FUEL CELLS AND HYDROGEN
JOINT UNDERTAKING

MultiPLHY

Risk Assessment Approach

Workshop on Safety of Electrolysis

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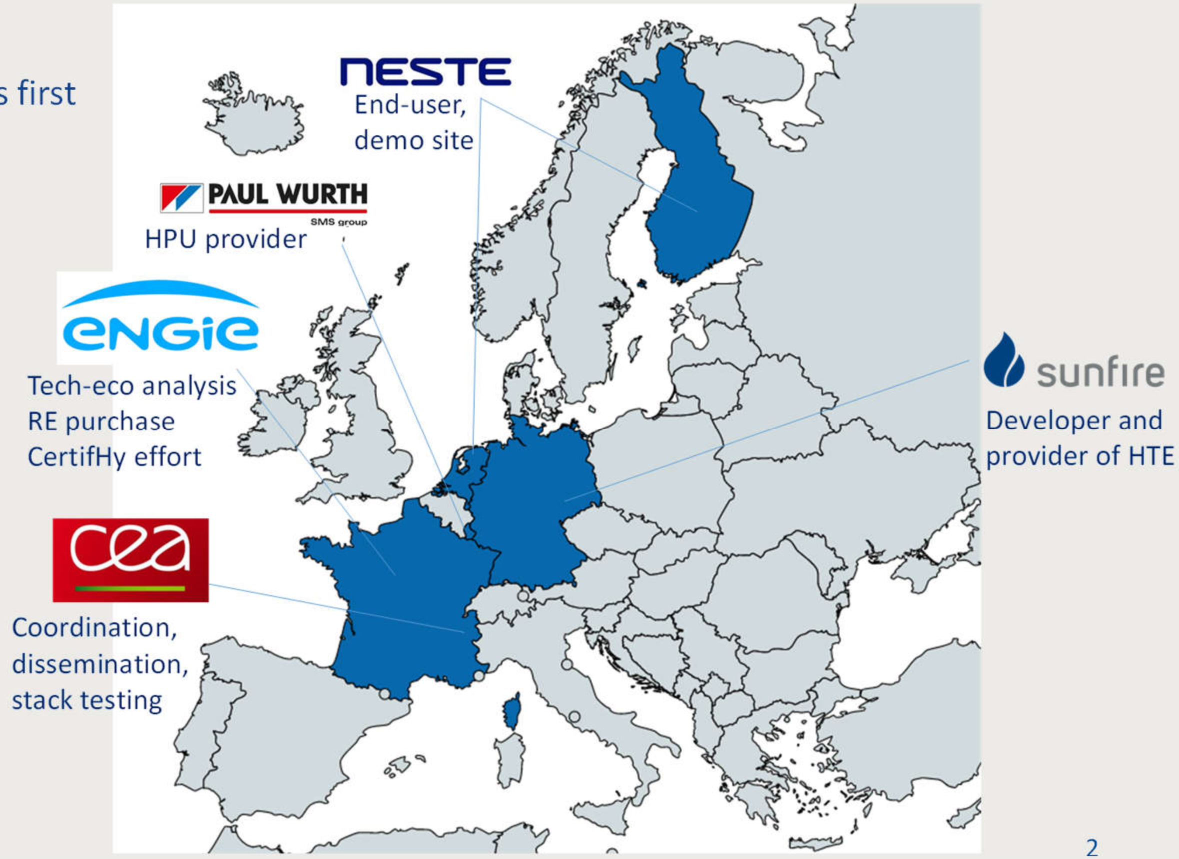
Workshop on Safety of Electrolysis

Project Brief

- Manufacturing, installation and integration of the world's first high T electrolyser (HTE) system in multi-megawatt-scale
  - Using SOEC technology
  - High electrical efficiency by utilizing steam instead of water
- Partners: CEA, **Neste, Engie, Paul Wurth, Sunfire**
- Safety responsible Person (per partner):
  - Emma Mehik (Neste)
  - Mirco Schlang, Anand Agrawal (Paul Wurth)
  - Linda Febvre, Sebastine Quesnel (Engie)
  - Jörg Brabandt (Sunfire)



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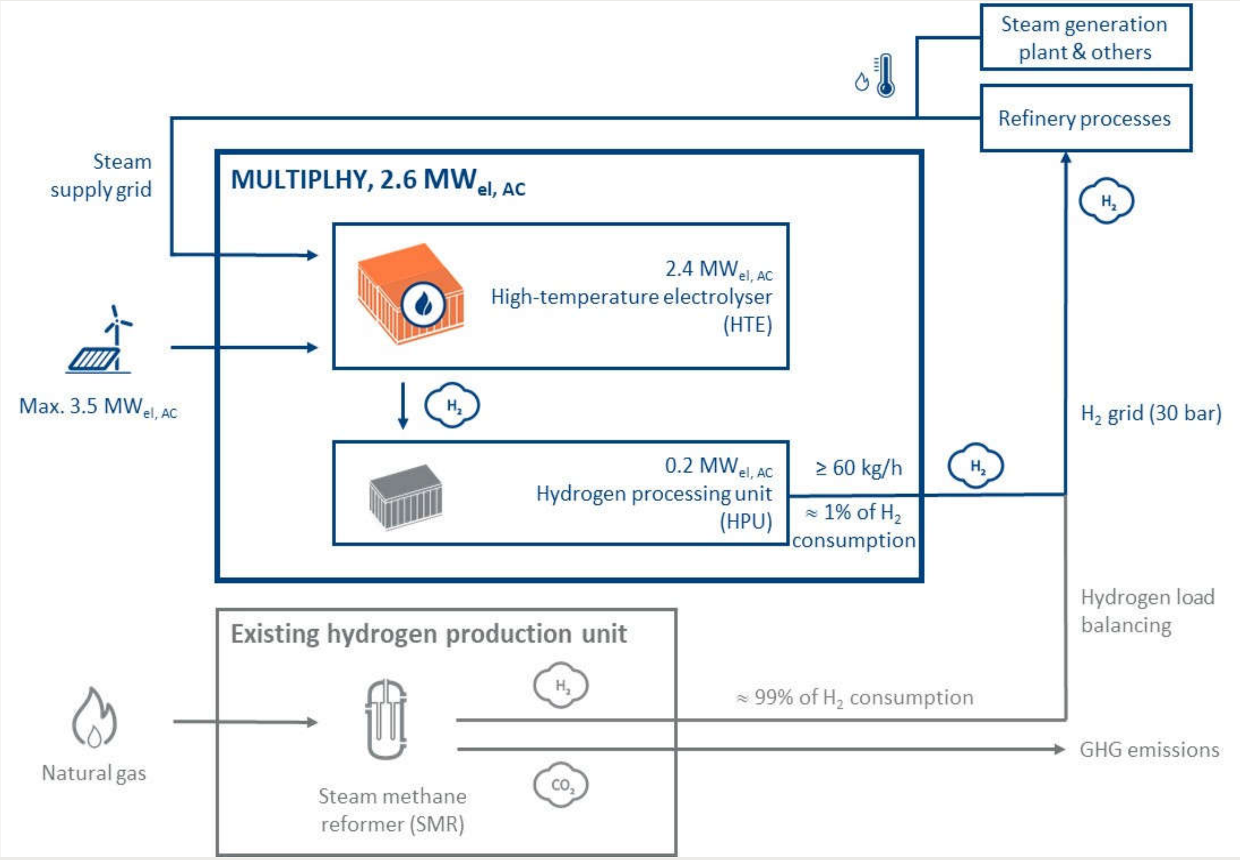
Project Brief

- H_2 production rate of ≥ 60 kg H_2/h (≥ 670 Nm³/h)
- Low inventory (< 5 kg H_2)
- Electrical power input about 2.6 MW_{AC}
- Location:
  Neste biorefinery, Port of Rotterdam
- Operation period of 16.000 h planned



Project Brief

- Acknowledgement
  This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 875123

	Year 1 2020				Year 2 2021				Year 3 2022				Year 4 2023				Year 5 2024			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
WP1 Coordination and Management																				
WP2 Stack Tests at 10 kW in Laboratory																				
WP3 System Design and Manufacturing																				
WP4 Integration in Refining Process																				
WP5 Technology Validation and Demnonstration																				
WP6 Regulatory Framework & Guarantee of Origin for the Hydrogen (CERTIFHY)																				
WP7 Market, Techno-Economic and Environment Studies																				
WP8 Dissemination, Communication and Exploitation																				

Regulations, Codes and Standards

- Machinery Directive (HTE and HPU); Pressure Equipment Directive (HPU)
- Directive 1999/92/EC (ATEX 137; for operation)
- To show compliance with these directives, amongst other the following widely recognized or under these directives harmonized European standards are used:
  - DIN EN ISO 12100:2011-03; Safety of machinery - General principles for design - Risk assessment and risk reduction
  - DIN EN ISO 13849-1:2016-06; Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design
  - DIN EN 60204-1:2019-06; Safety of machinery - Electrical equipment of machines - Part 1: General requirements
  - DIN EN 60079-10-1: 2016-10; Explosives atmospheres – Part 10-1: Classification of areas – Explosive gas atmospheres
  - DIN EN 61511-1:2019-02; Functional safety - Safety instrumented systems for the process industry sector - Part 1: Framework, definitions, system, hardware and application programming Requirements
- Within the project, design rules of the facility apply at the interfaces (piping, communication)
  - E.g. ANSI standard for flange connections

Risk Assessments

- Risk assessment and HAZOP performed by Paul Wurth (for HPU) and Sunfire (for HTE)
  - Internal in the companies for the conformity process of the units
  - Each involved TÜV Süd (different departments) for advisory and approval of explosion protection concept
- HAZOP of integrated system to be performed in near future under the lead of Neste (facility, operator)
  - As step 3 of Neste‘s „Six Step safety process“
  - Next steps to follow

- Internal requirements (processes, documentation) of the different partners not completely clear from the beginning
  - How deep is the „user“ involved into safety related design and processes for a „package unit“
- Different approaches of the partners may lead to deviations and extra work
  - To be overcome in a combined workshop (planned)

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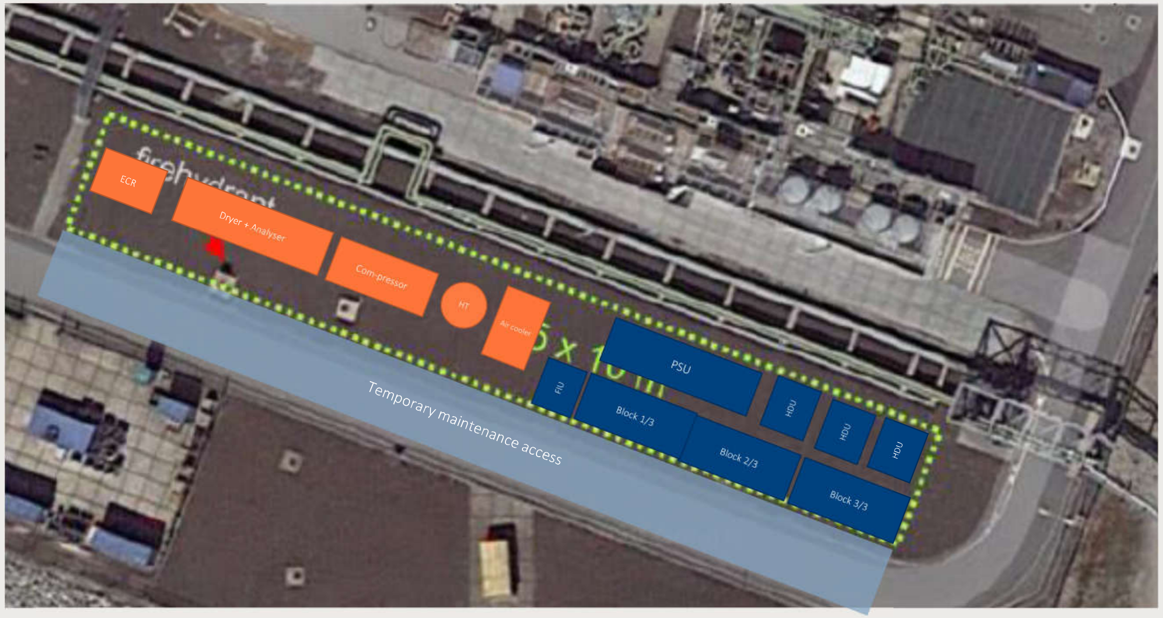
Prevention and mitigation



- ATEX zones:
  - System NOT designed to be installed in an ATEX zone
  - Only local zones will be marked (flanges, blowouts)
- Two different ventilation concepts:
  - HTE (High Temperature Electrolyser):
    - installed in open shelter;
    - natural ventilation of small leakages (at flanges or similar)
  - HPU (Hydrogen Processing Unit):
    - container with forced ventilation (safeguarded)
- Hydrogen sensors in HTE area and HPU
- Safety relief valves, pressure controllers (where applicable)
- Dilution of operational released Hydrogen (with air; below LEL; safeguarded)

Operational concepts, education and training

- Documentation of safety-related procedures to be implemented
  - General start-up procedure (when and how to vent initial Hydrogen)
  - Develop procedures for inerting pipes, vessels and HTE for commissioning, maintenance and decommissioning
- Maintenance concept to follow legal requirements and on-site standards (e.g. frequency of gas sensor calibration, leakage tests)
- Initial training for operator and maintenance team foreseen

Safety issues observed so far

- Location and position of vents to be chosen after flow distribution calculations
- Continuous venting of oxygenated air to be considered for the dimension of ATEX zones

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For further information
https://multiplhy-project.eu/