

Report on
Technical Feasibility of Fusion Energy
and
Extension of the Fusion Program and Basic
Supporting Researches

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The Subcommittee of The Fusion Council for Fusion Development Strategy

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Introduction

Fusion development in this country is promoted in accordance with the “Third Phase Basic Fusion Research and Development Program” decided by the Atomic Energy Commission in June 1992. This program declares the achievement of the self-ignition condition and long burn as its major objectives, and chooses the tokamak experimental reactor as the central device on which the achievement of these targets can be expected from the current technology. In August 1996, the Atomic Energy Commission further recognized the International Thermonuclear Experimental Reactor (ITER), which was in the Engineering Design Activity (EDA) phase by an international collaborative effort, as that tokamak experimental reactor.

When compared with other existing fusion experimental devices, ITER is significantly larger in dimensions, it should have entire social consensus for its construction. For this reason, the Atomic Energy Commission formed the Special Committee for the ITER Project (Special Committee) consisting of knowledgeable and respected members that represent various societies of the nation to intensively evaluate whether construction of the ITER would be appropriate. The Special Committee submitted the interim report entitled “Summary of the Discussion in the Committee and the Future Issues” in March 1998, and pointed out the following six issues that must be investigated and clearly answered so that the decision to propose hosting the construction of ITER could be made;

- (1) Survey of long term demand and supply of energy sources
- (2) Feasibility study of alternative energy sources
- (3) Technical feasibility of the fusion energy
- (4) Extension of the fusion program and basic supporting research
- (5) Distribution of resources for research
- (6) International relations.

On June 12, 1998, the *Fusion Council* formed the Subcommittee for Fusion Development Strategy to conduct discussions on the strategy for the development and realization of fusion energy. The subcommittee consists of specialists involved in fusion research from universities, the Japan Atomic Energy Research (JAERI), and industry. In these discussions, outside specialists having expertise in specific fields are invited to provide knowledge and opinions as required.

For topic (3) above, the Special Committee additionally requested an evaluation of the feasibility of fusion energy as a safe and reliable energy source from the aspects of technical potential, management capability, and characteristics of Japanese industrial structure. The evaluation was to include the involvement of a broad range of industries. For topic (4), the Special Committee requested a detailed overall plan for the realization of fusion energy. This plan was to include the roles of universities and industry in basic research fields such as advanced reactor studies and materials development, and the education and training of personnel, all which would support the ITER project and fusion development beyond. Further, it should describe the desired cooperative structure between the universities and industry, should Japan host ITER.

Based on June 12, 1998 request from the Fusion Council, the subcommittee intensively discussed the following three issues;

- (1) Technical feasibility of fusion energy,
- (2) Formation of the foundation for basic research that will support fusion reactor development over a long period including education of personnel, and the roles and cooperative structure of universities and industry, and
- (3) Matters on development strategy of the fusion reactor.

This subcommittee focused on the discussion of the technical feasibility of the tokamak fusion reactor whose confinement concept is same as that of ITER. The “Third Phase Basic Program for Fusion Research and Development” states that in selecting the core device for the next phase, concepts other than tokamak should also be considered and those alternative concepts that might surpass the tokamak should not be excluded. Knowledge obtained from tokamak alternatives is valuable for ITER support.

The subcommittee has held 25 discussion meetings from its inception through April 2000. This report summarizes the results.