



Authorization experience in hydrogen test trains on the Spanish railway network

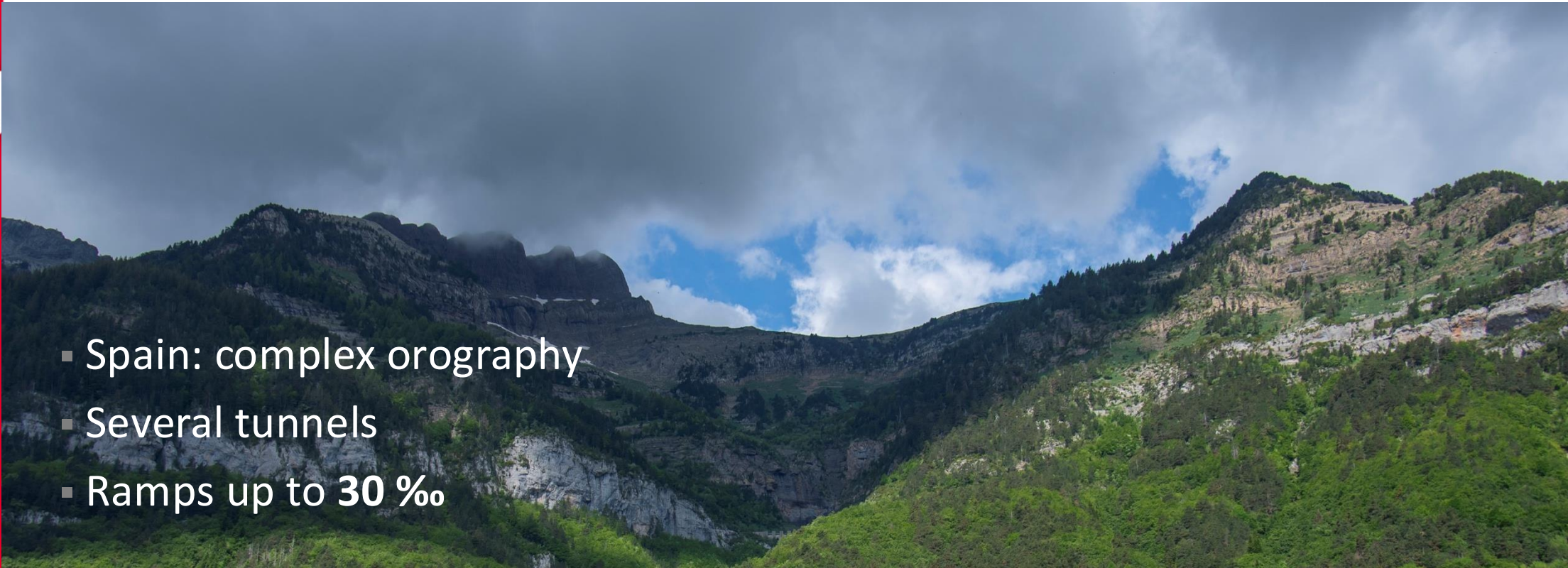
Inés Vadillo Cortázar_Head of R&D Sustainability Project in Adif

 **17-21**
Sept. 2024

 **Vienna, Austria**
Aula der Wissenschaften

Adif Railway Network Authorization process

- Spain: complex orography
- Several tunnels
- Ramps up to 30 %



Adif Railway Network Authorization process

Hydrogen test in Spain

- ### 1) Tardienta – Canfranc

June 2023

- ## 2) Torralba – Soria

Nov. 2023

- ### 3) Zaragoza – Teruel:

Dec/ Jan 2023

- #### 4) Madrid - Mérida

March 2024

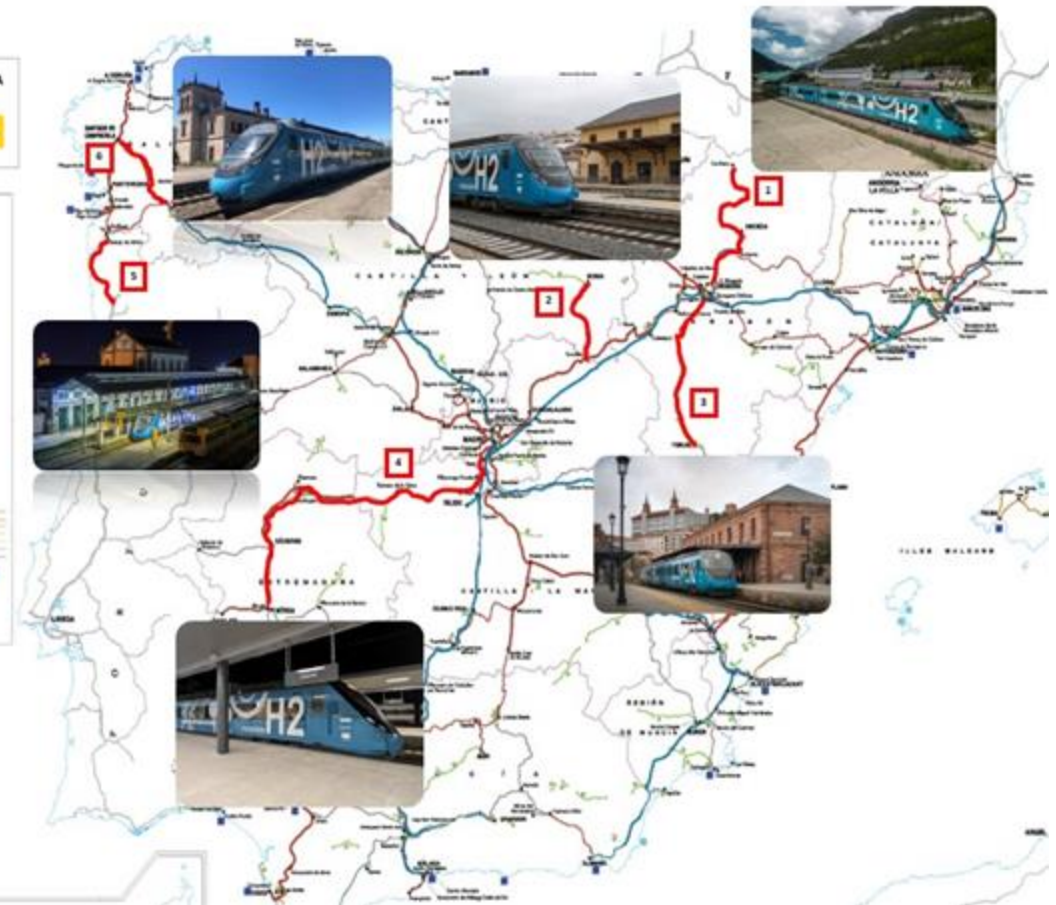
- ### 5) Tui – Nune (Portugal):

April 2024

- ### 6) Ourense – Santiago de

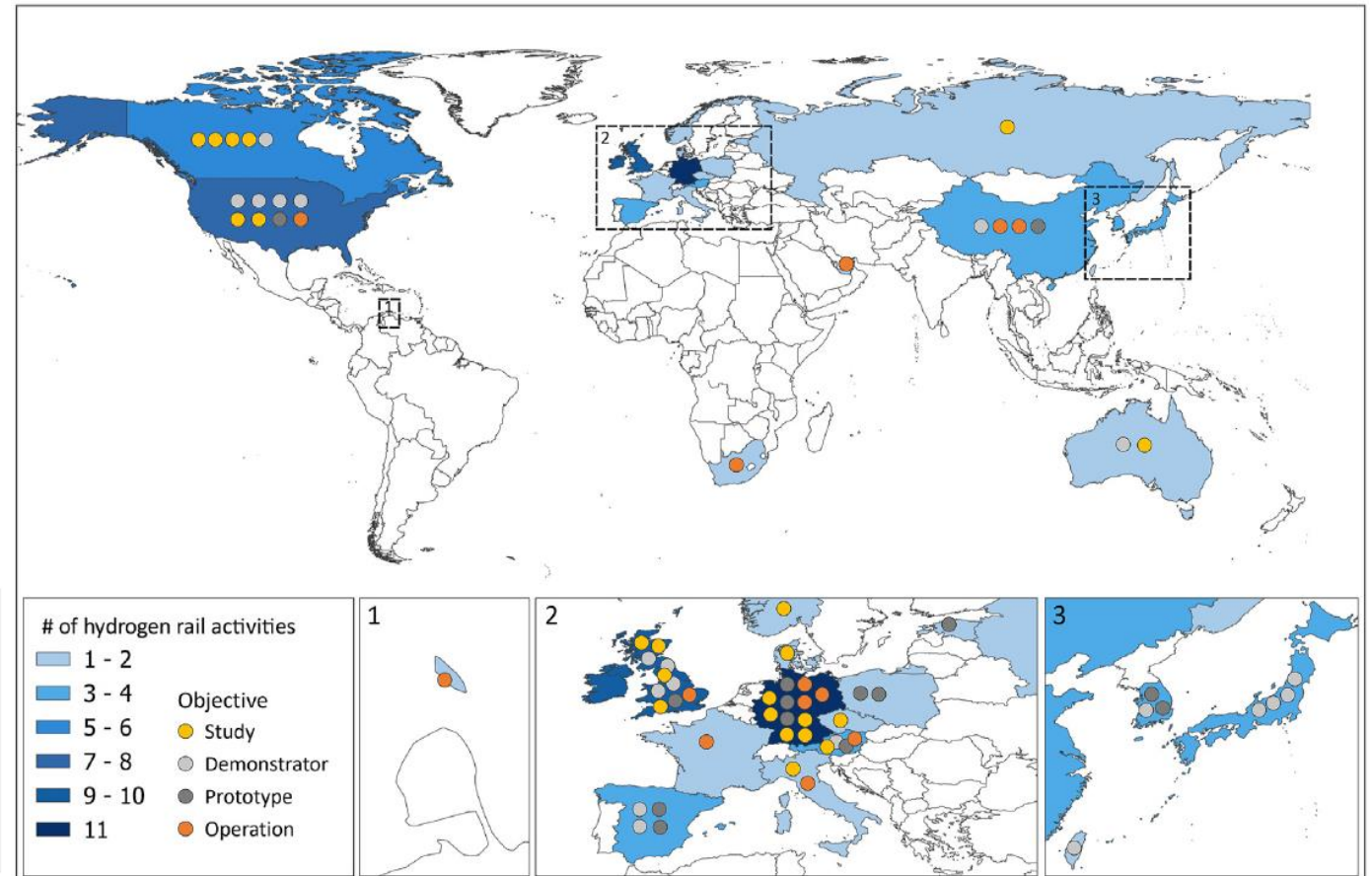
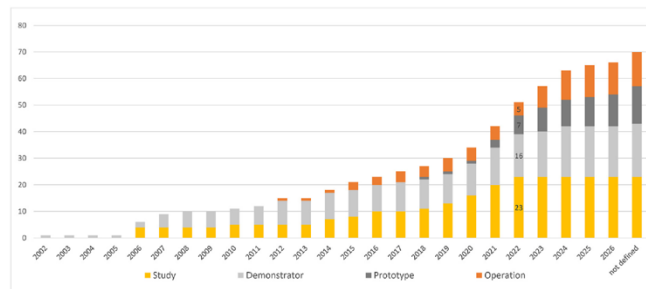
Compostela

April 2024



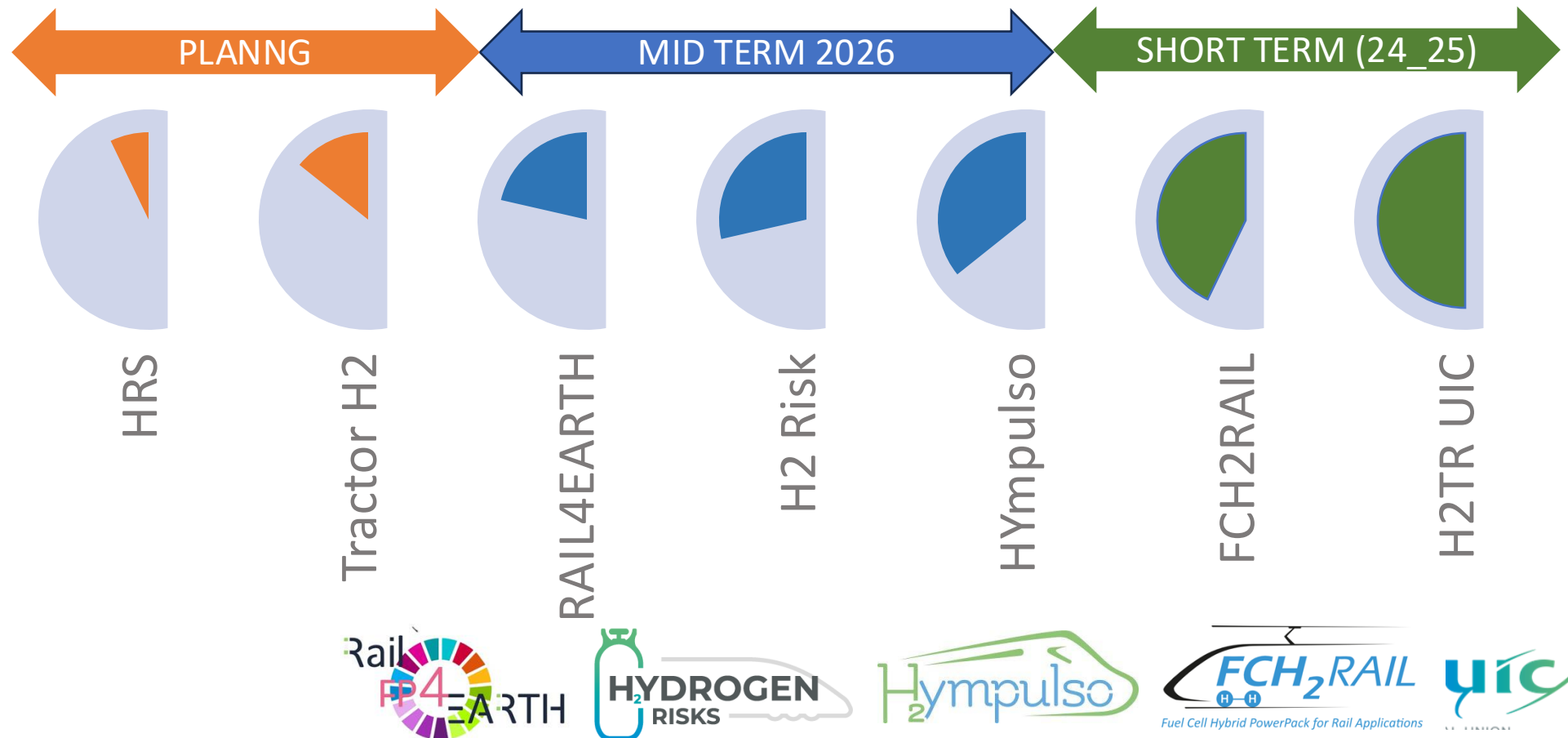
2022 Worldwide hydrogen activities in rail

- 80 projects analyzed
- 2026: planned **70** H₂ passenger trains operating
- **5** countries



Böhm, M., Fernández del Rey, A., Pagenkopf, J., Varela, M., Herwartz-Polster, S., & Nieto Calderon, B. (2022). Review and comparison of worldwide hydrogen activities in the rail sector with special focus on on-board storage and refueling technologies. *Elsevier*. doi:<https://doi.org/10.1016/j.ijhydene.2022.08.279>

Hydrogen projects in Adif



Why hydrogen fuel is not a dangerous good

- Law RD 412/2001, 20th April 133:
International rail transport of dangerous commodity (RID 2023):
- 1.1.3.2 Exemptions ..carriage of gases.
- ..provisions RID do not apply to the carriage of: a) Destined for **their propulsion...**
- NOTE: **Also.. a container...**, fitted with equipment.. destined for their propulsion.
- RID **reference** for the emergency plan



Emergency management

- Protective measures and emergency protocol.
- **Contingency plan** with operator.
- Risk control and emergency **response measures**.
- Management Risks in stops, parking
- Evacuation in emergency cases.
- **Tunnel Emergency Plan**.
- Communication protocols revision.
- **Training**.



COORDINATION PROTOCOL FOR PROTECTIVE MEASURES AND TESTING EMERGENCIES ON FCH2RAIL TRAIN TRACKS

Ref. PR – FCH2RAIL_PROTECTIVE MEASURES
MAY 2023

05/2023

Directorate-General for Strategic and Project Planning
BUSINESS STRATEGY DIRECTORATE
Strategic Innovation Sub-Directorate
Head of H2RAIL Project Development Area



EMERGENCY PLAN FOR HYDROGEN TRAIN TRACK TESTING

Ref. PR – H2_PROTECTIVE MEASURES
JULY 2024


06/2024

Directorate-General for Strategic and Project Planning
BUSINESS STRATEGY DIRECTORATE
Strategic Innovation Sub-Directorate
Head of H2RAIL Project Development Area

Authorization

Instruction

- Object: Conduct **bi-mode** train tests with **hydrogen fuel cell**
- Delivery of Specific Blocked Rules
- Scope **RFGI** by Adif
- Same **speed** as the original train
- 2 drivers + test driver are needed



CONSIGNA	P
	NO. 8/23
	<small>Madrid, May 19, 2023</small>
HYDROGEN TRAIN TESTS	

Organism: Adif's Corporate Directorate for Traffic Safety

Object: Conduct two-mode train tests with hydrogen fuel cells.

APPLICATION

Date: From 00:01 h on 27-05-2023 to 23:59 h on 17-09-2023

Hours: To be determined by the person in charge of Circulation, in agreement with the person in charge of the test.

Scope: RFIG administered by Adif

Lines, routes and material object of this Consigna:

Line 070 of: Bif. Huesca to Huesca
Route of: Almudévar to Tardienta
Route of: Tardienta to Bif. Canfranc (Width 1668)

Line 200 of: Madrid-Chamartín-Clara Campoamor to Barna Estació de França
Route of: Almudévar to Tardienta

Line 204 of: Canfranc to Canfranc
Route of: Canfranc to Hoya de Huesca railway line
Route of: Sabiñánigo to Canfranc

Material: Hydrogen fuel cell-powered S/463 automotive

0. PREAMBLE

This Consignment includes those special requirements, associated with the circulation and personnel involved in the tests, with respect to the normal conditions of operation of trains on the routes designated for the same.

1. MATERIAL-RELATED CONDITIONS

1.1. Composition and braking

The person in charge of the test shall ensure that, before each of the series of tests, the correct operation of the automatic brake from where the direction of travel is taken has been checked.

Conclusions

Possible to authorize and test an H₂ train in Spain:

- ✓ 1st Authorization gets about 3 months after presented to Adif's corporate safety department in 2023.
- ✓ A new **emergency document** was issued to ensure emergencies and tunnels
- ✓ **10.000 km test** in H₂ during 10 months without any incidents.



Challenges

Operate a hydrogen-powered train

- ✓ Another Authorization for a test soon
- ✓ Behavior in tunnels needs to be studied in more detail.
- ✓ Progress needs to be made on **regulation**.
- ✓ Need to be **educated** that H₂ is safe
- ✓ Need for a lot of technical dissemination in organizations. i.e. IRSC



Spain H₂ Challenge





**Thank you for
your attention!**

