Toward Practical Use of Fusion Energy

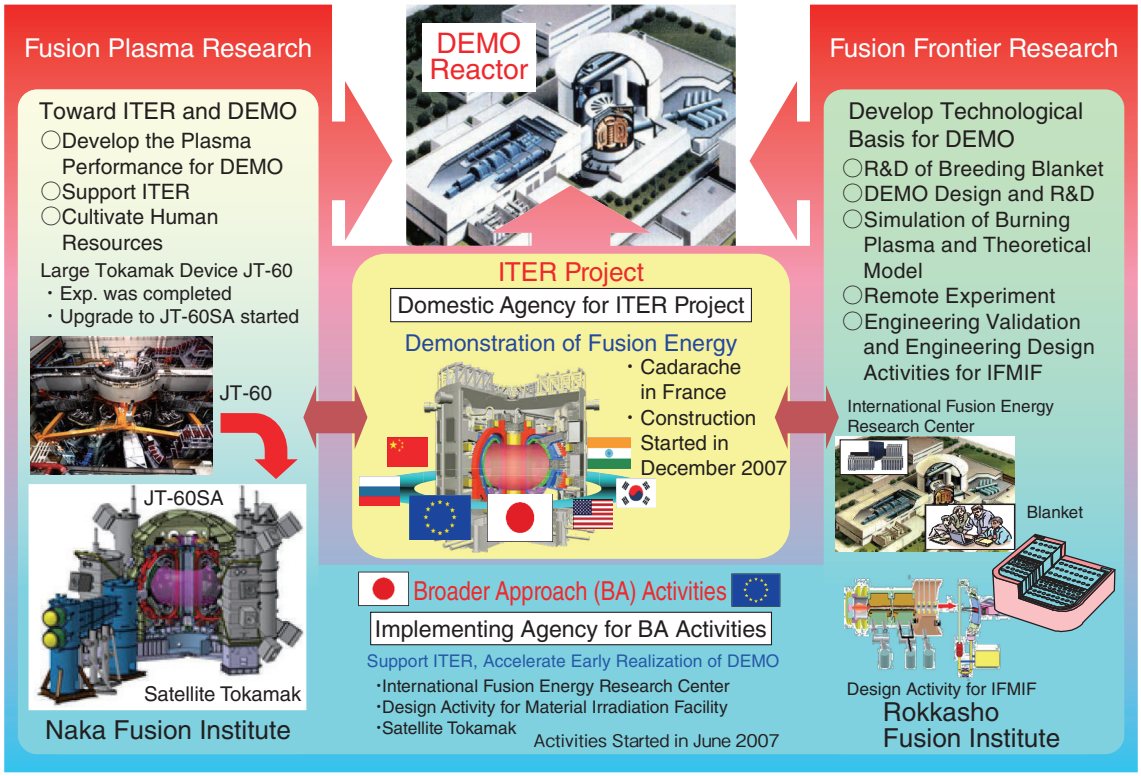

Fig.9-1 Steps involved in the development of the fusion DEMO reactor
Fusion plasma research and fusion frontier research are being pursued to develop a DEMO reactor. Furthermore, international cooperation toward the development of the International Thermonuclear Experimental Reactor (ITER) project and the Broader Approach (BA) activities is being promoted, aiming for the early realization of fusion energy.

Crucial research and development (R&D) on fusion plasma and fusion frontiers is being pursued through intensive international cooperation toward the practical use of fusion energy. For example, the International Thermonuclear Experimental Reactor (ITER) project, Broader Approach (BA) activities, and other collaborations (Fig.9-1), aiming for the early realization of a fusion DEMO reactor, are underway. Fusion plasma research is mainly being advanced at the Naka Fusion Institute, whereas fusion frontier research is mainly being advanced at the Rokkasho Fusion Institute.

ITER Project

The ITER project is an international cooperative project aimed at demonstrating the scientific and technological feasibility of fusion energy through the construction and operation of an experimental reactor. The ITER agreement came into force in October 2007, and the Japan Atomic Energy Agency (JAEA) was designated as the domestic agency for the implementation of the ITER project in Japan. JAEA proceeded with preparing the equipment that Japan agreed to provide and achieved various results in terms of technological development (Topics 9-1, 9-2, and 9-3). In particular, JAEA completed production of its entire quota of superconductors for the toroidal field coil in December 2014.

BA Activities

The BA activities are joint projects by Japan and the European Union to conduct supporting research for ITER and R&D for a DEMO reactor (which is the next step of ITER), aiming for early realization of fusion energy. The BA agreement came into force in June 2007, and JAEA was designated as the implementing agency of the BA activities in Japan.

The BA activities consist of three projects: projects in the International Fusion Energy Research Center (IFERC), the engineering validation and engineering design activities of the International Fusion Materials Irradiation Facility/Engineering Validation and Engineering Design Activities (IFMIF/EVEDA), and the Satellite Tokamak Program (STP). In the STP, the joint construction of JT-60SA by Japan and the European Union has progressed well. Topics 9-4 and 9-5 are results contributing to JT-60SA.

Fusion Plasma Research

The analysis of the JT-60 experimental data was promoted, and inter-machine experiments were conducted in order to achieve high economic efficiency for the fusion reactor by attaining a high plasma pressure. Topic 9-6 is a result that enables the measurement of the temperature and density of plasma with high accuracy.

Fusion Frontier Research

Various R&D activities are being executed by the Rokkasho Fusion Institute, aiming at the construction of a technological basis for the DEMO reactor. Topics 9-7 and 9-8 are results that lead to securing the safety of the fusion reactor. Topic 9-9 is a result that enables fusion fuel to be collected from seawater. Topics 9-10 and 9-11 are results that contribute to the development of a breeding blanket.