycle and international collaboration as shown in Fig. 1.

Monju is expected to develop advanced technical achievements as below.

1. Safety demonstration against station blackout as nuclear safety.
2. Demonstration of combustion of different kinds of plutonium and long-lived nuclides for efficient utilization of uranium resources and reduction of waste.
3. Development of high burnup fuel for plant improvement toward commercialization.

In particular with regard to the number 1, Monju is the sole loop-type Fast Breeder Reactor in the world which can validate natural circulation heat removal function. Natural circulation is adopted in next generation reactors for decay heat removal of the core without using external power supply after reactor shutdown.

Furthermore, expectation on Monju is considered to be significant because the other operable FBR prototype reactor in the Western countries, i.e. Phenix of France was shut down in 2009. Monju is actively offering prototype plant data to the world, which is important for FBR development. Monju can contribute to the world's FBR development as a place to perform irradiation tests to acquire FBR fuel and material

irradiation data critical for every country having FBR development programs. Monju will also make a contribution to emerging countries to develop FBR and to leading countries to refocus on the FBR after temporarily slowing down the development by providing education and training critical for improving technical level of FBR engineers and researchers.

Monju restarted operation for the first time in 15 years and is currently achieving significant result from the phase of the system start-up tests (SSTs) which consist of three steps: core confirmation tests, 40% confirmation tests and power rising tests. The series of SST, followed by power operation will be conducted to verify the power-generating technology. The result will be passed for designing the next demonstration reactors. Monju is determined to make every effort to make a contribution to the world and establish itself as an international asset of research and development.