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HSC Statement

ENS supports one European site for ITER

There is no development without an access to sufficient energy. However, mankind's current energy consumption, 80% of which is supplied by the combustion of coal, oil and gas, clearly threatens the Earths climate stability.

At present, there are two energy sources which, as an alternative to fossil fuels, contribute to society's energy supply without significant greenhouse gas (GHG) emissions : renewable energy sources and nuclear fission energy. In the longer term, however, there are high hopes that a third non GHG-emitting energy source can be mastered and put to use : nuclear fusion energy.

Nuclear fusion occurs when two light nuclei, isotopes of hydrogen, "fuse" together to produce one helium nucleus. As the mass of the resulting nucleus is smaller than the sum of the masses of the initial nuclei, energy is released in the process. But as the two nuclei are electrically charged, their electrical repulsion (the Coulomb barrier) must be overcome to bring them close enough to "fuse".

Fusion, which is the source of the energy radiated from the Sun and other stars, is by far the most widespread in the universe; the gravitational forces acting within those huge masses of matter are powerful enough to overcome the Coulomb barrier.

Achieving fusion on Earth in a controlled way without the help of these gravitational forces has proven to be extremely difficult. Scientists, worldwide, have struggled with this problem for more than four decades. Nonetheless the expectations are commensurate with the difficulties of this endeavour : if controlled D-T fusion (see Appendix) can be made to work and the necessary technology developed, the energy content of the Earth's lithium resources will be comparable to that available from coal or uranium resources (if used in breeder reactors).

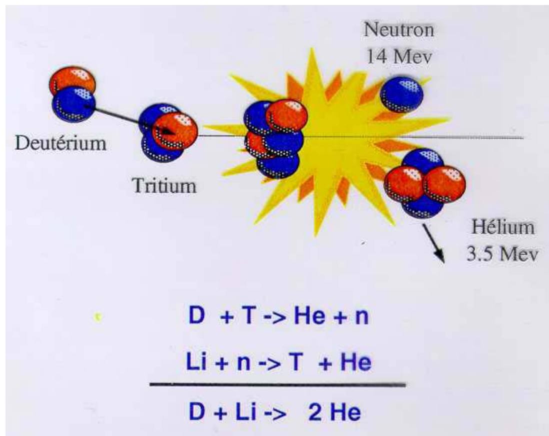
Nuclear fusion research is an outstanding, if not unique, example of international co-operation and, within this framework, of intra-European co-operation. The integration of all European fusion activities, which has been a feature of EU programmes for 30 years, has contributed enormously to the international position of excellence of European R&D in this area, as witnessed by the success of the Joint European Torus (JET) project.

The international community (Europe, Japan, Russia, Canada, and now China and the United States) is poised to move to the next step on the long road leading hopefully to controlled fusion energy : the ITER Project, possibly the largest international R&D project in existence.

The European Nuclear Society supports strongly the recent communication by the European Commission stating that it is important that the ITER Project be constructed in Europe, and that the candidate European site be identified as soon as possible.

Appendix : D-T Fusion

Among the possible fusion reactions, the "easiest" to achieve is the reaction between two hydrogen isotopes, the deuterium (D) whose nucleus has one proton and one neutron (normal hydrogen has a single proton for nucleus), and the tritium (T) whose nucleus comprises one proton and two neutrons. This fusion reaction is therefore :



Most of the energy is, unfortunately, carried out by the neutron.

Deuterium can be extracted from ordinary water : its resources are quasi-inexhaustible, but Tritium, being radioactive with a 13 year half-life, must be produced by neutron capture in Lithium 6, which becomes the limiting source of fusion energy (see above).

To force D and T nuclei to interact, two ways are under development :

- Crushing by implosion solid DT pellets (Inertial Confinement Fusion ICF)
- Heating at very high temperatures DT plasmas (Magnetic Confinement Fusion MCF).

Most specialists would agree that MCF is the preferred road to commercial fusion energy. ITER is a MCF experimental facility of 500 MW design capacity.

The combination of high temperatures and high neutron irradiation will be very challenging for the materials of any future fusion reactor.