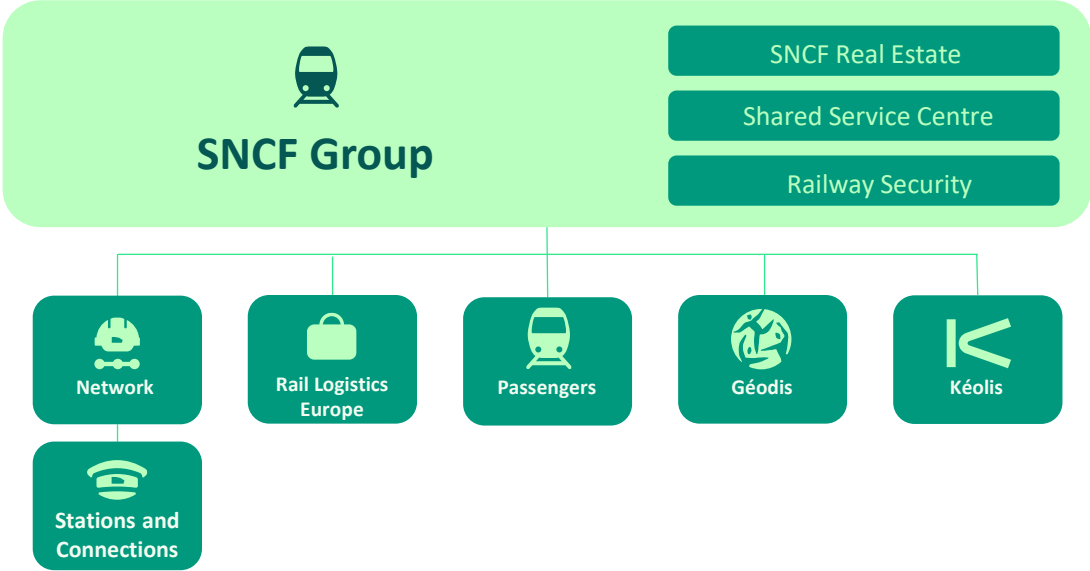


Hydrogen for the decarbonisation of rail transport in France

Jean-Aimé Mougnot, SNCF,
National Director of Regional Transport



SNCF Group



TER (express regional trains) in France

- + Regional trains are run on the basis of agreements with the 12 French regions, which are the Mobility Organisation Authorities (Autorités Organisatrices de la Mobilité - AOM). In 11 of these regions, these lines are currently operated by SNCF TER.
- + Each region has decided to gradually open up to competition.



1,2 million
daily passengers



8200
daily trains



+60% more customers since 2002

92% on-time in 2022



680
lines

3000
stations and railway
stops called at

27000
employees

11
regions in charge of
transport
having invested
8 billion €
in rolling stock



The SNCF Group's environmental goals

As part of its **corporate social responsibility strategy**, SNCF has committed to an ambitious program to reduce its greenhouse gas (GHG) emissions by 2030, including :

- + a 30% reduction in the transport domain,
- + and 50% in the real estate domain (when compared to 2015),
- + absolute terms, this represents a 533kt reduction in CO2 emissions for these two domains (-32% weighted average),

- + Reference value 2015: 1651 kt CO2,
- + Target value 2030 : 1118 kt CO2.



The current situation

- + Today, half of our trains are electric, and SNCF only emits 0.4% of the french transport sector's GHG emissions.
- + Since 1990, we have reduced our CO2 emissions per passenger carried by over 50%. This transition from diesel to lower GHG emission energy is a major challenge if we are to achieve carbon neutrality and phase out diesel by 2050.
- + TER is committed to reducing its CO2 emissions by 100,000 tonnes a year by 2025. The regions must be able to choose the best option according to their situations and needs and the TER teams' role is therefore to be able to offer the regions the most economical and lowest carbon footprint solutions possible, such as biofuels, battery trains, hydrogen trains, and hybrid trains.

Solutions for decarbonizing rolling stock



2021

TER B100

T2 2021 – 1^{ère} circulation Paris-Granville

T4 2021 – 1^{ère} circulation Paris-Laon

TER BIOGAZ

Remise de l'étude de faisabilité

T4 2021

2022

TER HYBRIDE

1^{er} tours de roue

2023

TER BATTERIES

1^{er} tours de roue

2024

TER HYBRIDE

2023 – 1^{ère} rame en

Exploitation
expérimentale

TRAIN H2

Début essais dynamiques

2025

TER BATTERIE

Fin 2024 – 1^{ères} rames
en exploitation

2026

TER H2

Fin 2025 – 1^{ère} rame livrée
(Service commercial T1 2026)

Why hydrogen as a solution?

SNCF SNCF Voyagers is conducting an experiment alongside 4 regions to test:

- Technical performance,
 - The hydrogen solution as a business model before its widespread use.
-
- + The Regiolis is a hybrid electric train (catenary and H2 powered), which allows it to conserve its H2 reserves when stationary or running under catenary power.
 - + The SNCF Group's choice is to provide the best possible advice to the regions on the best technology for the specificities of their networks and regional ecosystems (regional mobility policy). The hybrid electric/H2 train is a solution suited for certain uses.

Hydrogen trains :

3 challenges for TER activities

- + Master technology and supply,
- + Make hydrogen a tool for competitiveness and new services in the regions,
- + Make hydrogen a tool for curbing our energy costs, given the current severe pressure on energy and raw material prices.



Deploying hydrogen trains

- + In March 2021, the Auvergne-Rhône-Alpes, Bourgogne-Franche-Comté, Grand Est, and Occitanie regions ordered hybrid trainsets powered by electricity and hydrogen. These Régiolis H2 trains will partially replace TER diesel trains over the coming years.
- + The approval tests for these trainsets are scheduled to start in 2024, on a pre-production train at the end of production in Reichshoffen, with an end of 2023 launch date.
- + The commercial operation of the first trainsets is scheduled for early 2026. In its hybrid version, the hydrogen train will be self-sufficient for up to 600 km when carrying 220 passengers at 160km/h.
- + A 231-million-euro project, of which 215 million was provided by the four regions involved in the project, with state funding of 47 million €.