OXFORD

Monday 19th September

Ian Chapman, CEO, UKAEA
Introduction to Fusion & Tokamaks
This talk will begin by explaining the UK government strategy to delivering fusion and setting this in the context of other major fusion programmes internationally. It will then describe the major technical challenges required to deliver a magnetic fusion powerplant and give a brief overview of some of the key deliverables and discoveries that will be required on that pathway. An overview of recent major discoveries in the field will be presented to bring the delegates to the cutting edge of the field. Finally, a brief overview of the facilities at Culham will provide an introduction to the site tour later in the day.

Tuesday 22nd September

Susie Speller, University of Oxford
Magnets and Magnet Technology
Superconductors, with their ability to carry enormous electrical currents with no loss in energy, are an essential enable component for providing magnetic confinement in commercial fusion power plants. In this lecture, the diverse range of superconducting materials that can be used in high field magnets are introduced, with a key focus on understanding the specific materials and engineering challenges associated with the extremely harsh conditions of a fusion reactor

Dr Elizabeth Surrey, Former Head of Technology, UKAEA
Heating and Current Drive Technology

There are four types of heating and current drive systems available for tokamaks. Three depend on radiofrequency waves over a range of frequencies, the fourth uses neutral particle beams. The uses of the four different heating and current drive systems will be briefly described with emphasis on the technical requirements imposed by tokamak-based power plants. A technical description, along with example properties (power, frequency, pulse length, etc.) of each system and its individual components will inform the discussion. The components include a wide range of power supplies both d.c. and a.c., special coatings and windows, control and instrumentation, in addition to hardware. Some particularly demanding examples will be included.

Wednesday 21st September

Prof Niek Lopes Cardozo, Eindhoven University of Technology

Socio-economics of Fusion Energy

Will private companies bring fusion to the market soon?

Fusion holds the promise of unlimited, zero-CO2, safe energy, for all, forever. But the technology is extremely challenging. So much so, that after 60 years of research it is still not proven that a power-producing fusion reactor can be realised, the European roadmap projecting the first demonstrator (DEMO) in 2055.

But things have begun to shift, recently. The mainstream, government-funded fusion R&D programmes have achieved some major results: early February the EU programme announced a new fusion energy record achieved in the Joint European Torus (JET), a few weeks after the US inertial fusion programme achieved 'ignition' in the National Ignition Facility (NIF). In the meantime, the construction of the gigantic international fusion experiment ITER is well underway, with first operation expected in about 5 years from now.

The most surprising development, however, is the surge of private companies who aim at building a full power demonstrator within 10 years. As of last year, these companies are attracting billions (!) of private funding and feature highly competent, focused teams. Whereas the government-funded programme focuses on a single concept, the private initiatives explore a dozen different concepts in parallel. And they follow a completely different development philosophy.

In this talk I analyse these developments and discuss which innovation pathway could be the fastest route to fusion power. I compare the different approaches, ask the question how it is possible that private companies could be so much faster than the mainstream programme, and if it is likely they will succeed, and when, if even one of them is successful, fusion could start to play a role in the energy transition – for which thousands of power plants need to be build. The analysis is done in the context of the required energy transition, which dictates the pace but also the required investment level.