

# **Clean and Abundant Energy for the Mankind: The way of Fusion**

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Meeting the growing energy needs of our planet requires new methods of energy production taking into account the climate change and the reduction of fossil fuel reserves. Nuclear fusion is one of the most promising options in this endeavor. Nuclear fusion is the process by which energy is produced in the Sun and the stars. To produce energy from fusion, it is necessary to heat a gas composed of isotopes of hydrogen (deuterium and tritium) to very high temperatures, similar to those found in the sun (plasma). One way to achieve these conditions is to confine the plasma with strong magnetic fields. The most promising method for achieving this goal, among several types of magnetic confinement devices, is the “tokamak”. The “tokamak” in the shape of a torus is the leading candidate for the development of a future fusion power plant having several advantages, such as inherent safety, zero carbon emission, abundance of fuel, lack of long-lived radioactive waste, as well as reliability of power supply. In addition, it is estimated that fusion power plants will have the ability to provide electricity to the grid at a cost that will be similar to other energy sources.

The European Consortium for the Development of Fusion Energy (EUROfusion) has set as its goal the production of electricity from fusion by the year 2050. The main milestones in the roadmap for fusion power generation are three major facilities: (a) JET, which is the largest operating tokamak and testbed in fusion physics and technology, (b) ITER, which is under construction and will demonstrate the feasibility of maintaining of fusion with a positive balance in energy production for long periods of time, and (c) DEMO, which will be the first fusion power plant capable of supplying electricity to the grid.

This work will provide an overview of the basic fusion concepts, present the main objectives of the EUROfusion program and discuss the major scientific and technological challenges faced by fusion research today.