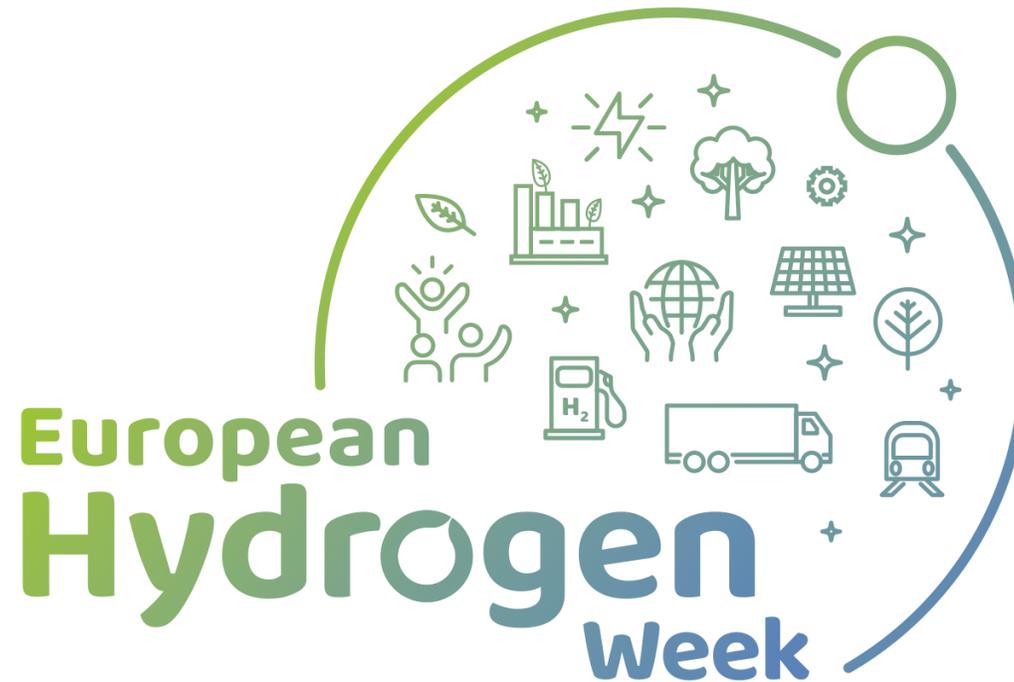


INNOSOFC

Development of innovative 50 kW SOFC system and related value chain

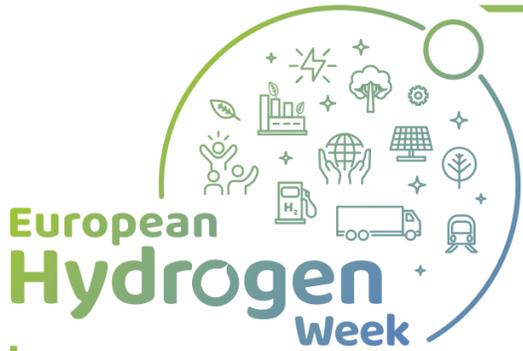


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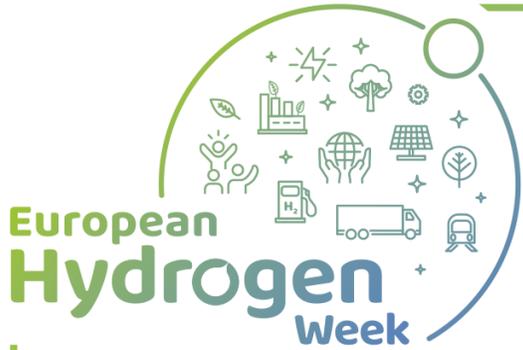
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Project Overview

- Call year: 2014
- Call topic: FCH-02.5-2014 Innovative fuel cell systems at intermediate power range for distributed CHP generation
- Project dates: 1.9.2015-31.10.2019
- % stage of implementation 11/2020: 100%
- Total project budget: 4 M€
- FCH JU max. contribution: 4 M€
- Partners: VTT, Elcogen Oy, Convion Oy, ElringKlinger AG, Forschungszentrum Jülich, ENEA, BlueTerra Energy Experts



Project Summary

Main objectives:

- Design, manufacture and demonstrate a SotA 60 kW SOFC system with 60% electrical efficiency and 4000 €/kW cost
- 3000 hours system demonstration and 10000 hours stack demonstration
- Identification and analysis of most promising end-users and applications

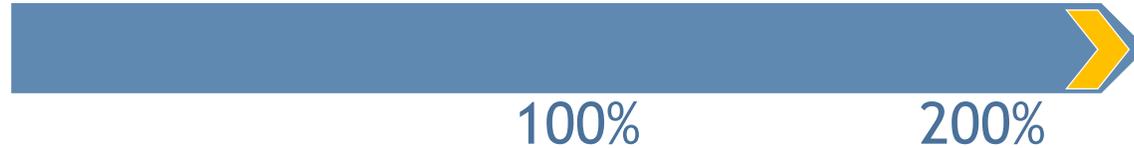
The project is based on the products of industrial partners (Convion, BlueTerra Energy Experts, Elcogen, and ElringKlinger) and motivated by their interest to further improve their products and consolidate an efficient value chain by collaboration.

Research centres, VTT, ENEA, and Jülich, support these companies to further develop, experimentally validate and demonstrate their products.

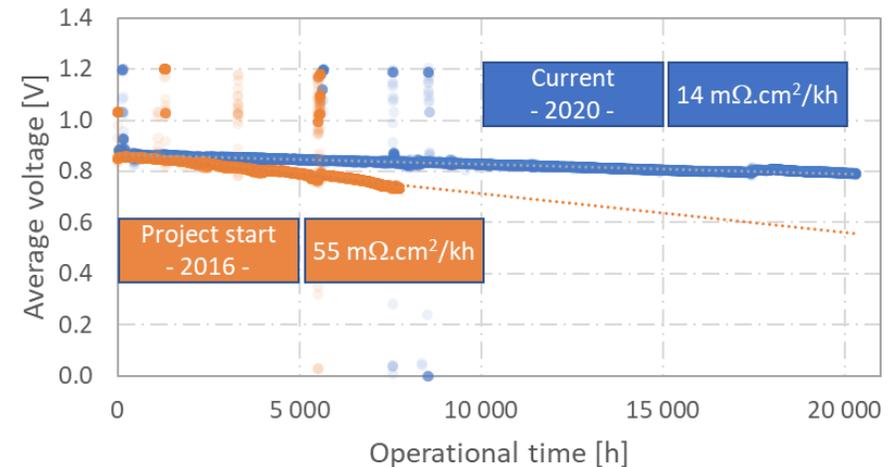
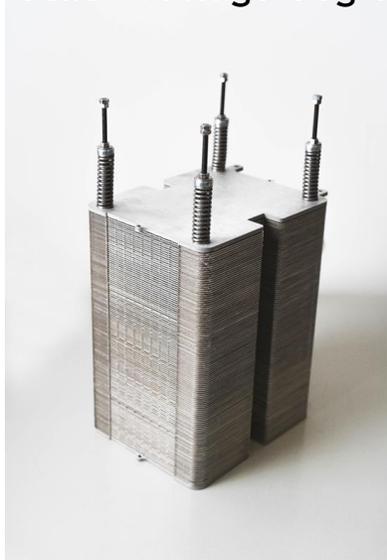
Project Progress - Stack development and manufacturing

Achievement to-date

Duration of stack demonstration



- Elcogen has optimized E3000 stacks for INNO-SOFC system in terms of manufacturability, pressure losses, and stack-system interface
- Stack durability has been demonstrated in >20000 hours test, which is on-going. Project target was 10000 hours demonstration. Stack voltage degradation rate has been below 0.5%/1000 hours.



Project Progress - System development

Achievement to-date

System
efficiency



Project
target 60%

INNO-SOFC system highlights

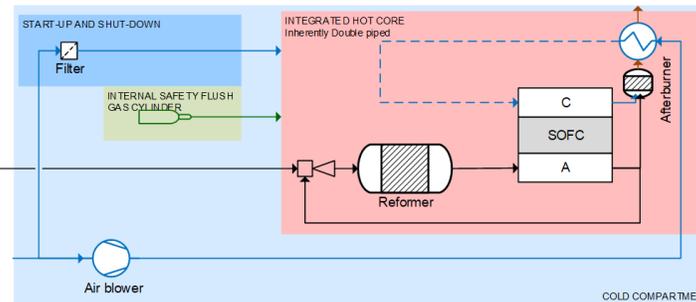
- No moving parts in anode recirculation
- No water feed
- All-in-one hot compartment, minimum feedthroughs
- Single and simple heat exchanger
- 67% reduction in component count

System efficiency

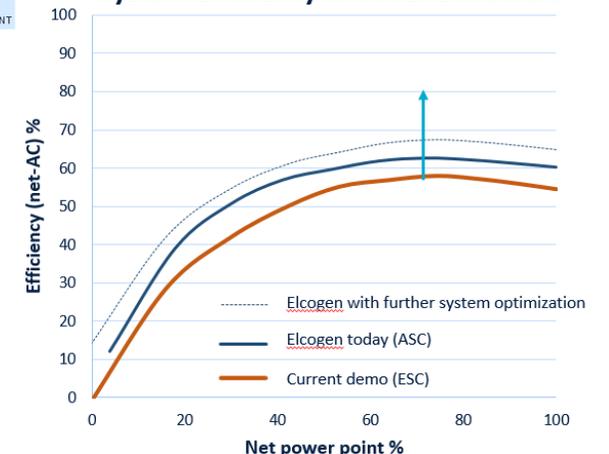
- 57%: achieved with ESC stacks
- 62-63%: peak efficiency with Elcogen ASC stacks
- 65-67%: Elcogen ASC with further system optimization
- Higher total energy efficiency achieved with building a heat recovery system (15-20% in addition)

Now:

- Customer interest increasing strongly in Asia and Europe
- Forming partnerships on key markets
- Establishment of delivery capacity

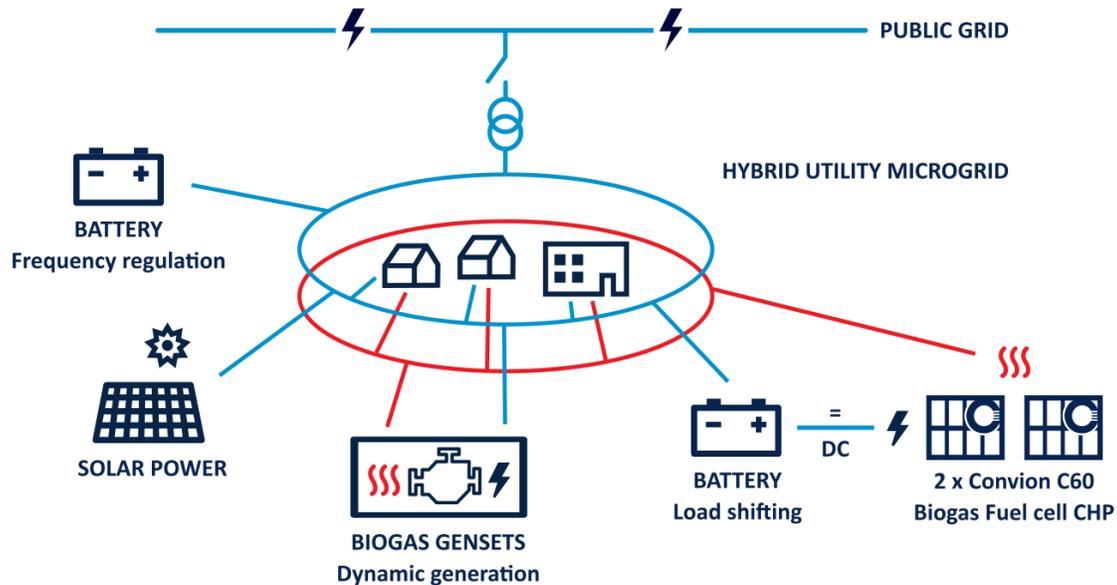


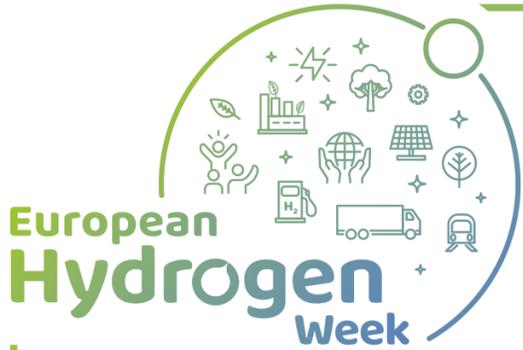
System efficiency with various stacks



Project Progress - System demonstration

- INNO-SOFC system is being demonstrated in LEMENE - an ambitious Finnish hybrid microgrid project for power independence 24/7, around the year.
- Two Convion C60 / INNO-SOFC SOFC units configured to DC power producing mode with combined output of 130kW.
- SOFC + battery storage powers the microgrid; exhaust /heat will be captured to a district heating system.
- First C60 system in continuous operation at site since 06/2020. Second system to be delivered end of 2020



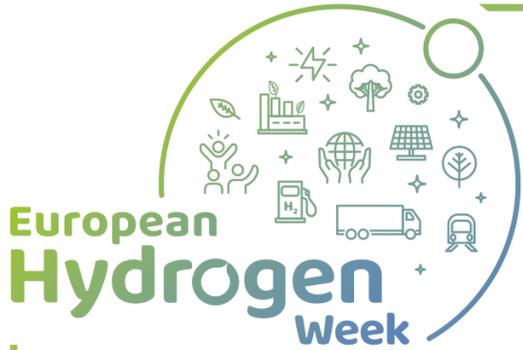


Risks, Challenges and Lessons Learned

System design and manufacturing took much more time than expected for several reasons:

- Redesign of the frame. Frame structure was changed from a separate pipe frame to a self-supported sheet structure, which was needed to reach cost target.
- Implementation of learnings from DEMOSOFC project.

Project duration was extended by 14 months.



Exploitation Plan/Expected Impact

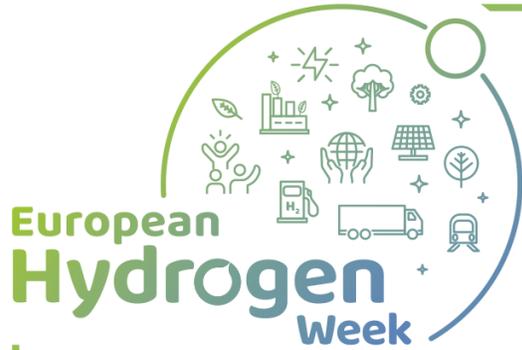
Exploitation

Industrial partners have improved and demonstrated their products, services, and supply-chains, which they will utilize in their businesses.

Research partners have improved their experimental facilities and know-how related to SOFC technology. This has led to wider and deeper offering for companies and public sector.

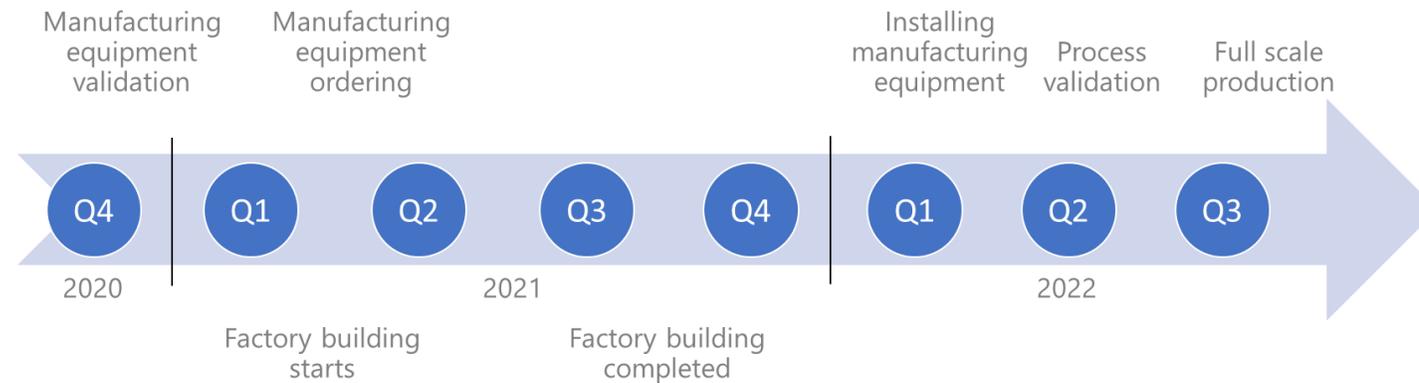
Impact

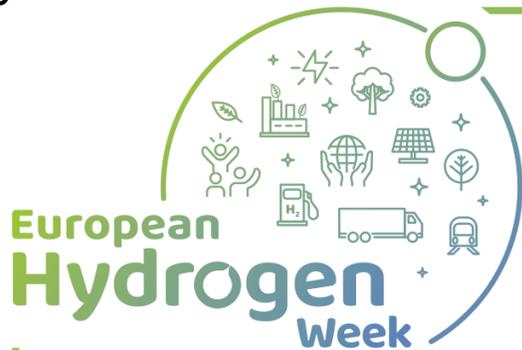
- Strong European value chain for SOFC systems from single cells and interconnects to stacks and complete systems.
- SOFC system with SotA efficiency
- Integration of knowledge from other EU-projects (NELLHI, DEMOSOFC, qSOFC)



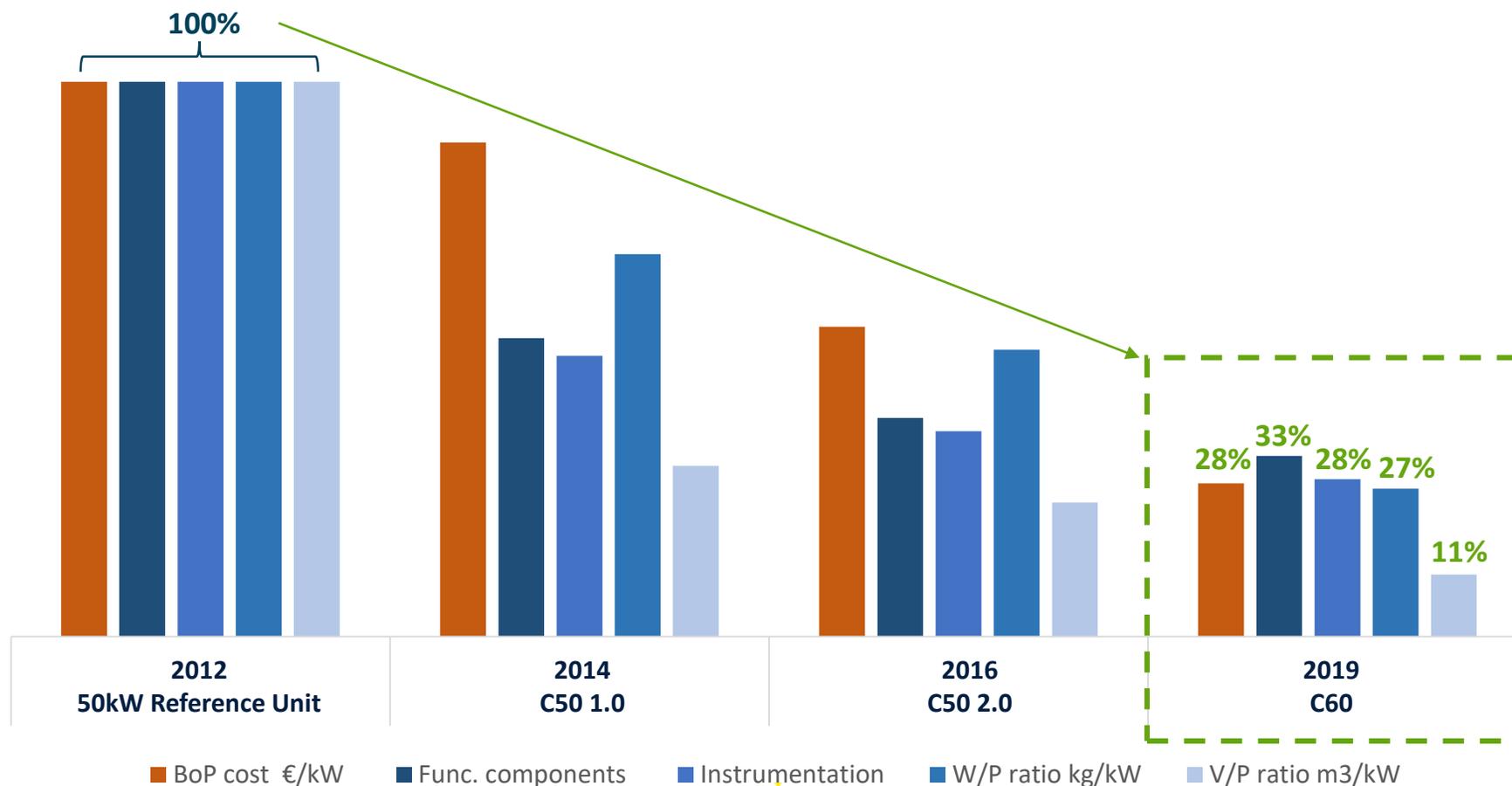
Impact example: Elcogen

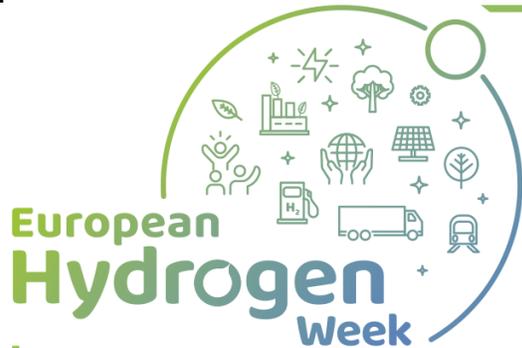
- Positive results obtained from INNO-SOFC and qSOFC projects have contributed to Elcogen and the European Investment Bank (EIB) signing a 12 M€ quasi-equity loan facility for further research and development, supported by the European Commission under the InnovFin program
- The goal of the financing is to aid in the set-up of a demonstration manufacturing plant for cells and stacks used in solid oxide fuel cell systems, creating highly skilled local jobs in the process
- Target capacity for the new factory is 50 MW/a and it will be located in Tallinn





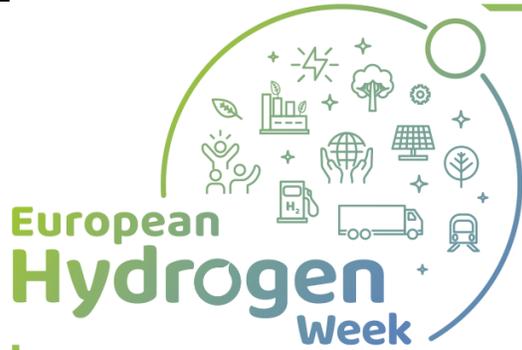
Impact example: Improvement of Convion's system





Dissemination Activities

- 20 presentations in workshops and conferences
- Three press releases (Elcogen and Convion)
- Two workshops organized, presentations in 9 conferences
- Five scientific articles
- INNO-SOFC newsletter distributed to 200 professionals
- Nine public deliverables
- Promotional and educational video, together with qSOFC and DEMOSOFC projects:
<https://www.youtube.com/watch?v=KK-sjnnEcuo>



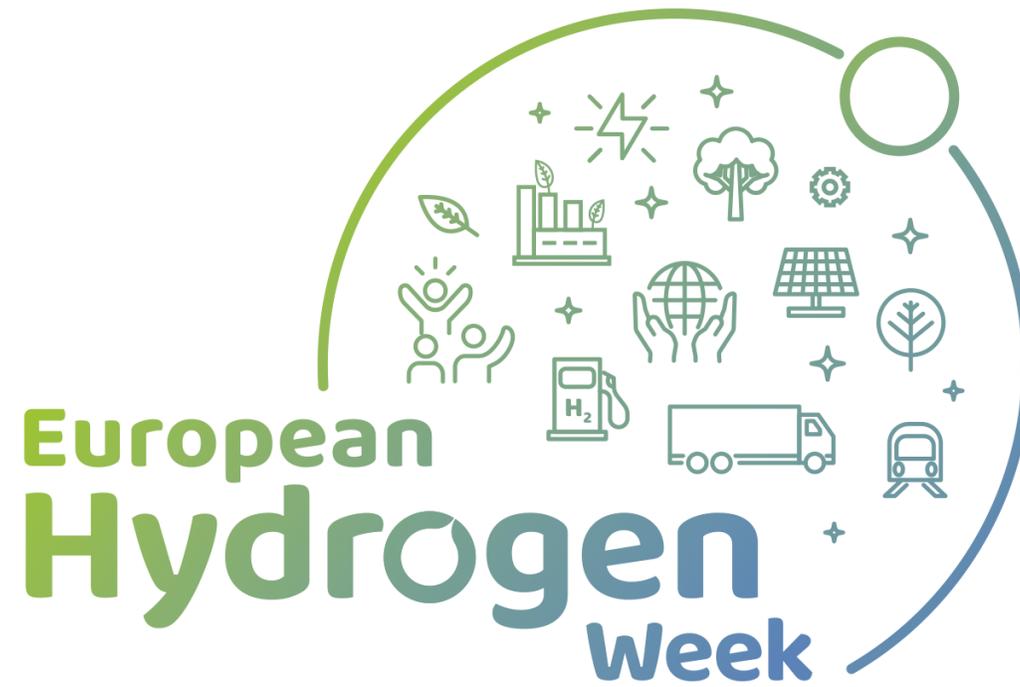
Synergies With Other Projects And Programmes

Interactions with projects funded under EU programmes

- FCH JU NELLHI: single cell and stack development, joint workshop
- FCH JU DEMOSOFC: system design, manufacturing, operational experience, joint workshop
- FCH JU qSOFC: quality assurance of stacks and stack components
- Marie-Curie HELTSTACK: single cell and stack development, joint workshop

Interactions with national and international-level projects and initiatives

- Finnish-German bilateral project STEP: stack development and characterization, joint workshop
- IEA Annex 32 (SOFC): information exchange
- EERA: information exchange



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