A COMPARISON BETWEEN A STEADY STATE AND A PULSED FUSION POWER PLANT

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The paper deals with the evaluation of the likely economic performances of different current drive (CD) fusion power plant, with duty cycle ranging from pure steady state (with non-inductive CD only) to pure pulsed operation (with inductive CD only).

A parametric assessment is proposed, based on estimates of costs and lifetime of components as well as power plant availability, discount rates and technological learning factor, as assumed for the European PPCS models [1]. Whenever possible the investment costs of the various plant components were evaluated referring the corresponding ITER values. For the remaining components, in particular the breading blanket modules, the cost evaluation was made referring to material and design parameters of Model-AB and Model-B of the PPCS studies [1].

As far as the plasma physical parameters are concerned, the same regime as in ITER is referred to, both in the start-up and the flat-top phases.

In order to guarantee the power plant be able to deliver base load electricity at any value of the fusion power duty cycle, heat storage is included in the model and related costs are accounted for.

The main advantages of the hybrid (inductive plus non-inductive) CD solution appear to be a reduced CD power needs and thus a less ambitious assumption as for CD efficiency and a smaller boot-strap current fraction.

Moreover, investment costs and cost of electricity for an hybrid power plant, though including thermal storage, can be lower than for the corresponding steady state, as shown in Fig.1.

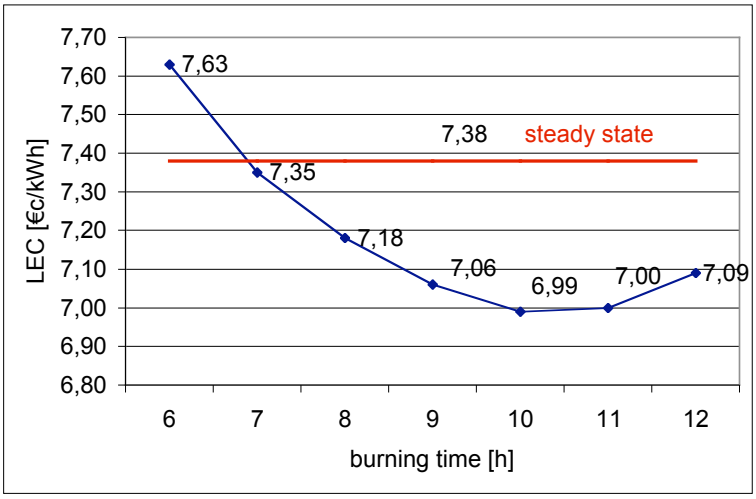

Figure 1: Levelised Electricity Cost as a function of burning time

References

[1] D. Maisonnier et al. "Power plant conceptual studies in Europe" Nuclear Fusion, vol. 47, N. 11, 2007, 1524