



POSITION STATEMENT

Fusion Energy

*Adopted by the IEEE-USA
Board of Directors (21 June 2019)*

IEEE USA supports U. S. fusion energy research and recommends:

- Support of ITER¹ as a full partner via U. S. Department of Energy (DOE) during the construction phase-- including both funding and commitment of U.S. expertise-- and support for use of ITER as a scientific instrument during the operations phase, in order to provide the first opportunity to observe and explore the burning plasma state that is scheduled to begin in 2025.
- Maintenance of a vigorous and stable domestic program, including magnetic and inertial fusion, and consideration of new research facilities, to address physics and technology topics beyond the scope of ITER, and to attract a new generation of talented scientists and engineers to enter the US fusion workforce. Such a program, coordinated by DOE, should involve national laboratories, universities, and, where appropriate, industrial partners. U.S. Government funding for such domestic program should be no less than funding for ITER.

Achievement of controlled fusion will offer a sustainable, carbon-free, proliferation-free, and environmentally attractive source of energy for the future. Fuel material is widely available and control of the process is inherently safe. The goal of fusion, in combination with sources such as solar and wind, driven by the earth's natural energy flows, is to provide mankind with an inexhaustible supply of energy and a stable global environment. Considering the timescale for commercialization, the concurrent evolution of enabling technologies, and the sweeping changes in the worldwide energy picture that will take place in the 21st century, the economic competitiveness of fusion is likely to improve. Recent advances in superconductor technology serve as an example.²

¹ Previously known as the "International Thermonuclear Experimental Reactor," this multi-national fusion research program is now referred to simply as "ITER."

² October 2, 2015 Fusion reactors 'economically viable' say experts by [Durham University, https://phys.org/news/2015-10-fusion-reactors-economically-viable-experts.html](https://phys.org/news/2015-10-fusion-reactors-economically-viable-experts.html)

Fusion requires a stable, long-term commitment of qualified personnel, facilities, and funding to develop the technology. Large projects such as fusion energy development and demonstration need new kinds of funding mechanisms and more long-range thinking.³

An ongoing international effort, ITER, in which the US is a participant, is critical to establishing the physics for the design of future fusion power systems. Its goal is to demonstrate the scientific and technological feasibility of fusion energy for peaceful use. But a committed and robust domestic research program is also essential to ensure that the US is prepared to compete as a major supplier of fusion power reactors as the technology matures into a commercial energy source. ITER is the key step and the US cannot afford to not be at the table, regardless of the outcome.

A balanced combination of domestic and international fusion research is the most effective means to advance the fusion program and promote U.S. interests. This approach ensures that the U.S. is positioned to play a significant role, while reaping significant benefits from the wide-ranging technological advancements and overall benefits of fusion development and scientific cooperation on a global scale. This is consistent with a recent recommendation from the National Academies of Science.⁴

International: The ITER project (www.iter.org), initiated in 1988 is an international effort to construct the world's first powerplant-scale fusion reactor. Involving seven members comprised of 35 nations, the project is the culmination of worldwide efforts to demonstrate the large-scale production of fusion power by 2035. ITER poses a grand challenge that will explore new frontiers of science and technology and demonstrate the ability of a complex international organization to cooperate on a large-scale project at a global level. Adequate funding for U.S. contribution to ITER is requisite to the project's ability to complete construction and begin operations on schedule.

The present fusion knowledge base, which has led the world fusion community to proceed with ITER, derives significantly from past decades of fruitful U.S. research and development by a highly productive and innovative U.S. scientific and engineering workforce. Other nations with emerging fusion programs, in particular China and Korea, are rapidly expanding their own domestic programs and workforce.

³ MIT and startup company [Commonwealth Fusion Systems](http://www.commonwealthfusion.com) (CFS) are working on developing practical fusion power plants in a public – private collaboration. MIT also founded “The Engine” program to help companies bridge the gap between lab and commercial success, particularly projects with development durations longer than expected by conventional venture capital funds. Some projects require up to 18 years, as in the case of SPARC, which is a fusion device demonstration project. MIT News Office, David L. Chandler, January 24, 2019
<http://news.mit.edu/2019/progress-practical-fusion-energy-0124>

⁴ Reference: FPN18-53: Report of the Committee on a Strategic Plan for U.S. Burning Plasma Research – National Academies of Science, December 13, 2018

Domestic: A vigorous U.S. domestic program is essential to capture and leverage the benefits of prior investments through strong, continuing involvement in fusion research and the ITER project. Strong support of existing DOE experimental facilities in the U.S., as well as nascent private sector fusion energy ventures⁵, will ensure continuity and inflow of the requisite scientific and engineering workforce⁶. Opportunities exist for the U.S. to take on leadership roles in key developmental areas, as well as alternative and/or enabling concepts that may optimize the fusion energy system. One or more new domestic facilities should be considered in order to make technical progress in these areas and facilitate U.S. leadership. Most importantly, however, in recognition of the long-term nature of the fusion program, stable government commitment is essential.

This statement was developed by the IEEE-USA Energy Policy Committee, and represents the considered judgment of a group of U.S. IEEE members with expertise in the subject field. IEEE-USA advances the public good, and promotes the careers and public policy interests of the nearly 180,000 engineering, computing and allied professionals who are U.S. members of the IEEE. The positions taken by IEEE-USA do not necessarily reflect the views of IEEE, or its other organizational units.

⁵ Lockheed Martin's Skunk Works® laboratory registered [a patent](#) in March 2018 for a compact fusion reactor (CFR). Forbes, August 1, 2018 Ariel Cohen, <https://www.forbes.com/sites/arielcohen/2018/08/01/will-lockheed-martin-change-the-world-with-its-new-fusion-reactor/#38752be54c49>

⁶ CFS, currently with 30 employees, is working on large superconducting magnet assemblies and there are about 20 companies actively involved in such fusion research. Op. cit. MIT News Office, David L. Chandler, January 24, 2019