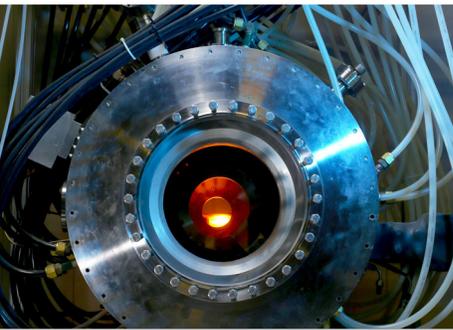




Building the Path to Fusion Energy

Fusion energy is at a pivotal moment. The fusion private sector is investing billions of dollars to develop a fusion pilot plant (FPP) and rival nations are competing for leadership in fusion energy.



An ECH transmission line for ITER developed at ORNL.
Source: ORNL

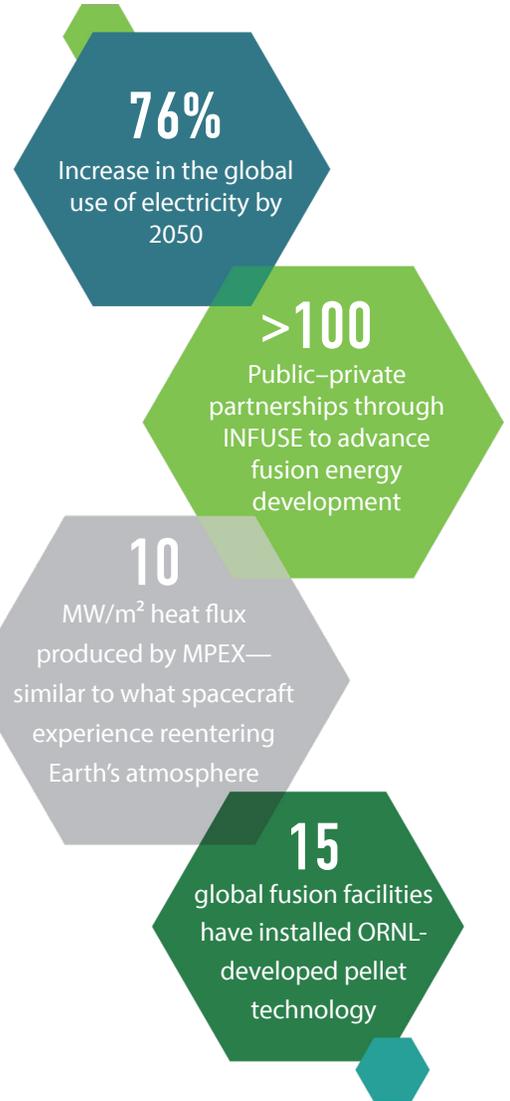
Oak Ridge National Laboratory (ORNL) is accelerating the fusion energy timeline to ensure that America retains a competitive edge in the global race for fusion commercialization.

ORNL is committed to building the path to fusion energy by providing the technical basis for burning-plasma physics, next-generation materials, and fusion nuclear technology. ORNL is the future home of MPEX, the Material Plasma Exposure eXperiment, a device that will enable testing of materials designed for future fusion devices.

ORNL also supports the international ITER project, providing 12 essential systems to support the operations and research of the 500 MW tokamak.

World-Leading Capabilities

To generate electricity from fusion, three main challenges must be addressed: (1) creating and sustaining a fusion power source, (2) developing materials that can survive in a fusion environment, and (3) developing fusion fuel self-sufficiency with efficient technologies for harnessing fusion power. ORNL has world-leading expertise in multiple areas crucial for fusion energy development and, with access to diverse tools and experts, has established an integrated approach to advance science and technology needed to resolve the scientific challenges associated with developing fusion energy.



“Fusion research is the key to unlocking a cost-effective and abundant energy resource. The work we do today is an investment in a brighter energy future for generations to come.”

Monica Gehrig, R&D Blanket Engineer

- **Burning plasma**—Scientists target a wide range of required technical thrusts needed to develop the burning-plasma physics basis for fusion experiments all over the world, a fusion pilot plant, and beyond.
- **Materials**—Scientists are creating novel materials, through traditional and advanced manufacturing techniques, for potential use in the extreme environments of future fusion reactors.
- **Computing**—Researchers are developing new codes for whole-device modeling and utilizing the Oak Ridge Leadership Computing Facility.
- **Blanket technology**—ORNL is establishing a program to lead first wall blanket development for fusion fuel and to close the fuel cycle.
- **Plasma measurement and control**—Researchers are pursuing new tools and techniques to control and measure plasmas, which are essential for optimization of fusion performance.

The ORNL-led Innovation Network for Fusion Energy program, or INFUSE, is focused on accelerating fusion energy development through research collaborations between industry and national laboratories.

infuse.ornl.gov

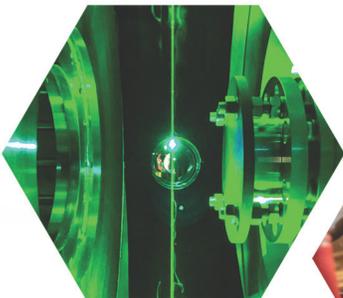
Impact and Collaboration

ORNL fusion delivers science and technology to enable the success of fusion devices around the world. In addition to participation in the seven-member international ITER project, ORNL engages in active collaborations with the UK Atomic Energy Authority (Joint European Torus), Korea Institute of Fusion Energy (KSTAR), Max Planck Institute for Plasma Physics (Wendelstein 7-X), and the French Alternative Energies and Atomic Energy Commission (WEST). ORNL is the world leader in pellet technology used for fusion fueling and mitigation of undesired plasma modes or disruptions. In recent years, fusion devices in seven countries have installed ORNL-developed technology to improve plasma performance and control.

ORNL is also an active collaborator with the DIII-D National Fusion Facility, Princeton Plasma Physics Laboratory (PPPL), universities, and the fusion industry. The INFUSE cost-sharing program, managed by ORNL with PPPL, brings together industry with national laboratory experts to resolve fusion technology challenges. ORNL also leads multiple projects in the Department of Energy's SciDAC Fusion Energy Sciences Partnerships program that utilize high-performance computing to accelerate progress in fusion research and bring fusion energy to the grid on a rapid timescale.

Uniquely ORNL

With a long history in both fusion and fission research, ORNL brings together expertise from across nuclear systems and technologies. Fusion at ORNL benefits from experts in radiation transport and neutronics, modeling and simulation, and practical licensing and technology deployment experience. The exceptional combination of resources at ORNL, from advanced manufacturing to neutron scattering to high-performance computing, enables innovative collaborations and solutions for fusion challenges.



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