27th IEEE Symposium on Fusion Engineering



Contribution ID: 219

Type: Poster

Analysis and derivation of the EU-DEMO high level plant requirements

Tuesday 6 June 2017 13:40 (2 hours)

Ultimately, a DEMO fusion power plant must mature the physics, design, and engineering/technology basis for a future fusion power plant (FPP). In doing so, it must also enable an extrapolable assessment of the economic performance of an FPP. Following discussions with stakeholders and fusion reactor experts, these goals have been further refined into a set of high-level plant requirements. In this work we analyse the implications of these requirements, and derive further requirements which can begin to be allocated to the various plant sub-systems.

In particular, the following requirements are discussed and analysed in more detail:

- Targeted overall plant availability (30%)
- Maximum shutdown duration for maintenance (250 days)
- Tritium self-sufficiency
- Provision of tritium for a fusion reactor beyond DEMO

The implications of the plant availability and unplanned shutdowns on the required tritium breeding ratio and tritium start-up inventory are assessed. The requirement for tritium self-sufficiency necessarily leads to a requirement to provide a tritium stockpile buffer in the event of unforeseen shutdowns. An attempt is made to define a term for this required stockpile of tritium and the implications on the TBR are shown. The presently unconfirmed and ill-defined requirement for DEMO to provide tritium for a future FPP is discussed and attempts are made to reach a coherent and reasonable definition of this requirement. A preliminary assessment of the impact such a requirement would have on the required TBR is made. Sensitivity studies are performed on the maintenance shutdown durations to determine their impact on other high level requirements. Requirements for the overall plant availability are refined and preliminary attempts are made to sub-divide and allocate the availability budget to sub-systems in the form of a lifetime reliability target.

Eligible for student paper award?

No

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Session Classification: T.POS: Poster Session T

Track Classification: Next step devices, DEMO, power plants