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The ITER Power Supplies: status and recommendations for the next tokamaks

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The ITER Electrical Power Supply Systems comprise the Electrical Power Distribution (EPD), the Coil Power Supplies (CPS) and the Heating and Current Drive Power Supply Systems (H&CD PS). They will be connected to the French 400 kV power transmission grid, which will supply about 120 MW steady-state power required by the standard auxiliary loads and 500 MW, 200 Mvar pulsed power for the plasma scenario and control.

Although the design concepts adopted for several components are based on well-established industrial technologies, the huge installed power capacity, which exceed 3 GVA, and the presence of several, large, one of kind components make the ITER Power Supplies quite exceptional both in term of size and complexity. The overall system design and the design, manufacturing and testing of each main component include challenges that have been progressively addressed by design iterations, design studies performed by specialized companies and R&D. Furthermore, impressive test facilities have been built around the world to experimentally perform the proof of concepts and qualify the most demanding components.

At moment, some components required for the post-first plasma operational campaigns are still at the conceptual design phase. At the same time, some high power components of the ITER 400 kV substation are already installed and are ready for their first energization. Moreover, the mass production of the EPD and CPS components is well advanced in order to start the on-site installation at the end of this year.

The first part of the paper summarizes the main technical data, key facts and figures and present status for the procurement and installation of all the ITER Electrical Power Supply Systems. The main justifications which have driven the choice of the design requirements and technologies adopted for the main components are also presented.

The second part of the paper is intended for the designers of the future large Tokamaks and reports the most important lesson learned during the design, manufacturing and testing of the components that have been built so far. Moreover, considering that technologies and devices for high power components are evolving by increasing the power capacity and reducing the unit costs, the paper also reviews new technologies and industrial products that are emerging and should be taken into account in the trade off studies for the power supplies of future large Tokamaks.

Eligible for student paper award?

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