WILL FUSION BE READY TO MEET THE ENERGY CHALLENGE FOR THE 21st CENTURY ?

Yves Bréchet
Haut-commissaire à l'énergie atomique
CEA, 25 rue Leblanc , 75015 Paris, France
yves.brechet@ cea.fr

The energy challenge is critical for todays'world. This is due to the finite amount of fossil fuel and to the growing energy demand of emerging countries. At the same time global warming appears to be the threat of the century. This is why the European Union has taken a strong commitment to reduce its CO2 production in the coming years and to develop low carbon energy production. Nuclear energy appears necessary in order to satisfy the demand of energy of tomorrow's world, at least in a transient stage including the GENIV type of reactors which will be able to burn depleated uranium and to minimize the amount of ultimate long live wastes. In the longer term, nuclear fusion seems to be even more attractive promising a production of energy with no limit on fuel materials and limited nuclear waste in the production cycle. However this attractive goal faces scientific and technical challenges which will not be easily overcome and require advanced investigations. In parallel, the common points between different possible routes, and the possibility of joining forces appear as strong assets. The aim of the present contribution will be to address both the challenges and the possible synergies.

Europe and France in particular are on the front-line of research on nuclear fusion. France has the honor of hosting two leading major research facilities for the study of nuclear fusion. The first one is the ITER facility currently under construction in Cadarache. At the same time, CEA is running the Laser Megajoule facility. LMJ is already operational for physics experiments with a limited number of beams, and more beams are currently added to reach the configuration of 176 beams. Although LMJ has been built to contribute to the French nuclear deterrence, CEA, in agreement with the Region Aquitaine, has decided to open it to academic research including IFE. In particular a petawatt laser PETAL has been developed explicitly as a research instrument for academic research.

A number of possible options have been envisaged for fusion research, often considered as excluding each other. The communities progressively evolve toward a more "collaborative approach". The classic opposition was magnetic confinement (MCF) vs inertial confinement (ICF). The choice made by CEA, for potential energy production, is MCF. However more and more research projects involve now both ICF and MCF, around topics of common interest : the behavior of material irradiated by high radiation and neutron fluxes, the need to develop new diagnostics tools adapted to burning plasmas, the problems of the interaction chamber and of breeding of nuclear fuel.

Finally, and in spite of a clear choice for MCF for energy production, keeping an activity in ICF for energy production will allow to begin addressing other issues related to drivers for future fusion facilities. Finally, by pursuing the research on Inertial Confinement Fusion, without overselling the prospectives, we are providing top-level scientific and technological research. We are maintaining high technological standard and preserving the role of our economies and of our industry, we are contributing to the training of new scientists and to a new technological leadership for tomorrow's society.