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The ITER Project: progress in construction and the preparations for operation

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The ITER project [1, 2] was established in November 2006 by the ITER Agreement involving seven Members (China, the European Union including Switzerland, India, Japan, Korea, the Russian Federation and the United States of America). ITER is a critical step in the development of fusion energy: its role is to confirm the feasibility of exploiting magnetic confinement fusion for the production of energy for peaceful purposes by providing an integrated demonstration of the physics and technology required for a fusion power plant. At the core of the facility, the ITER tokamak will confine a plasma heated to temperatures in the region of $1 – 2\times10^8$ K, in which deuterium-tritium fusion reactions will produce up to 500 MW of fusion power for periods ranging from several hundred to several thousand seconds. Rapid progress is being made in the on-site construction, the production of components for the ITER tokamak, plant and auxiliary systems, and in the preparations for on-site installation.

Supported by impressive achievements in fusion technology R&D, manufacturing of ITER components is advancing in factories and laboratories around the world. The international collaboration formed around the production of superconducting magnets for the ITER tokamak has produced over 600 t of Nb_3Sn and approximately 300 t of NbTi superconducting strand. 95% of the superconductors required for the ITER magnets are now complete, contributed by 6 out of the 7 ITER partners. Winding packs for the first 4 toroidal field coils have been produced in the EU and Japan, and central solenoid and poloidal field coil fabrication activities on the first-of-kind coils are underway in partners' factories in China, France, Russia and USA. Fabrication of the vacuum vessel is moving forward, with structures being manufactured under the responsibility of four contributing Domestic Agencies, while cryostat elements delivered to the ITER site by India are currently being assembled into large-scale sections of the cryostat (~30 m diameter × ~29 m height). Substantial elements of the power supply and cryogenic systems have also been delivered and several captive (water) drain tanks have been installed, the first equipment incorporated in the Tokamak Complex and the first steps in a multi-year on-site installation programme of tokamak and plant systems which is about to be launched.

Recently, a major update of the ITER baseline schedule and resource estimate has been undertaken, which was endorsed by the ITER Council in November 2016. The revised schedule foresees an earliest technically achievable date for First Plasma of December 2025 (subject to the Members' budget approval) and a target date for the transition to D/DT operation of late 2035. The presentation will introduce the physics basis for the project, review the current status of construction, highlight the progress which is being made in manufacturing and supporting technology R&D activities, and outline the scientific research programme being planned to advance from First Plasma to significant fusion power production in DT plasmas.

References

[1] *ITER Technical Basis*, ITER EDA Documentation Series No. 24, IAEA, Vienna (2002).

[2] B. Bigot, paper OV/1-2, *Proc. 26th IAEA Fusion Energy Conf., Kyoto,* (2016).