What is ITER?

ITER (Latin for "the way") is a major international research project with the goal of demonstrating the scientific and technological feasibility of fusion energy. The fusion power will be up to 10 times greater than the external power delivered to heat the plasma.

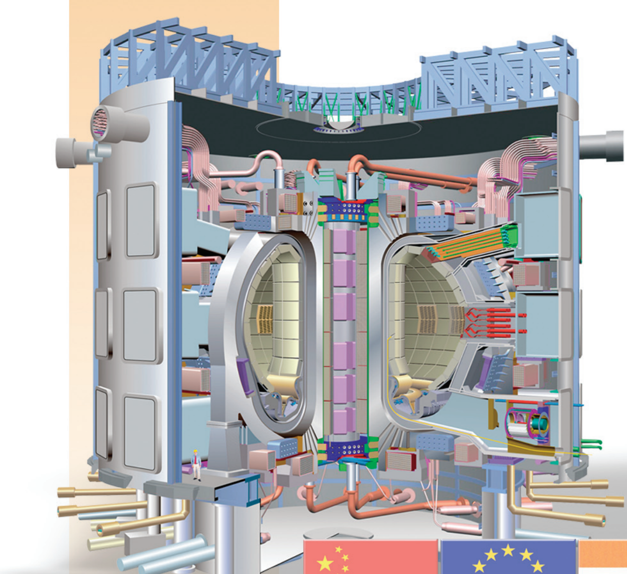
ITER is designed to be the premier scientific tool for exploring and testing expectations for plasma behavior in the fusion burning plasma regime, wherein the fusion process itself provides the dominant heat source to sustain the plasma temperature. It will provide the scientific basis and plasma control tools needed to move toward the fusion energy goal.

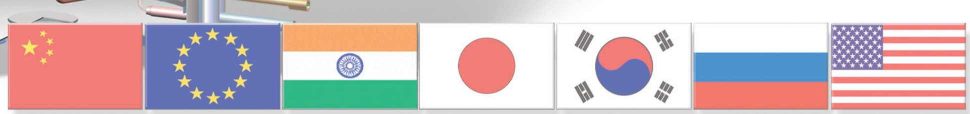
The ITER project confronts the grand challenge of creating and understanding a sustained burning plasma for the first time. Distinguishing characteristics of a burning plasma are the high level of interaction between the fusion heating, the resulting energetic particles, and the confinement and stability properties of the plasma. Achieving this strongly interacting burning state requires resolving complex physics issues and integrating new and improved technologies. A clear and comprehensive scientific understanding of the burning plasma state is needed to confidently extrapolate plasma behavior and related technology beyond ITER to a fusion power plant.

The project is being designed and built by the ITER partners: the European Union, India, Japan, the People's Republic of China, the Republic of Korea, the Russian Federation, and the United States. The device will be built at Cadarache in southeastern France, with the European Union being the host party. First plasma is scheduled for 2016.

Why is the U.S. a partner? Developing a predictive understanding of a burning plasma is the overarching goal of the U.S. Fusion Energy Sciences program in the Department of Energy's Office of Science. ITER will enable study of a fusion-powered "star on earth," where the same energy source that drives the sun and other stars is reproduced and controlled for sustained periods in the laboratory. This "star" consists of an ionized gas, or plasma, heated to fusion temperatures (greater than 100 million degrees centigrade) in a magnetic confinement device known as a tokamak, the most advanced magnetic fusion concept.

U.S. research. The burning plasma research program in the United States is being organized to maximize the scientific benefits of U.S. participation in the ITER experiment.

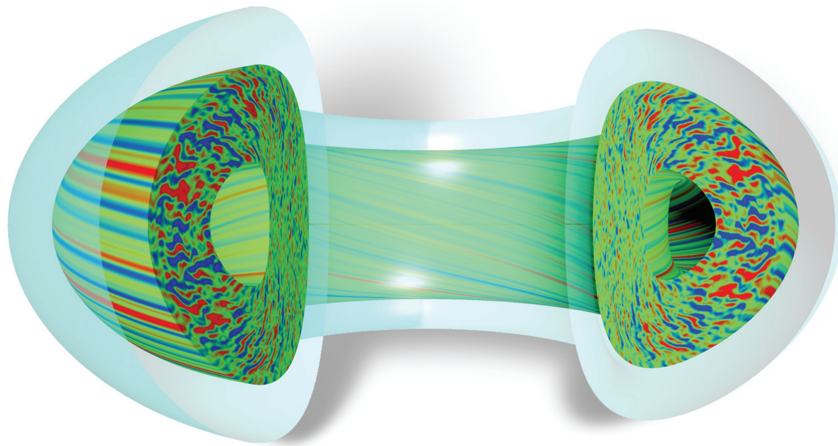




China • European Union • India • Japan • South Korea • Russia • United States

The U.S. research agenda for ITER addresses four fundamental questions relevant to understanding fusion plasmas and the surrounding environment:

- Can a self-heated fusion plasma be created, controlled, and sustained?
- How does the large size of the plasma required for a fusion power plant affect its confinement, stability, and energy dissipation properties?
- Can the tokamak confinement concept be extended to the continuous, self-sustaining regime required for future power plants?
- What materials and components are suitable for the plasma containment vessel and its surrounding structures in a fusion power plant?



Simulated electron density fluctuations in a shaped tokamak plasma by fusion researchers at General Atomics

U.S. contributions to ITER. The United States will contribute hardware components, personnel, cash, and contingency during the construction phase. For the construction phase, the United States is an equal, non-host partner responsible for about 9% of the construction cost of the international ITER Project. The total U.S. portion of the ITER costs is about $1.1 billion. During operations, the U.S. will be a 13% partner.

The U.S. ITER Project Office is hosted by Oak Ridge National Laboratory with partner labs Princeton Plasma Physics Laboratory and Savannah River National Laboratory. The project will be accomplished through a collaboration of DOE laboratories, universities, and industry.

What does this mean to me? The fusion effort is important to both science and energy. Fusion research makes critical contributions to the fields of plasma physics, materials science, computational modeling, and advanced manufacturing. When the technical hurdles are overcome, fusion has the potential to provide our grandchildren and future generations with an energy source that is safe, has a virtually unlimited supply of fuel, and does not produce greenhouse gases or long-term highly radioactive waste.

For further information, see the 2006 report to Congress from the U.S. Burning Plasma Organization (http://burningplasma.org/) and the U.S. ITER website (www.usiter.org).

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U.S. DEPARTMENT OF ENERGY

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