CREATE THE SUN
ITER

Fusion, the ultimate energy source for a sustainable society in the 21st century.
The 3 tenets of fusion

**Virtually inexhaustible fuel resources**

The fusion fuel, deuterium and lithium, are readily extracted from sea water and provide a secure source of energy.

**Environmentally friendly**

Fusion doesn’t emit carbon dioxide or other greenhouse gases into the atmosphere and doesn’t produce high-level radioactive waste. All waste generated by fusion is low-level and can be safely managed.

**Inherently safe**

If any disturbance occurs, the plasma cools within seconds and the reaction stops with no risk of a meltdown. Tritium is used as a fuel but the techniques for the safe storage and handling of tritium are well developed, and ITER has been designed with strict safety measures to ensure containment.

What is "the ITER Project"?

The ITER Project is an ambitious energy project of unprecedented scale and involves more than 30 countries collaborating under the ITER Agreement. The goal of the ITER Project is to demonstrate the scientific and technological feasibility of fusion energy for peaceful purposes.

Together, the ITER members—China, the EU, India, Japan, South Korea, Russia, and the US—represent more than half of the world’s population and more than 80% of the global gross domestic product.

ITER Organization

**The international governing body for the ITER Project**

The ITER Organization was officially established on October 24th, 2007, the same day the ITER Agreement came into effect. The ITER Organization oversees the construction and operation of ITER and is located in Saint-Paul-lez-Durance, France. The ITER Project is progressing steadily in cooperation with the domestic agencies for the seven parties of the ITER Agreement.

The ITER tokamak

ITER is a doughnut-shaped vacuum chamber, which allows for sufficient temperature, pressure, and confinement time to create a plasma in which fusion can occur. This superheated plasma, the fuel for the fusion process, is electrically conductive, and can thus be manipulated by electrical or magnetic fields. Think of iron filings in the presence of a magnet, except in ITER’s case, the magnets are giant superconducting coils that surround, shape, and confine the plasma.

**Main specifications of ITER**

- **Plasma Major Radius**: 6.2m
- **Machine Weight**: 23,000t
- **Fusion Power**: 500MW

The 3 Goals of ITER

**Demonstrate a burning (self-heating) plasma**

ITER has been designed for high fusion power gain. For 50 MW of power injected into the ITER machine via the systems that heat the plasma it will produce 500 MW of fusion power for periods of 400 to 600 seconds. This tenfold return is expressed by Q \(\geq 10\) (ratio of heating input power to thermal output power).

**Demonstrate the integrated operation of technologies for a fusion power plant**

Scientists can study plasmas under conditions similar to those envisaged in a future power plant and test technologies such as heating, control, diagnostics, cryogenics, and remote maintenance in an integrated way.

**Recovery of heat energy and tritium breeding tests**

Scientists will conduct experiments for extracting heat from the fusion energy generated by burning plasmas. In later stages of ITER operation, tritium breeding tests will aim to demonstrate the feasibility of producing tritium within the vacuum vessel.

QST—ITER Japan Domestic Agency: JADA

The ITER Agreement mandates that the parties, through their respective domestic agencies, procure and deliver approximately 90% of the ITER components to the ITER site. Designated as Japan’s domestic agency for the ITER Project, QST is in charge of manufacturing and delivering commissioned components and equipment, such as the superconducting coils. QST also serves as a liaison and coordination office for dispatching Japanese personnel to contribute to the ITER Project.
Fusion—the ultimate energy source for a sustainable society in the 21st century.

What is fusion?
Fusion—the source of power for the stars in the universe, including the Sun—is the process by which hydrogen nuclei collide at incredible speeds and "fuse" into heavier atoms, releasing tremendous amounts of energy in the process.

ITER is located in Saint-Paul-lez-Durance in southern France, about an hour's drive from Marseille. Under construction since 2007, buildings now dot the vast ITER site. The ITER site is home to about 1,000 ITER Organization employees, as well as a sizeable population of engineers and researchers from all over the world, all collaborating to make ITER a reality.

Photos courtesy of ITER

**Dimensions**

- Total area: 180 hectares
- Width: 400 m
- Length: 1 km

*8,000,000 m²*
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Japan contributes to the construction of ITER by procuring the major components (so-called "high-tech components") of ITER, in collaboration with the ITER Organization and Participating Parties.

### In-kind Procurement for Japan

Japan’s share for:

- **TF Conductors**: 25%
- **TF Winding and Integration**: 47%
- **TF Structures**: 100%

Superconducting coils that generate magnetic fields to confine high temperature plasma.

- **TF Coil Winding**
- **TF Coil Structures**
- **TF Coil Integration**

ITER is this big when compared to a 180 cm tall adult!

### Central Solenoid Coils

**Japan’s share for CS Conductors**: 100%

The key superconducting coils that generate powerful magnetic flux to start-up, control, and shut-down the plasma.

### Radio Frequency Heating System

**Japan’s share for Gyrotrons**: 33%

Plasma heating device using electromagnetic waves, based on the same principle as a microwave oven.

### Diagnostics

**Japan’s share for diagnostic systems**: 16% of the total diagnostics

Diagnostic systems for measuring the density and temperature of ions and electrons in the plasma, the distribution of impurities, and for monitoring neutron flux.

### Neutral Beam Injector

**Japan’s share for High-voltage (HV) bushing**: 100%

**1 MeV high-voltage direct current power supply system**: 100%

Plasma heating device that injects high-energy neutral particle beams into the plasma.

### Remote Frequency Heating System

**Japan’s share for Diagnostic systems**: 14%

Diagnostics for measuring the density and temperature of ions and electrons in the plasma, the distribution of impurities, and for monitoring neutron flux.

### Test Blanket Modules (TBM)

**Japan’s share**: 50%

Device to test mockups of breeding blankets and viable techniques for ensuring tritium breeding self-sufficiency in a real fusion environment.

### Tritium Removal Plant

**Japan’s share**: 50%

Facility that removes tritium from tritiated components and materials. The separated tritium is purified and treated to be reused. A de-tritiation system also removes tritium released during the recycling processes.

### Blanket Remote Handling System

**Japan’s share**: 100%

Remote handling equipment to maintain and replace the shield blankets.

### Central Solenoid Coils

**Japan’s share for CS Conductors**: 100%

The key superconducting coils that generate powerful magnetic flux to start-up, control, and shut-down the plasma.

### Divertor

**Japan’s share for outer target**: 100%

Device that extracts helium and impurities produced by the fusion reaction.

### Power Plant

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The Quest for Sustainable Energy

What is fusion?
Fusion—the source of power for the stars in the universe, including the Sun—is the process by which hydrogen nuclei collide at incredible speeds and "fuse" into heavier atoms, releasing tremendous amounts of energy in the process. On Earth, however, fusion reactions are most easily replicated by using isotopes of hydrogen, namely, deuterium and tritium.