ITER AND THE FUSION ECOSYSTEM

FOUNDATIONS FOR FUSION

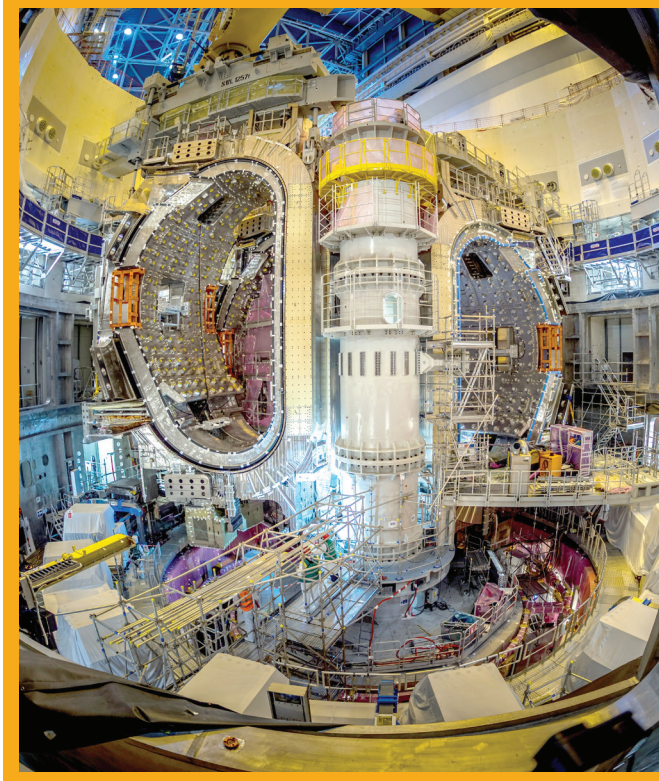
ITER will deliver essential science foundations for fusion, particularly the physics understanding of the production and control of a sustained fusion power source, or burning plasma. ITER is purposefully using a well-understood tokamak design with low temperature superconducting magnets to demonstrate industrial scale (500 megawatts) fusion power for hundreds of seconds. This has not yet been achieved by any fusion system and will be a critical step for practical fusion.* To be clear, ITER is not intended to be a model for a pilot power plant. Rather, ITER's primary role in the fusion ecosystem is to provide foundational physics knowledge of a burning plasma that will set up other fusion approaches for success.

With ITER assembly continuing and early plant commissioning underway, fusion experts are preparing for the start of research operations. Information and know-how from ITER are already being shared with U.S. fusion companies and research entities. The United States and other ITER members anticipate ITER research as an integral part of their fusion road map strategies.

MULTI-SECTOR INNOVATION AND PARTNERSHIPS

The fusion industry has grown substantially in the last decade, with ~50 global fusion companies now active (half in the United States) and nearly $10 billion in private investment. Industry is developing innovative fusion architectures and leveraging public research and experts to accelerate concepts for the delivery of fusion energy. The DOE Fusion Science & Technology Roadmap (2025) emphasizes a multi-sector pathway to fusion energy, with government investment building technology infrastructure to reduce risk for industry, advance research, and grow the U.S. fusion ecosystem through public-private partnerships.

* The National Ignition Facility at Lawrence Livermore National Laboratory has demonstrated fusion ignition and fusion gain over very short durations of less than one second.



Inside the ITER tokamak pit. Photos: ITER Organization

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ITER remains an indispensable part of the fusion ecosystem. Some companies are targeting near-term goals for a pilot plant, while other industry timelines will intersect with ITER operations. The operational flexibility of ITER paired with its extensive diagnostic measurement tools, data sets, and test facilities will aid industry's next steps to practical fusion energy.

LOOKING AHEAD

The private fusion industry continues productive interactions with ITER and is leveraging ITER expertise and information. ITER will begin research operations in 2034, nuclear operations in 2035, and full power deuterium-tritium operations demonstrating a self-sustaining fusion power source in 2039 and beyond.

In parallel, the United States and other ITER members are prioritizing investments in key fusion technology areas to address industry needs and reduce risk for future pilot plants. Areas of focus include fusion materials and fuel cycle technologies. Progress is also underway to establish regulatory certainty for fusion, with a U.S. framework for fusion proposed by the Nuclear Regulatory Commission in 2024. As efforts advance, utility needs and public interests will inform the viability of economical fusion energy.

A U.S.-provided central solenoid magnet module (center) is positioned for assembly inside the ITER facility.
Photo: ITER Organization

Recent national studies and fusion community reports affirmed ITER's scientific value and contributions to a path to commercial fusion energy:

(2025) *Fusion Science and Technology Roadmap.* DOE Fusion Energy Sciences.

(2024) *FESAC Facilities Construction Projects (draft).* Fusion Energy Sciences Advisory Committee (FESAC) Subcommittee.

(2023) *International Collaboration Opportunities, Modes, and Workforce Impacts for Advancement of US Fusion Energy.* FESAC International Benchmarking Subcommittee.

(2021) *Bringing Fusion to the U.S. Grid.* National Academies of Sciences, Engineering, and Medicine.

(2021) *Powering the Future: Fusion and Plasmas.* FESAC.

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