

International Thermonuclear Experimental Reactor (ITER) – UPSC Notes

ITER, which is the Latin for “the way”, is an acronym for the International Thermonuclear Experimental Reactor. International Thermonuclear Experimental Reactor (ITER) is a **nuclear fusion power plant**.

Background

- The development of nuclear fusion as a practical energy source could provide great benefits.
- This fact has been widely recognised, and fusion research has enjoyed a high level of international cooperation.
- Since early in its history, the International Atomic Energy Agency has actively promoted the international exchange of fusion information.
- In this context, the IAEA responded in 1986 to calls at the summit level for expansion of international cooperation in fusion energy development.
- In 1987, the representatives of the world's four major fusion programmes developed a detailed proposal for co-operation on the International Thermonuclear Experimental Reactor (ITER) Conceptual Design Activities (CDA).
- The ITER CDA, under the auspices of the IAEA, began in April 1988 and were successfully completed in December 1990.
- Based on the results obtained by the CDA, the Engineering Design Activities of ITER were performed and were successfully completed.

About ITER Project

- ITER is a unique partnership of nations jointly responsible for the construction, operation, and decommissioning of an experimental fusion facility.
- ITER being an experimental reactor, it will allow the study of fusion reaction which governs the Sun and other Stars.
- Nuclear fusion will take place in the form of Plasma in a Tokamak.
- ITER Project is experimental in nature, as the name suggests.
- It is a collaboration of six countries and one European Union (EU).
- ITER is run, funded and designed by seven members.
- The seven members are:

- European Union (EU),
 - India,
 - China,
 - Japan,
 - Russia,
 - South Korea and
 - The United States.
- The construction period of ITER is ten years, which will be followed by operation in two phases. The third is the decommissioning phase.

Objectives of ITER Project

- The overall programmatic objective of ITER Project is to demonstrate the scientific and technological feasibility of fusion energy for peaceful use.
- A main goal of ITER is to demonstrate the safety and environmental potential of fusion and thereby provide a good precedent for the safety of future fusion power reactors.

Location of ITER

- European Union suggested France, but Japan wanted it to be installed in Japan.
- EU and Japan decided to come to a solution
- Finally, in Moscow, on 28th June 2005, all the member countries decided **France** as the location where the ITER project will be installed and run.
- Construction began in 2007.

Components of ITER Project

The technical components of the ITER project are discussed below:

1. Tokamak - Tokamak is a device that confines the Plasma in a Toroidal shape using a magnetic field.
2. Magnet System - It is used to confine the Plasma in the Tokamak in Toroidal shape. Since Plasma is in ionized form, the magnetic field acts on the ions which are at a very high temperature, around several million degrees Celsius.

3. Cryostat - It is used to provide a super cool environment to vacuum where high-temperature Plasma will be confined.
4. Vacuum Vessel
5. Breeder Blanket - Tritium is a key element in the ITER project. Since Tritium is available in very little quantity on earth, it is necessary to produce Tritium in the reactor itself.
6. Cooling systems

India and ITER

- Realizing that ITER is an important step on the path to develop fusion energy, India initiated the process of joining ITER as an equal partner by showing its desire to the already existing six partners.
- After a series of steps and negotiations, India has become a partner in the ITER project.
- India will contribute equipment worth nearly 500 million US dollars to the experiment and will also participate in its subsequent operation and experiments.
- This equipment will largely be made by Indian industries.
- India has committed in this long term programme with the following objectives, namely,
 - To fulfill the commitment of delivering Procurement Packages accepted by India.
 - To contribute to the research in burning fusion plasma in the ITER.
 - To acquire self-sufficiency in the critical area of fusion reactor technologies by actively participating in the construction and operation of ITER.
- At the successful completion of this project, India will be ready to build its fusion reactor.