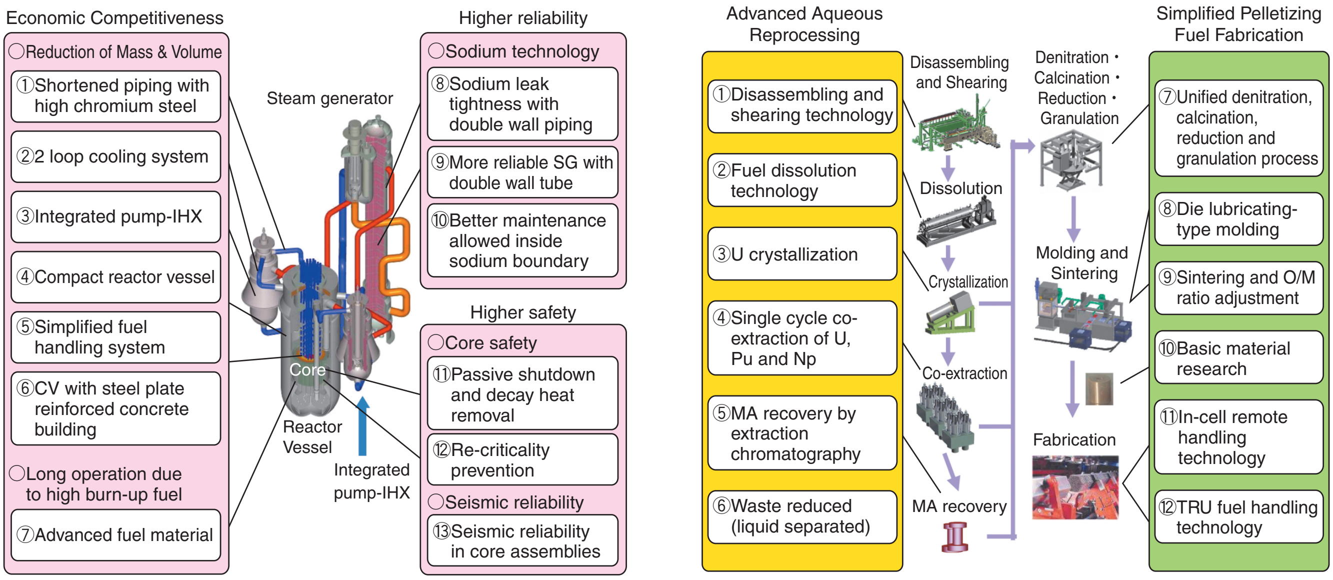
# 1 Research and Development of Advanced Nuclear System

## Toward the Commercialization of Fast Reactor Cycle Systems

### —Plans for Innovative FBR Cycle Technology Development—




(a) Innovative reactor system technologies　　(b) Innovative fuel cycle system technologies

**Fig.1-1　Innovative FBR cycle technologies**

(a) In plans for innovative technology development in the reactor system, development of 13 new technologies is proposed in the fields of reduction of mass and volume, core fuel material, sodium technology, core safety, and seismic reliability, from the viewpoint of economy, safety and reliability.

(b) In plans for innovative technology development in the fuel cycle system, there are priorities such as sustainability and nuclear non-proliferation in addition to economy and safety, and 12 new technologies are proposed in the fields of the reprocessing spent fuel and the fuel fabrication.

Aiming for the start-up of a demonstration fast breeder reactor (FBR) around 2025 and its introduction on a commercial basis before 2050, we are now promoting the "Fast Reactor Cycle Technology Development (FaCT)" project, with the collaboration of electric utilities and manufacturers.

In the FaCT project, we are developing a combination of the sodium-cooled FBR cycle system utilizing oxide fuel, advanced aqueous reprocessing, and simplified pelletizing fuel fabrication. The FaCT project will decide on which of the innovative technologies (Fig.1-1) to adopt by 2010 and present conceptual designs of commercial and demonstration FBR cycle facilities along with development plans to realize them by 2015. In FY2008, three years after the start of the FaCT project, an interim report of the current results and future plans were made in preparation for the technology selection in 2010. Here is a summary of each topic shown after the following pages:

As part of the development of the FBR system, research into the demonstration reactor and the commercial reactor systems will be promoted, and a general conception of the nuclear reactor plant will be decided upon (Topic 1-1). In the development of core fuel, to lessen the environmental burden, a core fuel that contains Minor Actinide (Topic 1-2) and irradiation tests of core integrity (Topic 1-3) will be developed. To make the reactor vessel compact and to reduce the construction cost, 3-dimensional analyses that clarify the thermal striping phenomenon in the reactor core internal structure were developed (Topic 1-4), and we presented a rationalized design which meets new, higher standards for structures and components (Topic 1-5). For reliability improvement, a sensor monitoring the wall thinning of the high-temperature piping during operation is being developed (Topic 1-6), and the oxidation mechanism of sodium combustion, basic knowledge for sodium leakage prevention technology, has been clarified (Topic 1-7). For the improvement of safety, a reasonable building design that can endure a huge earthquake is being sought, and for this, valuable data on the process leading to the breakage of a seismic isolation device was obtained (Topic 1-8).

For the fuel cycle system, highly effective dissolution technology in the reprocessing system is being developed (Topic 1-9). In the solvent extraction processes, U-Pu-Np co-extraction has become possible (Topic 1-10). In studies of fuel fabricating processes, the mechanism of microwave heating denitration is being elucidated (Topic 1-11).