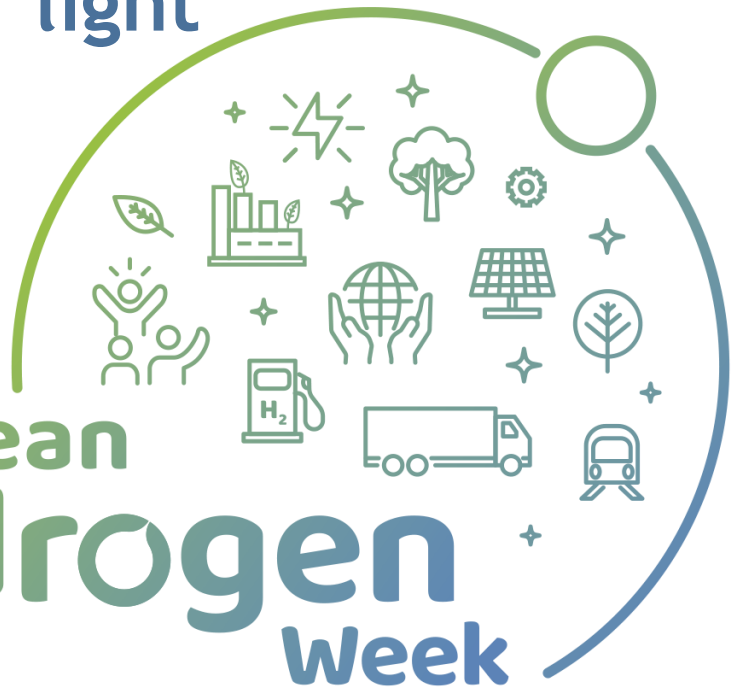
H2ME & ZEFER: flagship projects in hydrogen mobility for light vehicles in Europe



elementenergy
an ERM Group company

Hydrogen Mobility Europe

ZEFER

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Agenda

1. **Introduction to the H2ME and ZEFER projects**
2. Paris deployment demonstrates the case for FCEVs
3. New trends show increasing FCEV performance and new models becoming available on the market
4. Q&A

H2ME & ZEFER are part of a family of European funded projects supporting the commercialisation of hydrogen mobility in Europe

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Hydrogen Mobility Europe (H2ME)

- Project started in June 2015 – end in **June 2023**
- **€170m** of budget & **€67m** of funding
- Deployment in **9+ countries**
- **45+ HRS** *(40 built)*
- **> 1400** FCEVs [1] *(>900 delivered - Mirai I & II, Hyundai ix35 & Nexo, Honda Clarity, Mercedes B-Class et GLC F-Cell, Renault Kangoo H2, Stellantis HK0)*

Zero Emission Fleet for European Roll-out (ZEFER)

- Project started on Sept. 2017 - end in **Aug 2023**
- **€17,5m** of budget & **€5m** of funding
- Deployment in 3 European cities: Paris, London, Copenhagen
- **HRS upgrades** in 3 European cities
- **180** vehicles *(all delivered - Mirai I et II, Hyundai ix35 et Nexo)*

The funding aims to move hydrogen mobility from the demonstrator stage to the pre-commercial stage

- **Real-world experimentation -** Collection of a detailed data set for Europe, field trials, performance demonstration and user offer.
- **Evaluation of marketing strategies** - Robust assumptions for future deployments and business cases.
- **Market stimulation and price reduction** - Growing supply and price reduction are positive signs.
- **Foundations for larger scale deployment and ecosystems** - 1,000 HRS in France by 2028 (H_2 Strategies), 10,000 taxis/PHV in Paris by 2024, H_2 Valley projects, IPCEI...

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[1] *Fuel Cell Electric Vehicle*

H2ME: Europe's flagship H2 light mobility initiative has supported the deployment of many of the vehicles and stations in operation in Europe today

25 million km driven & 377 tons of H_2 refuelled [1]

- **1/3 of the existing public HRS and the FCEVs in operation today** in Europe are funded by the **H2ME initiative.**
- **Green mass mobility and logistics solutions have been proven in cities**, with similar ranges, refuelling time and technology reliability to conventional vehicles.
  - Vehicles average between 19 km and 128 km of driving / day. In some cases**, they have driven > 1 000 km in a single day.**
    - **Reached 100+km/1kg H_2.**
    - **Average availability** is **effectively 99%+ for all FCEV**
  - The most utilised HRS in the project alone has dispensed **75 tonnes H_2 since Q3 2017** due to usage from taxis.
    - Stations are able to deliver fast fills back-to-back. The average time spent stopped at the refueller is typically under five minutes.

Hydrogen refuelling and mileage since start of the project

[1] *From project starts until June 22*

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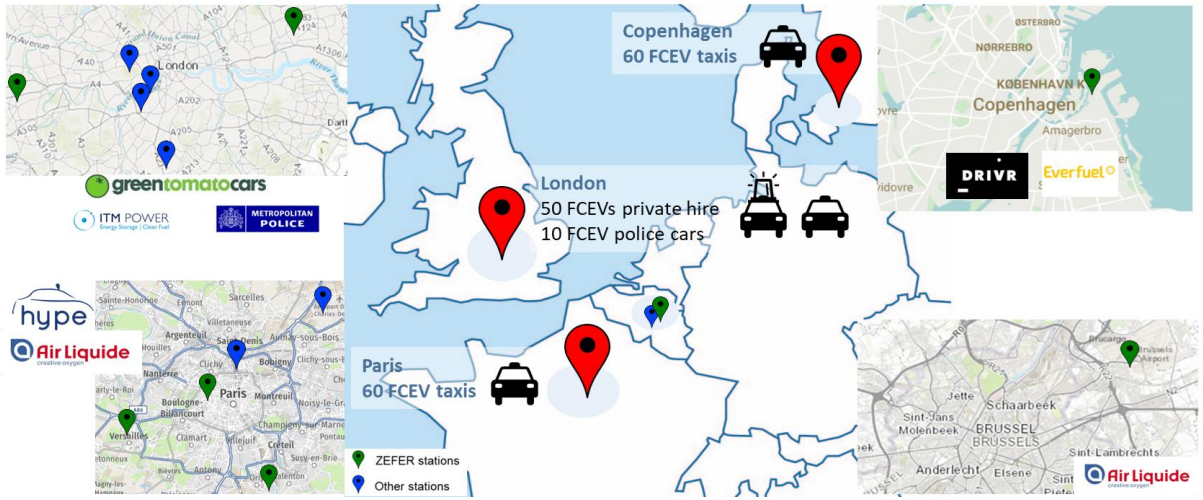
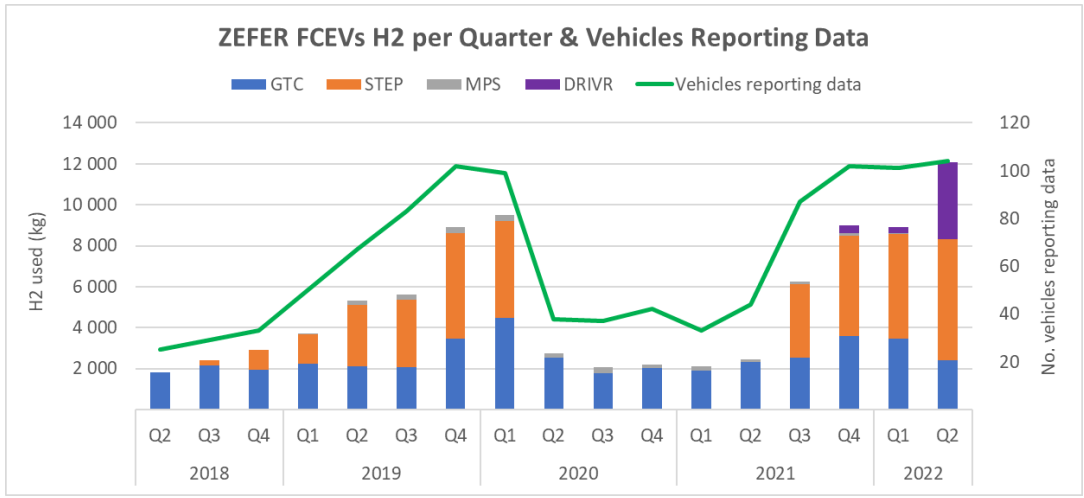
ZEFER: confirmed deployment in “captive fleet” is particularly relevant for FCEVs and can ensure an "anchoring demand" for HRS

- ZEFER focuses on "captive fleets" in intensive applications and has initiated the deployment of **three fleets in European capitals.**
- **The deployment of fleets of vehicles makes it possible to find an economic equilibrium for charging stations,** which proves difficult at a low level of demand (<200 kg/day).
- The stations used by these fleets in the three cities are amongst **the most used in Europe**[1] including those in Paris (operated by HYSETCO) with HRS distributing 10 tons per month at the moment[2].



ZEFER deployment



H_2 refuelled & vehicles reporting data in ZEFER

[1] *With the Den Haag (NL) HRS, also catering to taxi FCEVS*
[2] *For the three stations operated by HYSETCO in Q3 2022*

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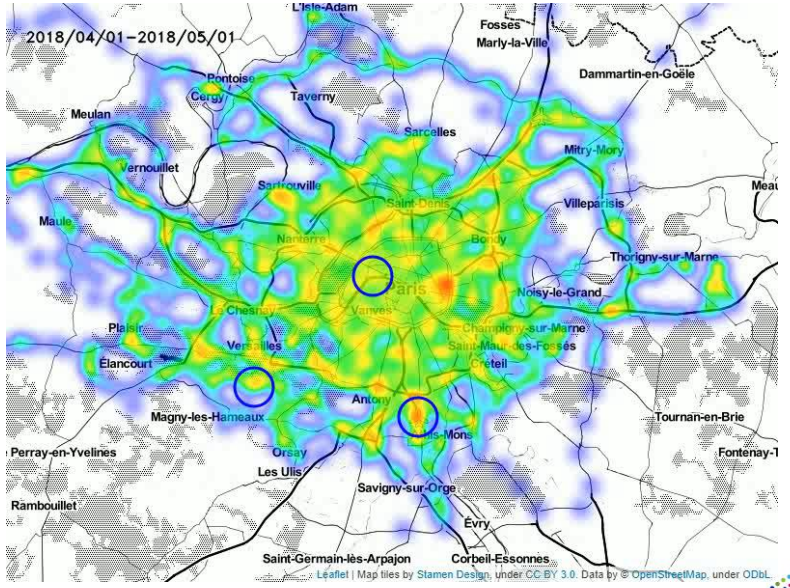
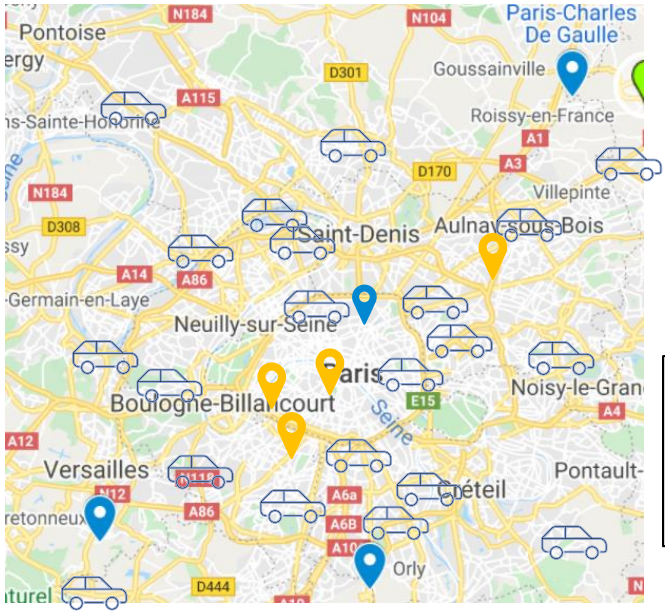
The case of Paris shows that experiences acquired in H2ME & ZEFER give a robust springboard to further roll-outs

- In Paris, the increase in refuelling is due to a combination of **the fleet deployment, the HRS reliability and their presence in strategic areas** (illustrated by the blue circle in the heat map below).
- Analysis of the Hype fleet shows that an **FCEV can comfortably fulfil a 300 km journey** on a single fuel while its BEV counterpart need to be recharged to make the same trip.
- **ZEFER & H2ME have paved the way for further deployment** as illustrated by the stated ambitions of pure players (Hype, HYSETCO) and actors focusing on hydrogen production / distribution (Elogen, McPhy, Symbio). All are part of H2ME or ZEFER.



Heatmap of the Hype fleet in the Paris area since 2018



H_2 mobility ecosystem in Paris by 2025

Legend:

- HRS in currently in operation	
- HRS under commissioning (*to be opened by Q1 2023*)	
- Number of HRS in operation by 2024/2025	**>35**
- Number of H2 vehicles by 2024	**>10,000**

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New trends show increasing FCEV performance and new models becoming available on the market

- Although there are still few models available on the market today, **manufacturers are offering ever more efficient and competitively priced vehicles.**
- This is the case with the second generation of the Toyota Mirai and data shows **that Mirai 2 is cheaper and travels 20% more kilometres per day.**
- The increased performance **and 5-seat capacity caters well to operational needs** for taxi operators.
- First deliveries (limited series) of the **BMW iX5 are expected by the end of the year**. The new 2-tank family SUV will offer even greater performance.

	Toyota Mirai Gen 1	Toyota Mirai Gen 2	BMW iX5
			
Entry level price		*15% less than to Mirai 1*	*TBD*
Horsepower	182 hp	151 hp	374 hp
Seats	4	5	*5*
Acceleration 0 → 100 km/h	9.6s	9s	*TBD*
Range	550 km (NEDC)[1]	644 km (WLTP)[2]	*TBD*
Stack Power Rating	113 kW	128 kW	275 KW
Tank Capacity	5 kg H_2	5.6 kg H_2	Double tank
Tank Pressure	700 bar	700 bar	700 bar
Battery Pack Size	1.6 kWh NiMH[3]	1.2 kWh Lithium-ion	TBD

Technical comparison of Mirai I, Mirai II & iX5

[1] New European Drive Cycle
[2] Worldwide Harmonised Light Vehicle Test Procedure
[3] Nickel Metal Hydride

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Thank you for your attention

Any questions?

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