Contribution ID: **804** Type: **not specified**

P2.233 First considerations on the Balance of Plant for a HELIAS power plant

Tuesday, 18 September 2018 11:00 (2 hours)

With the advance of fusion research both in physics and engineering and the start of the conceptual design development of respective fusion plants it becomes important to study how fusion will interact with the energy system. However, in order to study the interface between a fusion plant and the energy grid, the details of the Balance of Plant (BoP) must be known and modeled.
Recently, first studies of the BoP for a pulsed tokamak DEMO have been started. Following the DEMO approach, first studies for a stellarator BoP will be presented in this work. In contrast to pulsed tokamaks, stellarators are by design intrinsically capable of steady-state operation. Consequently, stellarators are attractive candidates for a direct-coupled-plant design (DCP) which directly links the primary heat transfer system (PHTS) and the power conversion system (PCS). However, fusion needs to be compatible with the future energy system (Energy System Integration-2050+) that will face significant challenges to balance loads due to the high share of fluctuating sources from massive variable renewable energy sources (VRES). Consequently, the need for sources increases which can be tuned in a flexible way to react on a fast time scale to the needs of the energy system. Therefore, a BoP with an intermediate heat and storage system (IHTS) using an integrated thermal energy storage system (ESS) seems attractive to cope with such demands. However, detailed modeling is required to assess how an ESS can be well coupled with the PHTS. Possible options for the storage could be a solid carrier medium or liquid metals. In this respect, an indirect-coupled-plant design (ICP) seems unnecessary for a stellarator, but remains to be studied.
In this work the BoP with an IHTS is modeled for the HELIAS power plant concept using the industrial software EBSILON® (STEAG).

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Session Classification: P2