Presentation Overview

- F4E procurement scope in the ITER Fuel Cycle (FC) area:
  - Water Detritiation System (WDS);
  - Hydrogen Isotope Separation System (ISS).

- Hints for F4E Tenders.
The ITER Fuel Cycle: overview

Disruption Mitigation System
- Gas Puffing
- Glow Discharge Cleaning
- Fusion Power Shutdown System
  - Service Vacuum Systems
  - Neutral Beam Injection
    - Neutral Beam Cryo Pumps
  - Torus Cryo Pumps
  - Roughing Pumps
  - Leak Detection
  - Automated Control System, Interlock System

Fueling
- Gas Distribution
- Pellet Injection

Storage and Delivery
- Isotope Separation
  - Tokamak Exhaust Processing
    - (1), (2), (3)
  - Analytical System

External Supplies
- Tritium Depot
- MBA 2

Isotope Separation
- H/D + T (ppm levels)

Water Detritiation
- O₂/NO₂ + Q₂
- O₂

Atmosphere and Vent Detritiation
- Off Gas Release
- Hydrogen Release

Torus
- Cryostat
- Cryo Pumps

Q₂: mixture of hydrogen isotopes (H, D, T),
(1) Hydrogen-like gases: He, Ne, Q₂;
(2) Air-like gases: CO, CO₂, Ar, N₂, O₂, NO;
(3) Water-like gases: Q₂O, hydrocarbons (CQ₄)
WDS objectives are:

- To provide interim storage of tritiated water in Water Holding Tanks and Emergency Tanks;
- To detritiate water and discharge detritiated hydrogen streams (oxygen is exhausted via the gas detritiation system).

This is achieved by the Combined Electrolysis Catalytic Exchange method:

- Cracking tritiated water into hydrogen and oxygen (current design 20 kg/h@10Ci/kg);
- Stripping the residual tritium from the hydrogen stream before its exhaust through stack.
- Returning tritium to the Fuel Cycle via the Isotope Separation System (ISS).
- Releasing Oxygen via Atmosphere Detritiation System (DS)
Current status of procurements:

**F4E**

- Contracts for preliminary and final designs and manufacturing for:
  - Emergency Tanks, Water Holding Tanks, Feeding Tanks (completed 2019);
- Contract for preliminary design of WDS Main part (completed 2016)

**ITER IO**

- 4 year multi-Lot Engineering framework contract tender underway (Launched in 2019) with one specific Lot for WDS preliminary design support
  - Focus on providing support on outstanding specific component technical issues to reduce technical risk on core components such as electrolysers, hydrogen permeators, catalytic exchange columns…etc.
LPCE-columns (L16 m x D 500mm)

Feeding Tanks (2x12 m³)

Emergency Tanks: 2x100 m³ (L 9.4m x D 3.9m, x H 4.8m)

4x20 m³ Tritiated Water holding Tanks (D 3.2m x H 4m, 10⁻⁶-100 Ci/kg)

High level Tritiated Water holding Tanks (2x7 m³, 100 Ci/kg up to 300 Ci/kg)

Electrolyser units (up to 500 Ci/kg)

TEP decay tanks

ISS

Preliminary design by Kraftanlagen Heidelberg GmbH
ITER WDS: 100 and 20 m³ Tanks installed

Final Design and Manufacturing by ENSA

RIBM, 07-08 April 2021, Giovanni Piazza
**Water Detritiation System contract 2023-2030**

**Scope:**
- Final Design,
- Manufacturing,
- Testing, packing & delivery to ITER

**Procedure:** Competitive with Negotiation

<table>
<thead>
<tr>
<th>C-for-T</th>
<th>Award</th>
<th>FDR</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2/23</td>
<td>Q3/24</td>
<td>Q4/25</td>
<td>Q3/30</td>
</tr>
</tbody>
</table>

- 2023-2024
  - Call for Tender, negotiation, award.
- 2024-2025
  - Final Design including FDR
- 2026-2030
  - Manufacturing and factory testing
- 2030
  - Delivery

**Competences required:**
- Chemical engineering: distillation technologies, packing/catalysts, permeators, electrolysers,
- Mechanical Engineering: manufacturing of medium/large size component, glove-boxes
- Handling of tritiated gases,
• HISS Objectives are:
  
  ➢ Recycling of tritium & deuterium from ITER Tokamak exhaust;
  
  ➢ Support of WDS operation by detritiation of hydrogen stream for discharge.

• This is achieved by:
  
  ➢ Cryogenic distillation to separate the hydrogen isotope mixtures supplied by various ITER systems;

  ➢ deliver the products at required hydrogen isotope quality to the Storage and Delivery System (SDS) and the WDS;
Current status of procurement:

**ITER IO**

- Contracts for conceptual design of HISS completed (2019):

- 4 year multi-Lot Engineering framework contract tender underway (Launched in 2019) with one specific Lot for HISS preliminary design support
  
  - Focus on providing support on outstanding specific component technical issues to reduce technical risk on core components such as cryo-heat exchanger cryo-distillation columns.
Hydrogen Isotope Separation System contract 2023-2029

Scope:
- Final Design,
- Manufacturing,
- Testing, packing & delivery to ITER

Procedure: Competitive with Negotiation

C-for-T Q2/23
- 2023-2024
  Call for Tender, negotiation, award.

Award Q3/24
- 2024-2025
  Final Design including FDR

FDR Q4/25
- 2026-2029
  Manufacturing and factory testing

Delivery Q2/29
- 2029
  Delivery

Competences required:
- Chemical engineering: distillation technologies, packing, He-refrigerators,
- Mechanical Engineering: manufacturing of medium/large size component, glove-boxes,
- Handling of tritiated gases.
Hints for F4E Tenders

• Key aspects to be considered when applying for F4E procurements:
  
  o **F4E is an EU agency** and follows public institution financial regulations, i.e. limited flexibility in comparison with private enterprises.

  o **Competitive with Negotiation** procedure contracts are planned in the Fuel Cycle area; Invitation to Tender (ITT) are published on the EU official Journal and on F4E Website (12-15 months duration from ITT to contract signature).

  o **ITER is a Nuclear Installation** and a *first of its type facility* ⇒ very stringent safety and quality requirements ⇒ *not negligible effort/time* will be spent in:
    
    - documentation preparation and review;
    - development of design, manufacturing and testing with associated procedures reviews;
    - qualification of personnel with the associated documentation (SQEP);
    - Audits carried out by F4E and ITER IO but also, potentially, by French Authorities (ASN).
Contact: Fusion for Energy’s Market Intelligence Group

Mehdi Daval: mehdi.daval@f4e.europa.eu, (+34.93.489.7454)

Follow us on:

- www.f4e.europa.eu
- www.twitter.com/fusionforenergy
- www.youtube.com/fusionforenergy
- www.linkedin.com/company/fusion-for-energy
- www.flickr.com/photos/fusionforenergy