



International Thermonuclear Experimental Reactor (ITER) Assembly

Why in News

Recently, the International Thermonuclear Experimental Reactor (ITER) celebrated the start of **Assembly of the ITER Tokamak at Saint-Paul-Lez-Durance, France.**

Key Points

▪ Significance of the Event:

- The Celebration was hosted **virtually** by the French President and **all ITER member countries participated** either in person, or electronically through remote mode.
- India also participated in the celebrations and considered the **global participation of scientists** to project as a perfect illustration of the age-old Indian belief - **Vasudhaiva Kutumbakam.**

- Vasudhaiva Kutumbakam is a Sanskrit phrase which means '**The World is One Family**'.

▪ India's Contribution:

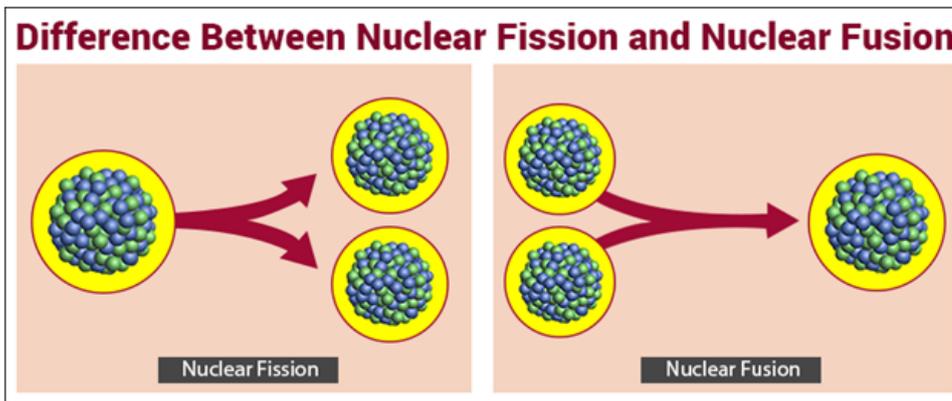
- India also mentioned about its fair share in terms of its in-kind contributions, viz., the cryostat, cryogenic and cryo-distribution systems, auxiliary heating devices, multi megawatt power supplies, etc.
- ITER cryostat is manufactured by **India (Larsen and Tourbo)**. Cryostat is a chamber that can maintain **very low temperatures.**
 - It is the largest stainless steel high-vacuum pressure chamber ever built (16,000 m³) providing the high vacuum, ultra cool environment for the ITER vacuum vessel and the superconducting magnets.
 - The target for the **first plasma is 2025.** At extreme temperatures, electrons are separated from nuclei and a gas becomes a plasma—**an ionized state of matter similar to a gas.**
- **European Union (EU)** is responsible for the **largest portion of construction costs** (45.6%); the remainder is **shared equally** by China, Japan, South Korea, Russia, USA including **India (9.1% each).**

Nuclear Reactions

▪ Description:

- A nuclear reaction is the process in which **two nuclei**, or a nucleus and an external subatomic particle, collide to produce one or more new nuclides.
- Thus, a nuclear reaction must cause a transformation of at least one nuclide to another.

▪ Types:



- **Nuclear Fission:**

- The nucleus of an **atom splits** into two daughter nuclei.
- This decay can be **natural** spontaneous splitting by radioactive decay, or can actually be **simulated** in a lab by achieving necessary conditions (bombarding with neutrons, alpha particles, etc.).
- The resulting fragments tend to have a combined **mass which is less than the original**. The missing mass is usually converted into nuclear energy.
- Currently all commercial nuclear reactors are **based on nuclear fission**.

- **Nuclear Fusion:**

- Nuclear Fusion is defined as the combining of two lighter nuclei into a heavier one.
- Such nuclear fusion reactions are the **source of energy in the Sun and other stars**.
- It takes considerable energy to force the nuclei to fuse. The conditions needed for this process are extreme – millions of degrees of temperature and millions of pascals of pressure.
- The **hydrogen bomb** is based on a thermonuclear fusion reaction. However, a **nuclear bomb based on the fission** of uranium or plutonium is **placed at the core of the hydrogen bomb** to provide initial energy.

International Thermonuclear Experimental Reactor

- **Establishment:**

- International Thermonuclear Experimental Reactor (ITER) is a collaboration of **35 nations** launched in **1985**.
- It is located in **France**.

- **Aim:**

- It aims to build the **world's largest tokamak** to prove the **feasibility of fusion** as a **large-scale and carbon-free** source of energy.
 - The **tokamak** is an experimental machine designed to harness the energy of fusion. Inside a tokamak, the energy produced through the fusion of atoms is absorbed as heat in the walls of the vessel. Like a conventional power plant, a fusion power plant uses this heat to produce steam and then electricity by way of turbines and generators.

- **Applicable Principle:**

- The project is based on **fusion** which is also an **energy source** for the **Sun and stars**.

- Every fusion reaction in the Sun, in which two hydrogen atoms fuse into one helium atom, releases two [neutrinos](#).

▪ **Significance:**

- ITER will be the **first fusion device** to maintain **fusion for long periods** of time and also **to test the integrated technologies**, materials, and physics regimes necessary for the commercial production of fusion-based electricity.

▪ **Participation:**

- The ITER members include **China, the European Union, India, Japan, South Korea, Russia and the United States**.
- According to the **ITER Agreement (2006)**, the above mentioned seven members will share the cost of project construction, operation and decommissioning.
- They also share the experimental results and any intellectual property generated by the fabrication, construction and operation phases.

[Source:PIB](#)

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