

**Statement of Tim Luce**  
Head of Science and Operations Domain  
ITER Organization

**Before the Committee on Energy and Natural Resources  
United States Senate**

**September 22, 2022**

***Hearing on the Federal Government's Role in  
Supporting the Commercialization of Fusion Energy***

Thank you to the Chair, Senator Manchin, Ranking Member Barrasso and Members of the Committee, for this opportunity to discuss fusion energy.

I am Tim Luce, and I am presently the Head of the Science and Operations Domain and Chief Scientist for the ITER Organization. The ITER Organization is responsible for coordination of the design, assembly, commissioning, and operation of the ITER tokamak, with the goal of demonstration of fusion power production at the power plant scale.

The world needs reliable energy in sufficient quantity to support the development of society without adverse impact on our environment. To address this need, multiple solutions both for the near-term and in the future should be explored.

Fusion energy is not yet at the stage to satisfy the need for abundant clean energy. However, we know that fusion has the potential to provide that energy for millennia. Fusion can be realized around the globe, enabling a global access to energy, which should reduce one source of conflict among nations. But this potential of fusion remains to be fully demonstrated at the scales required for energy production for the planet.

ITER plays an essential role in this demonstration. While proper conditions for fusion power have been demonstrated in research laboratories around the world for a few seconds at a time, the challenge remains to produce fusion reactions that produce megawatts of power with substantially greater output than input. A fundamental element of the ITER mission is to validate our physics understanding that it is possible to produce a burning (or self-heating) plasma at the power plant scale of 500 MW output, 10 times the input power. A second key element is to test some of the essential technologies to bring fusion into the energy economy.

Now under assembly, ITER is more than 75% complete for infrastructure and components needed for first plasma operations. As a Member of the ITER Agreement, the U.S. plays an essential role. About 85% of the capital investment in ITER is supplied by in-kind contributions. For the U.S., this is the responsibility of the ITER Project Office in Oak Ridge under the direction of the Department of Energy, which continues to deliver a range of high-tech systems necessary for mission success, including the central solenoid magnet at the heart of the ITER tokamak. Through the research enabled through the Office of Fusion Energy Sciences, the U.S.

fusion program has been a leader in the physics understanding that led to the ITER design and continues this leadership with physics R&D directed toward optimization of the ITER Research Plan. Finally, the ITER Organization consists of staff from all the Members, and U.S. staff play a vital role in all facets of the work ongoing in the ITER Project.

While the ITER Organization cannot advocate for any specific proposals to Member governments, we wholeheartedly support the development of roadmaps to fusion energy by the Members. Preparing to build on the success of ITER will bring the maximum return on the ITER investment.

In this light, we note positively the recent National Academies of Science, Engineering and Medicine report. The title, *Bringing Fusion to the U.S. Grid*, places the focus on fusion playing a role in the energy supply economy, which is our fervent hope as we work toward accomplishing the ITER mission.

The above referenced National Academies report states that “technology and research results from U.S. investments in ITER, coupled with a strong foundation of research funded by the Department of Energy (DOE), position the United States to begin planning for its first fusion pilot plant.... [and] much of the experience gained through the ITER process is relevant to a pilot plant regardless of its configuration.” It is appropriate to note here specific places where ITER has contributed or will contribute to a fusion energy roadmap.

First, ITER will demonstrate our scientific understanding of fusion plasmas and inform designers of future fusion pilot plants and power plants regarding trade-offs among key design features such as pulsed versus steady-state operation.

Second, ITER is providing us with practical experience in designing, manufacturing, assembling, and operating a fusion facility that can be licensed under nuclear safety regulations. Independent of the ultimate details of future facilities, the basic nuclear safety objectives of confinement of radiological materials and protection of the public and workers will be constant. Satisfying regulatory oversight is one of many areas in which lessons can already be learned from the ITER experience.

Third, the in-kind supply model for ITER components has made and should continue to make a positive impact on industry, resulting in the development of a new global fusion supply chain and workforce. These are essential steps that will support the design and construction of a fusion pilot plant and eventually a fusion economy.

ITER is a prudent investment as part of a fusion energy strategy. For a fraction of the total investment, which minimizes the risk, each of the ITER Members receives 100 percent of ITER science, technology and associated intellectual property. Specifically for the U.S., a contribution of ~9 percent toward construction and ~13 percent toward operations provides all of the return. I would emphasize here that ‘know-how’ is both the most important and the most difficult intellectual property to capture. We encourage all of the ITER Members to take full advantage of ITER through aiding in staff recruitment and taking advantage of the new Long-Term Assignment program that will be introduced in the coming year. To form and execute an

effective roadmap, 'know-how' is vital and can only be gained by direct experience. As for all Members, ITER is thus an invaluable resource for the emerging U.S. fusion industry.

Continued U.S. support for ITER is essential for the path to fusion energy and provides important experience for a fusion pilot plant. The ITER Organization is grateful for the support for fusion by this committee and its counterpart in the House, and by individual Members of Congress. We also acknowledge the support from the Department of Energy through the Office of Science, especially the Office of Fusion Energy Sciences, the U.S. ITER Project Office, and the many U.S. supplier companies contributing to ITER. Finally, we are very grateful to the individual U.S. researchers, engineers, and those in other disciplines in the National Laboratories, universities, and industry who have made fusion their goal and passion, whether directly toward ITER or in parallel. This passion is necessary to realize our common goal of seeing fusion energy take its place in the energy economy.

Thank you for your interest. I welcome any questions you may have.