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RESEARCH DAYS
15-16 NOVEMBER

FCH2RAIL

Fuel Cell Hybrid PowerPack for Rail Applications

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**Co-funded by
the European Union**

Project Overview

- Call year: 2020
- Call topic: FCH-01-7-2020 - **Extending the use cases for FC trains through innovative designs and streamlined administrative framework**
- Innovation Action (IA)
- Project dates: 1 January 2021 - 31 December 2024
- % stage of implementation 01/11/2023: 75%
- Total project budget: 13,4 M€
- Clean Hydrogen Partnership max. contribution: 10 M€
- Other financial contribution: N/A

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Partners



TOYOTA
Toyota Motor Europe

CAF
Construcciones y Auxiliar
de Ferrocarriles

DLR
German Aerospace Center

renfe
Renfe Operadora

Stemmann-Technik
Stemmann Technik

**Infraestruturas
de Portugal**

adif
Administrador de
Infraestructuras
Ferrovias

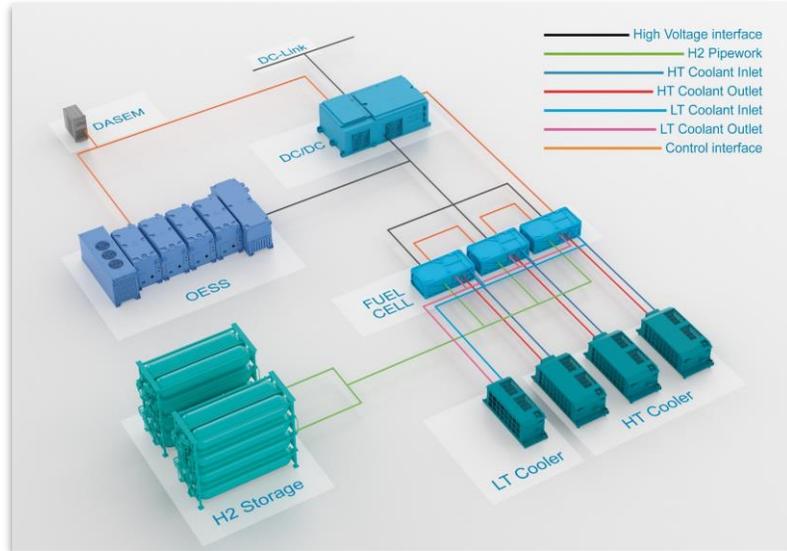
**Centro Nacional del
de Hidrogeno**



Project Summary

Main Objectives:

1. Develop, build, test and homologate a multi-purpose **Fuel Cell Hybrid PowerPack**
2. **Demonstrate FCHPP** in a Bi-mode Civia multiple unit
3. Propose a **normative framework** for hydrogen in railway vehicles
4. **Demonstrate competitiveness** of fuel cell traction against existing diesel solutions
5. Identify and benchmark **innovative solutions to improve energy efficiency**



Project Summary

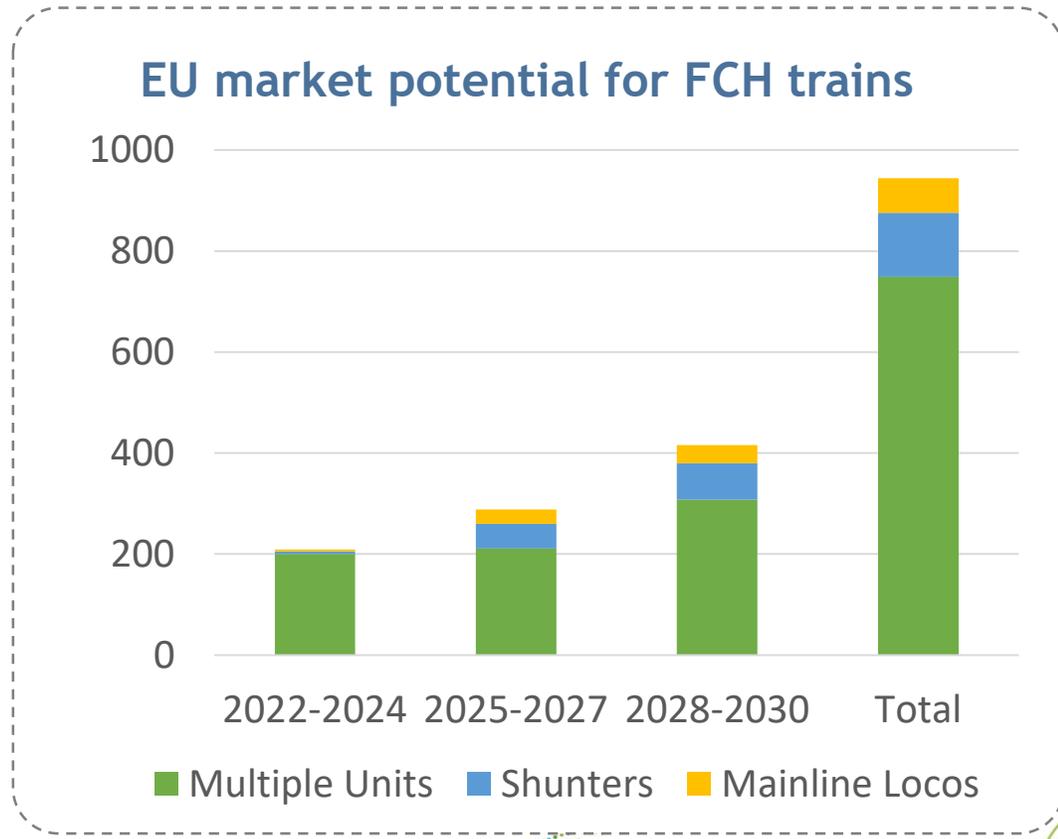
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- Application and market area:



- Global positioning vs international state-of the art:

- FCH2RAIL develops a multi-purpose PowerPack suitable for different applications, with or without catenary
- International SoA: Pure hybrid H2 trains, no Bi-Mode functionality

Source: [Study on the use of Fuel Cells and Hydrogen in the Railway Environment - Europe's Rail \(europa.eu\)](https://europe.europa.eu/en/stories/2022/05/24/clean-hydrogen-partnership)



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Project Progress/Actions - TRL7 Homologation of FCH PowerPack



Achievement to-date

TRL 4-5

Status at M1



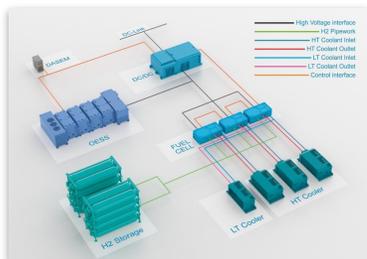
25%

50%

75%

TRL7

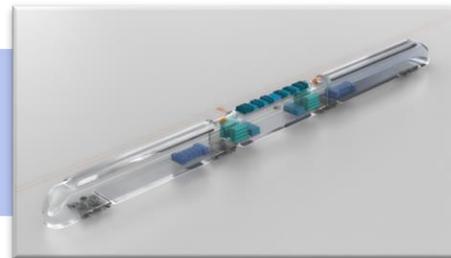
Specific Objective 1: Develop, build, test and homologate a multi-purpose Fuel Cell Hybrid PowerPack applicable for different rail applications (Multiple Unit, Mainline and Shunting Loco) and suitable for retrofitting existing trains, to reach TRL7.



2021
FCHPP development



2022
FCHPP testing



2022
FCHPP integration



2022/2023
Train tests and homologation



May 2023
1st Authorization



Project Progress/Actions - FCH Bi-mode Train Demonstration

Achievement to-date

Status at M1



Specific Objective 2: Demonstrate the Fuel Cell Hybrid PowerPack in a Bi-mode multiple units using external energy supply in catenary operation and fuel cell hybrid system as power source on non-electrified sections, supported by an innovative train wide energy management system to minimise the energy and power consumption.

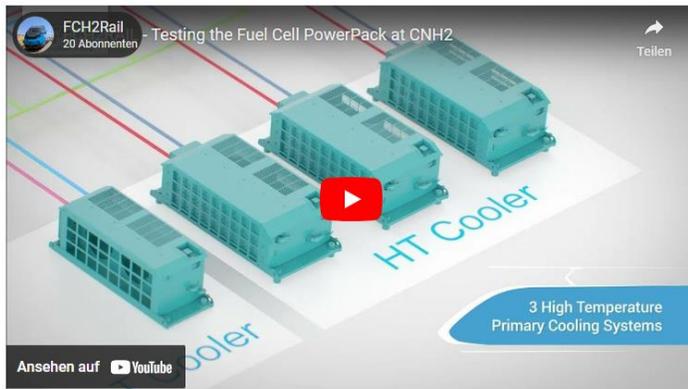
Achievements:

First Hydrogen Train on the Spanish railway network

- 5. June 2023 : Bi-mode fuel cell train running on public tracks in the Pyrenees and in Canfranc station.
- Since November 2023: Bi-mode fuel cell train running on public line Torralba – Soria.

Video documentation of project achievements

Testing the FCHPP



<https://youtu.be/mC7EGb9VA7w>

Train transformation



<https://youtu.be/bFBR6nhyEVI>

The Journey Begins!



<https://youtu.be/s4JfnDbrLW8>

Risks, Challenges and Lessons Learned

H2 refueling more challenging than expected:

- Identification of applicable standards and regulations for H2 in railway environment
- lack of commercial solutions to refuel large quantities of hydrogen in a short time
- supply chain availability

Mitigation Measure:

Development of HRS prototype in FCH2RAIL project

Current status:

- So far provisional dispenser solutions have been applied to enable train operation
- since November 2023 parts of the HRS are in operation



Exploitation Plan and Expected Impact

Exploitation

The project partners...

- established processes for homologation and authorization of H2 trains in Spanish and Portuguese railways
- validated technical concepts on system and subsystem level for further product development
- gain real live experience for decision-making about introduction of H2 trains in the railway network
- participate in national and international standardization activities:
 - provided “Normative Gap Analysis” to stakeholder network in hydrogen and railway sector
- published results and datasets:
 - in scientific journals and conferences, i.e. IJHE, TRA, EHEC, WCRR, IRSA, InnoTrans 2022
 - in project webpage www.fch2rail.eu, YouTube , LinkedIn
 - datasets of line analysis and train driving profiles publicly available in zenodo repository

Impact

- Proof of technical feasibility and approvability of H2 trains in Spanish railway network achieved
- Bi-mode operation enables new services currently not provided by conventional diesel trains or pure fuel cell hybrid trains
- Visibility of the new technology, in railway and hydrogen communities and to the general public

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Horizontal Activities Interfaces and Co-operations





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