Fusion energy

Fusion roadmap

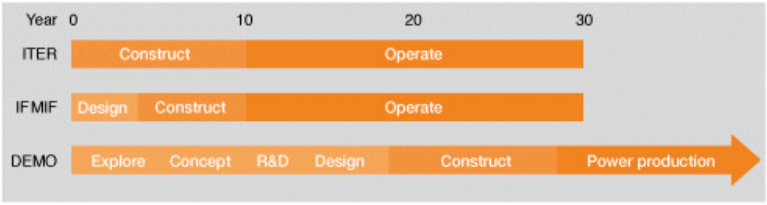
Fusion Electricity: A roadmap to the realisation of fusion energy – European R&D plan published in 2012.

Fusion power plant video

A fly-through animation based on designs from recent European fusion power plant studies.

Achieving fusion power

Fusion is expected to become a major part of the energy mix during the second half of this century. With adequate funding, the first fusion power plant can be operating in the 2040s. To achieve this, a series of development steps need to be taken, which are set out in the **European fusion roadmap, published in 2012**. CCFE is working with its counterparts around Europe to implement this plan, which would see fusion power on the grid by 2050.



ITER

ITER is the next major international fusion experiment and a crucial step towards commercial fusion energy. It is designed to release 500 megawatts of power from fusion reactions during pulses of up to 600 seconds. ITER aims to validate technology for the prototype power stations that are expected to follow it.

A truly global undertaking, the participants in ITER represent more than half the world's population: China, the European Union, India, Japan, South Korea, Russia, and the United States of America. It is the world's largest international co-operative scientific research and development project.

The ITER site is next to an existing energy research site at Cadarache in southern France. An international team is now constructing the machine, with the first plasma expected in the mid 2020s. This will be followed by a 20-year period of operation that will test essential physics and technologies for the fusion power plants of the future.

More information on the UK's contributions to ITER preparations is in the **Research** section.

Full details on the project are at the **ITER website**.

IFMIF

Selecting the right materials for commercial fusion plants will be crucial. The metals used in tokamaks will need to withstand the extreme conditions produced by high-energy fusion neutrons.

In parallel with ITER, **IFMIF (the International Fusion Materials Irradiation Facility)** will be constructed to test materials for future fusion power plants against neutron damage and irradiation. IFMIF is a particle accelerator that will produce high-energy neutrons and fire them at samples of materials identified as suitable for the walls of commercial tokamaks. Completion of IFMIF's design is now being taken forward as a joint European/Japanese project and a site for the facility is being identified.

DEMO

Once the scientific and engineering systems have been tested on ITER, the next stage will be to build a demonstration fusion power plant integrating the results. Designs are already advanced for this prototype machine, known as 'DEMO'.

DEMO will produce two gigawatts of electrical power to the grid, a similar output to a standard electrical power plant, and will be online by 2050. If successful, it will lead to the first generation of commercial fusion power stations.

Components of a fusion power plant

(Courtesy of **www.euro-fusion.org**)

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