EUROPEAN COMMISSION

Community Research

FUSION ENERGY FOR THE FUTURE

How can we harness fusion power on earth to benefit mankind?

This brochure explains why and how the EU is funding research on this option for future sustainable energy production.

Fusion is the powerhouse of the universe
It is the energy source for the sun and other stars

Energy is vital

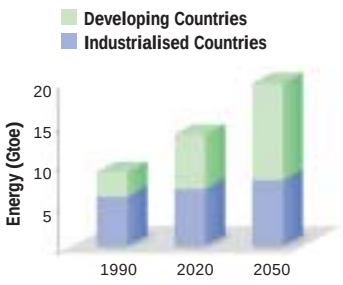
(Courtesy of NASA)

Modern society depends on access to a ready supply of energy. Energy is used everywhere: for transport, heating, lighting, and in industry and agriculture. At the moment, most of this energy is produced by burning **fossil fuels** such as coal, oil and gas, some comes from **nuclear fission,** and a small amount is produced by **renewable sources,** mostly hydroelectric and biomass.

Energy demand is increasing

Even with considerable efforts on energy saving, world energy demand may double over the next 50 years. This is because per capita consumption is increasing and the world's population is expected to grow from 6 billion today to almost 10 billion in 2050.

Most of this rise in energy demand, and the growth in population, will occur in developing countries where rapid urbanisation is increasing the need for large-scale electricity generation.



Projected growth in world energy consumption

SIXTH FRAMEWORK PROGRAMME

Protecting the environment

The burning of fossil fuels generates carbon dioxide, a **greenhouse gas** which traps solar radiation.

There are growing concerns about the resulting global warming and other damaging effects on the environment.

Action is needed now to ensure a mix of long-term, secure and sustainable energy supplies, able to reduce the environmental impact and satisfy growing energy demand.

Fusion: an option for safe and sustainable energy supply

Fusion offers the possibility of an **emission-free and reliable long-term energy supply with some important advantages:**

- Fusion power stations can be made inherently safe – 'runaway' or 'meltdown' accidents are impossible;
- The fuels are abundant everywhere for large-scale production;
- Day-to-day operation of a fusion power station does not require the transport of radioactive materials;
- There are no greenhouse gas emissions; and
- With a suitable choice of materials, waste will not be a long-term burden on future generations.

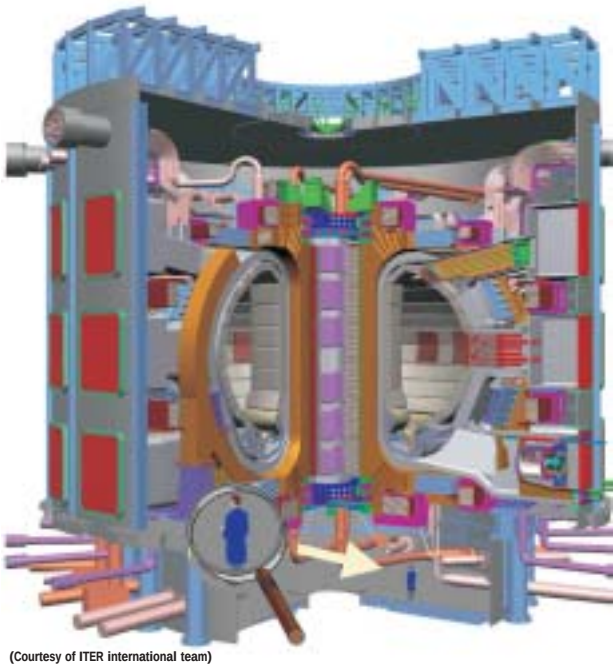
(Courtesy of EFDA JET)

How fusion works

Atoms of light elements, such as hydrogen, collide and fuse together at the extremely high pressures and temperatures which exist at the centre of the sun (about 15 million degrees Celsius). This process releases a large amount of energy but at a rather slow rate.

To increase this rate on Earth, scientists have succeeded in producing gas with temperatures ten times higher in fusion devices. Megawatts of power have been produced for a few seconds.

In Europe, this has been achieved in the Joint European Torus (JET), the world's largest fusion device which currently holds the world record for fusion power.



(Courtesy of ITER international team)

The Next Step

Europe and its international partners are looking for the best way forward to construct a large **'Next Step'** experimental facility, called ITER. This will build on the success of ground-breaking experiments conducted on JET and on medium-sized devices in laboratories across Europe.

ITER will be the next step on the path to safe and sustainable fusion power. It will generate 500MW of power for periods of initially up to ten minutes, and should be able to sustain steady-state operation. It will thus demonstrate the scientific and technical feasibility of fusion power in a device of power station dimensions.

Fusion R&D in Europe

Fusion research in the EU Member States and associated countries is coordinated in a single European programme. This has allowed the realisation of projects such as the Joint European Torus (JET), which are too large for any one country to undertake. Nearly 2000 scientists and engineers are currently working on a broad range of fusion R&D projects in more than 20 laboratories, including JET.

The Sixth Framework Programme (2002-2006) has a budget of €750 million for fusion research, including up to €200 million for the possible construction of ITER.

This wide-ranging coordination of the programme has helped Europe to secure a leading role in world fusion research.

Looking forward

In its decision on the Sixth Framework Programme, the Council of Ministers said:

> ***'Fusion energy could contribute in the second half of the century to the emission-free large-scale production of base-load electricity. The advances made in fusion energy research justify the further pursuit of a vigorous effort towards the long-term objective of a fusion power plant.'***

The results from the next major experiment will form the basis for the construction of a first power station, producing significant amounts of electricity, to demonstrate the safe and reliable operation of a fusion power plant.

By the second half of the 21st century fusion could make significant contribution to the world's energy production.

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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