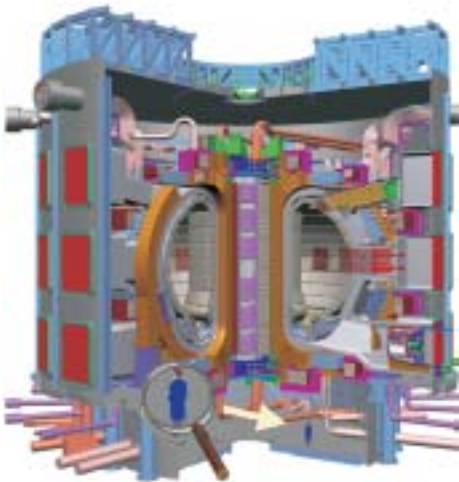




ITER, THE ROAD TO FUSION ENERGY

ITER, which means "the way" in Latin, is an international research and development project conceived to take the next major step in the development of fusion energy as a safe, clean and sustainable energy source for our planet. The ITER design already represents a remarkable scientific achievement which has been made possible by close collaboration between hundreds of leading scientists from laboratories, universities and industries around the world.

The result of their joint efforts is the first complete design of a fusion device of conventional power station size, based on well-established physics and proven technology. It is much more than a conceptual design requiring further development – it is a detailed plan ready for implementation. Experiments conducted in many fusion devices worldwide have provided a solid physics base for extrapolation to the ITER scale. A number of the key high-tech components (such as superconducting coils) have been developed by industry and tested to the point of being ready for industrial production. This international collaboration has broken new ground in demonstrating that the work of a geographically widespread, multicultural team could be coordinated on such a scale while meeting demanding technical challenges.



Cut-away drawing of the ITER tokamak showing the D-shaped vacuum vessel, surrounding structures, and the cylindrical cryostat which forms one of several safety barriers.

(Courtesy of ITER)

Demonstrating the feasibility of fusion power

ITER will prove the scientific and technological feasibility of fusion power. It will be a machine of the tokamak type in which the toroidal (doughnut-shaped) fusion plasma is confined by very strong magnetic fields. The main objective of ITER is to demonstrate prolonged fusion power production in deuterium-tritium plasma. Compared with current concepts of fusion power stations, ITER will include most of the necessary technology, will be of slightly smaller dimensions, and will operate at about one-fifth of the power level.

ITER parameters

| | |
|--------------------------------|-------------------|
| Height | 24m |
| Width | 30m |
| Plasma volume | 350m ³ |
| Fusion power (thermal) | 400 - 500MW |
| Plasma duration | 300 - 500s |
| Power amplification: transient | >10 |
| steady state | >5 |
| Plasma current | 15MA |

The ITER negotiations in progress

The final design for ITER is the result of an intense international collaboration. The design was assessed and approved by the ITER participants in July 2001. Formal intergovernmental negotiations on a possible legal framework for ITER began in November 2001 and are ongoing.

Currently, the *parties to the ITER negotiations* are the European Commission (with a mandate to represent the European Union (EU)), and the governments of Canada, Japan and the Russian Federation. The People's Republic of China has expressed interest in joining ITER while the United States government is considering rejoining the project.

Initially, the negotiations addressed the *Joint Implementation Agreement*, to be finalised in preparation for a possible decision in 2003 to build ITER. This agreement will govern the construction, operation and decommissioning of ITER and will include issues such as siting, procurement allocation, and the structure of its international organisation. Supporting the negotiations, joint *Coordinated Technical Activities*, which run until the end of 2002, are addressing relevant technical aspects to maintain the integrity of the international project, to adapt the design to the conditions of the specific ITER sites under consideration, and to support preparation for licensing.

At the European level the Commission, as one of the founders of the ITER project, is playing a leading role in the negotiations on behalf of the EU. Its mandate, initially to negotiate on legal matters, was extended by the Council on 27 May 2002 to cover site and cost-sharing aspects. The creation of a specific legal entity in Europe to manage the EU contribution to ITER is also under active consideration.



Worldwide site proposals for ITER



European Union

The EU has two candidate ITER sites: Cadarache in France and Vandellós in Spain:

- The initial technical assessment at Cadarache in 2001 showed that it meets ITER site requirements.
- December 2002: the French Minister for Research asked the Commission to define the conditions under which a European site for ITER at Cadarache could be proposed to the other parties.
- The *Dossier d'Options de Sûreté* is now being examined by the French Safety Authorities as the next towards the licensing procedure for the construction of ITER at Cadarache.
- April 2002: the Spanish Government formally announced the proposal of a site at Vandellós, near Barcelona.
- Socio-economic studies and technical assessment of the Vandellós site for ITER are ongoing.
- May 2002: the Cadarache site proposal was confirmed by France following the presentation by the Commission of a document on the proposed financial cost sharing as a basis for negotiations.
- June 2002: the European Delegation submitted the EU site proposals to the other ITER parties, having obtained an extended negotiating mandate to cover siting and cost issues.



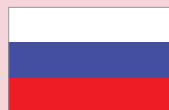
Canada

- June 2001: Canada presented an offer to site ITER at Clarington, Ontario.
- April 2002: the Canadian Government approved the *Scope of the Environmental Assessment Guidelines* for the ITER project – a step towards obtaining a licence to construct the facility.



Japan

- June 2002: Japan proposed siting ITER at Rokkasho in Aomori.



The Russian Federation

- Russia is not expected to propose a site but has stated its intention to participate in ITER joint implementation.

A fast track to fusion power

During the Belgian presidency of the EU in the second half of 2001, Research Ministers requested an investigation into the feasibility of a "fast track" to fusion power generation. A group of independent experts, chaired by Professor David King (Chief Scientific Advisor to UK Prime Minister Tony Blair) discussed this idea and reported their conclusions to the EU Council Presidency.

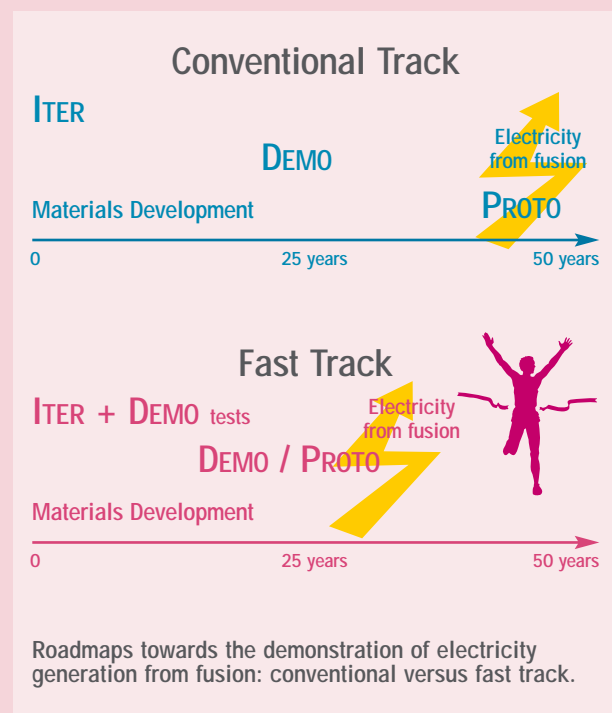
According to the experts, a fast-track approach could demonstrate that electricity generation from fusion would be feasible within 20 to 30 years from the start of ITER construction. The 'conventional' roadmap forecasts a timescale of about 50 years towards the commercial scale. The fast track would shorten this period by reducing from two to one the number of generations of experimental machines after ITER. Some of the technology tests planned for the demonstration machine (DEMO) would be started in ITER, and the prototype power station step (PROTO) would include all the remaining technological developments as well as demonstrating electricity generation on a commercial scale. Initially, this would require additional resources as more activities would progress in parallel, but the overall amount of funding to reach the final goal could be substantially reduced.

The first step required for a fast track is the prompt realisation of ITER.

How to accelerate

Expert opinion on how a 20- to 30-year fast track for fusion could be achieved:

- ITER is the essential next step and should be constructed as soon as possible.
- Existing fusion devices should continue to contribute to the knowledge base as long as is feasible.
- Tests of breeding and high-grade energy extraction blanket modules for DEMO should be done in ITER.
- The DEMO and PROTO generations of experiments should be combined into a credible prototype for a power-generating fusion reactor.
- A facility to test and verify materials exposed to fusion reactor irradiation conditions is required in parallel with ITER.
- Industry's role should be significantly enhanced during the realisation of ITER.



More information is available at:

http://europa.eu.int/comm/research/energy/index_en.html

<http://www.iter.org>

<http://www.efda.org>



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