

Fusion for Energy activities on the ITER fuel cycle and the European Roadmap for fuel cycle technology developments

Wednesday 11 June 2025 10:10 (40 minutes)

Fusion For Energy is responsible for delivering large units of the ITER fuel cycle. This involves extensive design and technology developments for the tritium plants' Isotope Separation and Water Detritiation systems in preparation for manufacturing. The manufacturing of the cryogenic adsorption pumps for the ITER torus and plasma pumping is well advanced, and the delivery of the fully tritium-compatible Torus Cryopumping System to ITER is nearly complete.

In parallel with the procurement activities for ITER, Fusion for Energy launched a Technology Development Programme (TDP) in 2024 as part of its Industrial Policy implementation actions. This TDP aims to build and reinforce European Fusion Supply chain capabilities for critical future commercial fusion technologies.

To define the fuel cycle roadmap, it was first necessary to identify the fuel cycle key technologies and their current technology readiness level. Fusion for Energy organized a Fuel Cycle workshop that covered vacuum pumping, storage and injection, fuel purification, isotope separation, water detritiation, air detritiation and tritium management. Starting with an online event in February 2025 an exhaustive list of fuel cycle technologies was prepared to complete the drafted fuel cycle technology map.

During the in-person workshop in March 2025, Fusion for Energy brought together academia, research laboratories, industry, start-ups and the ITER Organization to discuss and characterize each of these technologies. Experts from all relevant technology fields contributed to creating a database with the current readiness level of the mapped technologies. The database includes information on the applicability of the technologies, available test facilities, active and interested European entities, and the necessary next steps to advance technology's maturity. The 80 participants developed a comprehensive technology database that allows for defining a European roadmap for the Fusion Fuel Cycle domain.

The outcome will serve all stakeholders to guide their actions in their respective domains and interests, allowing an effective investment of resources. Given the fast evolution of technology, a periodical follow-up of the workshop outcome is assured in subsequent technology mapping exercises.

The presentation will provide a brief overview of the current F4E activities for the ITER fuel cycle procurements and will outline the new activities of the Fuel Cycle Technology Development Programme, including the 2025 European Roadmap for fusion fuel cycle developments.

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Session Classification: Tritium Fuel Cycle

Track Classification: Tritium Fuel Cycle