Toward Commercialization of Fast Breeder Reactor Cycle

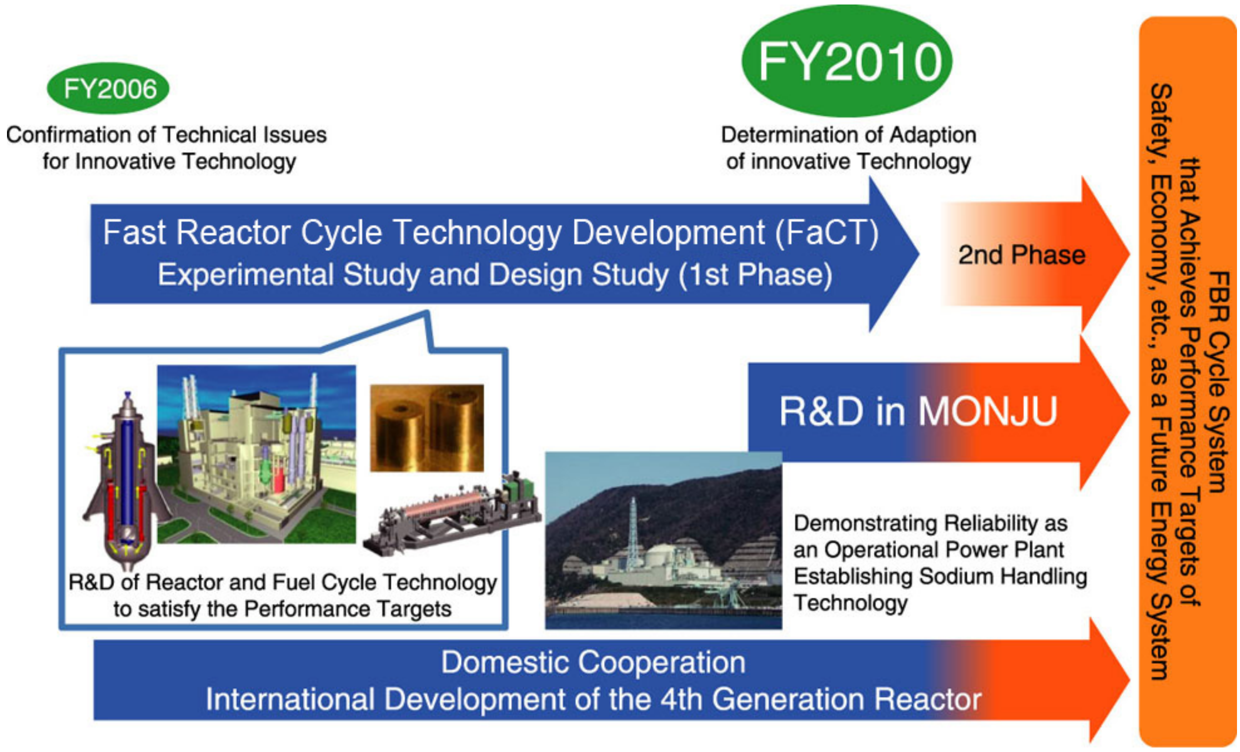

Fig.1-1 Overview of research and development aiming to commercialize FBR cycle
With the aim of future commercialization of the FBR cycle that has superior performance than other energy-supply systems in terms of safety, economy, environmental preservation, effective resource use, and nuclear-proliferation resistance, we are conducting an experiment and a design study on innovative technology to satisfy the performance target.

We are promoting the research and development (R&D) of “Fast Rector Cycle Technology Development” named “FaCT project” and R&D in “MONJU” in order to commercialize the fast breeder reactor (FBR) and the related fuel cycle (Fig.1-1).

We set the performance target of the FaCT project such that the power supply needs of the future will be satisfied. Further, we have been conducting an experiment and a design study of innovative technology based main concept, which is a combination of the concepts of a sodium-cooled fast reactor using an oxide fuel, advanced reprocessing, and a simplified pelletizing fuel fabrication. In the end of FY2010, we had determined the innovative technologies to be adapted to realize a commercial system and completed the first phase. The system start-up test of the “MONJU” was resumed and the core confirmation test was completed in FY2010. The summary of the topics that will be discussed in the following pages is as follows.

In order to establish a safety design criteria as an international standard for the next-generation (4th-generation) reactor, we developed a safety design concept for FBR, with multilateral cooperation (Topic 1-1). In addition, we developed an evaluation method to quantify the frequency and impact of a hypothetical core-disruption accident (Topic 1-2) and a method for evaluating the performance of a core-cooling system by natural convection at the loss of pump power supply (Topic 1-3). We also demonstrated the feasibility of accident management (AM) at “MONJU” (Topic 1-4). In this study, by performing tests on actual materials, we identified the parameters for evaluating material integrity (Topic 1-5). We predicted the feasibility of a steel-plate-reinforced concrete containment vessel that satisfied both safety and economic requirements (Topic 1-6). Using the results of “MONJU” core confirmation test, we showed that the nuclear data was highly reliable (Topic 1-7).

For the fuel fabrication, we showed that microwave heating is suitable to make the raw fuel powder appropriate for the mass production system (Topic 1-8). To develop the long lived fuel, we confirmed the integrity of the irradiated cladding material of the next-generation fuel (Topic 1-9), and we showed the feasibility of using an extra oxygen absorber to prevent corrosion on the inner surface of the cladding (Topic 1-10). On the basis of the hot experiment using spent fuel for the preliminary study on process operation for increasing efficiency, we developed a dissolution simulation code for the reprocessing technology (Topic 1-11). In relation to the pyroprocessing for the metallic fuel, we showed the issues to enhance the dissolution efficiency (Topic 1-12). In addition, we are also conducting an experimental study to establish a new process for the installation stage of the FBR cycle (Topic 1-13).