



## An example from France – hydrogen buses in Lens

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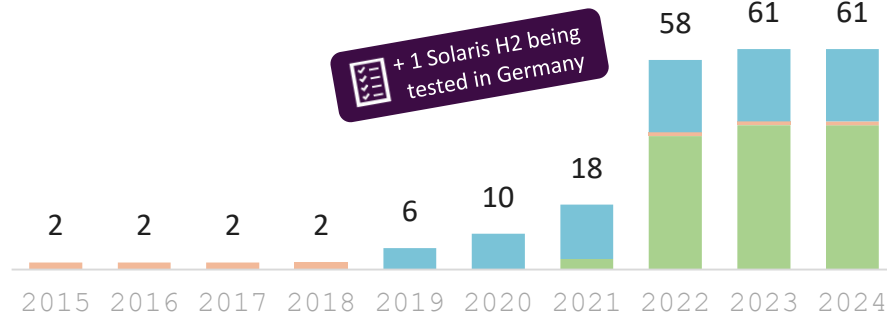
**MOVE**



# Our international experience

## Hydrogen bus & coach fleet evolution

(based on vehicle orders and ongoing deliveries to date)



- By the end of 2021, Transdev Group will be operating 19 H<sub>2</sub> vehicles
- Hydrogen technologies are being tested:
  - Hydrogen bus with dominant fuel cell (100% FC)
  - Retrofitted<sup>1</sup> hydrogen bus (H<sub>2</sub> Retrofit)
  - Electric bus equipped with an hydrogen range extender (H<sub>2</sub> REX)

2 main bus makers account for most of Transdev

Group fleet including a new French player:

Solaris and Safran

<sup>1</sup> H<sub>2</sub> retrofit refers to the operation of replacing a thermal powertrain with a set of electric motor and a fuel cell.

## The fleet in detail

Location	Bus OEM	Technology	Units	Operation
Lens	Safran	H <sub>2</sub> REX	6	Nov. 2019
Toulouse	Safran	H <sub>2</sub> REX	5	Apr. 2022
Auxerre	Safran	H <sub>2</sub> REX	5	Oct. 2021
Normandy	IVECO BUS	H <sub>2</sub> Retrofit	1	2022
Rouen	VAN HOO	100% FC	14	Sep. 2022
Fos-sur-Mer	?	100% FC	3	2023
Eindhoven	VDL BUS & COACH	H <sub>2</sub> Retrofit	2	2015-2019
HWGO	APTS VDL BUS & COACH	H <sub>2</sub> REX	4	Jun. 2020
HWGO	SOLARIS	H <sub>2</sub> REX	4	Early 2022
HWGO	SOLARIS	100% FC	20	2022
Sandviken	SOLARIS	100% FC	2	2022
Auckland	GBV	100% FC	2	Mar. 2021
Auckland		100% FC	1	

1<sup>st</sup> hydrogen intercity coach

+1<sup>st</sup> hydrogen train in Bavaria, Germany 2023

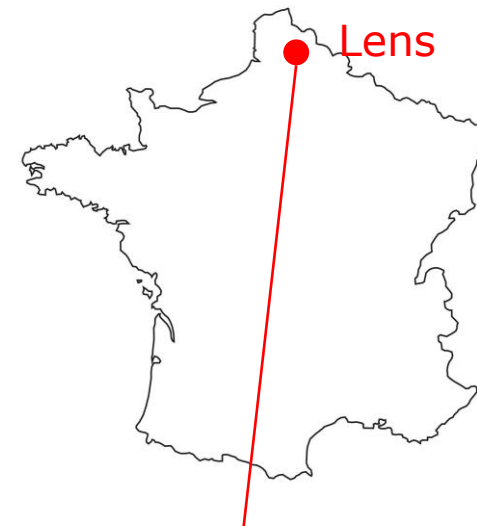
# Réseau TADAO – Lens, France

## About the network:

- 650 000 inhabitants
- 500 vehicles
- 18 million passengers /year

## About the hydrogen project:

- Line Bulle 6 - 13,4 km
- Launched november 2019
- First hydrogen bus line in France with 6 buses



# The project

## Timeline:

- 2017: launch on the H2 plant process
- 2018: selection of the bus provider: Safra
- 2019: start of the H2 plant and H2 buses

## Stakeholders:

- The PTA: Syndicat SMTAG: regional authority
- Transdev
- Engie for the H2 plant
- Safra for buses



# Lessons learned



ZE solution with high operational range: 300 – 400 km and beyond.

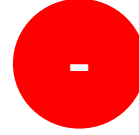
Hydrogen Fuel cell buses can replace one-to-one conventional buses:

- Quick refueling process: comparable to a diesel vehicle
- Low weight: 9 to 10 kg H<sub>2</sub> for 100 km driving.
- No loss of passengers capacity.

Complete flexibility: No infrastructure needed in the city for refueling

Energy recuperation during deceleration and braking.

Equivalent energy cost if hydrogen is available as a by-product from chemical processes.



High investment for fuel cell buses

- Fuel cells are still expensive

High energy consumption costs compared with other electric drive line technologies

High maintenance costs : the lifetime of the fuel cell is lower than the vehicle lifetime. (high TCO).

The workshop has to be in conformity with hydrogen safety regulations.

A technology that has still to be improved: projects are still pioneer