

# PREFACE

## NEXT EUROPEAN TORUS

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The Next European Torus (NET) is a device aimed at demonstrating the feasibility of useful energy production from deuterium and tritium fusion reactions.

The main objective of the European fusion program, in the medium term, is to develop the scientific and technical basis necessary to construct NET. This is done by carrying out a substantial research program in tokamak physics on the Joint European Torus (JET) and, in future, six specialized medium-sized tokamaks (ASDEX Upgrade, COMPASS, FTU, TEXTOR, TORE SUPRA, and TCV) as well as since 1983, the design of NET and a supporting technological development program, which should culminate with a decision on the construction of NET in 1994.

During the definition phase of NET (1984–85), the physics and technology issues critical for the design have been focused on and their interdependencies have been analyzed. The need for an optimum balance of risks and difficulties between physics and engineering was recognized in several design areas. These findings have proven to be of value in establishing priorities in the research and development (R&D) program.

In 1986, the NET activity entered the predesign phase, which is expected to be concluded in 1989.

Up until now about 200 professional person-years have been devoted to the NET design, and more than 200 professionals are engaged, in the associated European laboratories and industries, to carry out R&D programs in technology related to NET.

The main objectives of NET are to achieve controlled ignition and extended burn, possibly up to steady state, and to demonstrate the feasibility of the basic technologies of a reactor. Therefore, NET has to have the flexibility required to conduct a wide spectrum of physics investigations and to incorporate as

far as possible reactor-relevant technologies and engineering testing capability.

A parameter set of the device has been identified to carry out the predesign and to define the R&D tasks in sufficient detail. However, present uncertainties, mainly in confinement physics, are still too large to extrapolate with confidence to ignition conditions. Reducing these uncertainties is a prerequisite for being able to make a definite choice for the parameter set of NET. Therefore, a revision of these parameters is foreseen for 1989 when an improved physics data base and understanding are expected to be obtained. A further iteration will be made before 1993, when a proposal for deciding on the construction of NET is to be made.

The contributions presented here summarize the status of the design at the end of 1987. The first paper is an executive summary and provides the rationale for the choice of objectives and the main characteristics of the device as well as the overall planning of the activities. The second paper describes the physics basis of NET and various scenarios of physics performance, and discusses the critical physics issues that need further investigation. The third paper is a general description of the plant; it also serves as an introduction to the following two papers, which deal in greater detail with the basic machine and the in-vessel components. Issues related to the operation cycle of the machine and to its assembly and maintenance are described in the subsequent two papers, followed by an overview of the heating and current drive as well as the plasma exhaust and fuel processing systems of the device. The requirements to be fulfilled for the testing of nuclear components on NET and the testing scenario anticipated for NET are discussed in the tenth paper. The

series ends with three papers on work done in the field of general systems analyses; they cover the reliability and availability assessment that is carried out for NET, the approach to safety issues, as well as the scoping studies that have been performed.

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