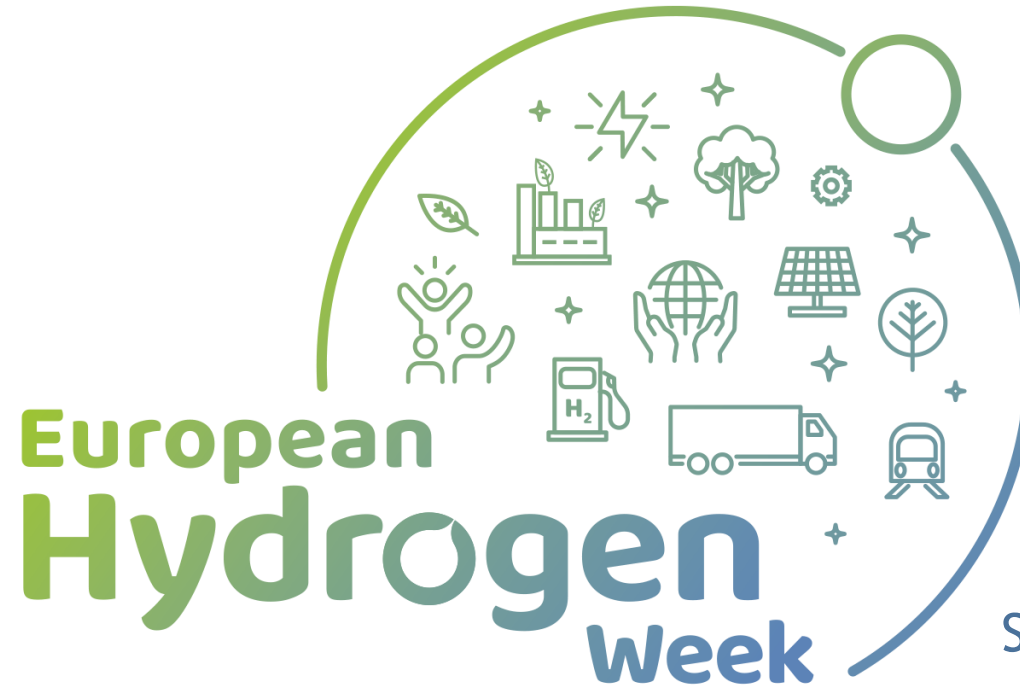


ZEFER

Zero-Emission Fleet vehicles

for European Roll-out



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Project Overview

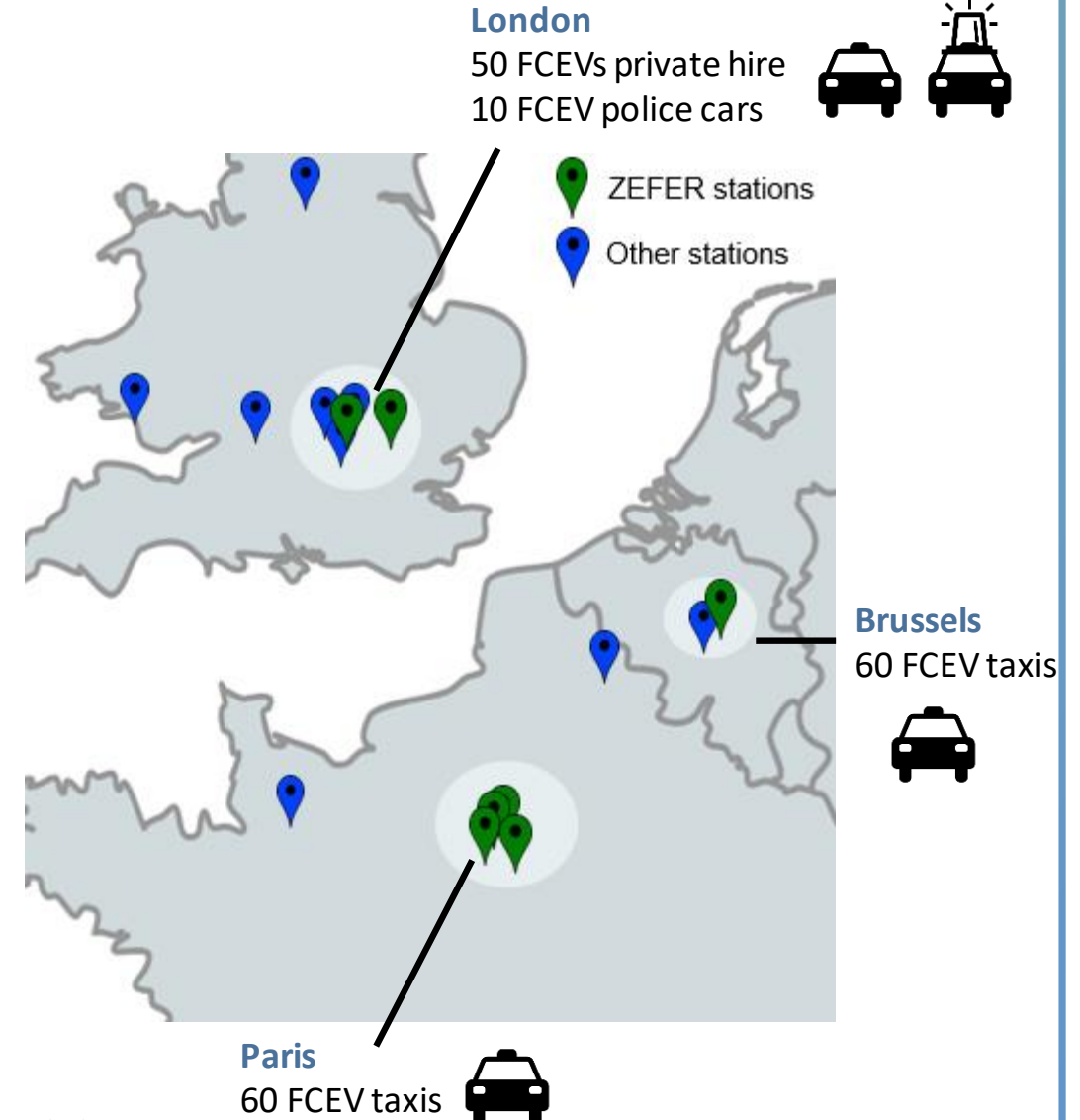
- Call year: 2017
- Call topic: FCH-01-6-2017: Large scale demonstration of Hydrogen Refuelling Stations and Fuel Cell Electric Vehicle (FCEV) road vehicles operated in fleet(s)
- Project dates: 01/09/2017 - 31/08/2022
- % stage of implementation: 63%
- Total project budget: €17.56 million
- FCH JU max. contribution: c. €5 million

Partners:



Project Summary

- ZEFER aims to demonstrate **viable business cases** for fuel cell electric vehicles (FCEVs) in fleet applications.
- **180 FCEVs will be deployed in taxi, private hire and emergency service fleets** that require the operational benefits of the technology and are used in cities where the value of zero emissions can be monetised.
- **Existing hydrogen refuelling station (HRS) networks will be used and upgraded** to test the performance of infrastructure under high demand and improve the business case for HRS operation, both in terms of the size and certainty of revenues.



Project Progress

Status of deployment activities



Deployment

0 FCEVs
0 HRS upgrades

117 FCEVs 3 upgrades

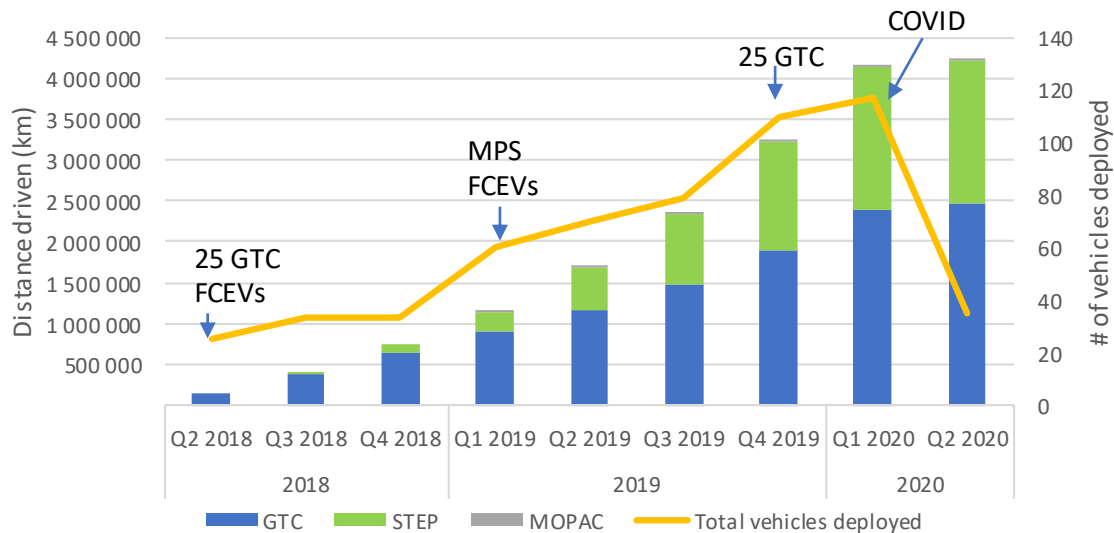
180 FCEVs
4 HRS upgrades

25%

50%

75%

ZEFER cumulative distance driven



- All project vehicles have been ordered, with **60 FCEVs operational in London and 57 in Paris**.
- FCEVs are being used as a direct replacement for petrol/diesel vehicles, with over **4.2 million kilometres** amassed since April 2018.
- HRS upgrades have been completed in London and Brussels and nearly **115,000kg of hydrogen has been dispensed** since the beginning of the project*.

*total volume dispensed by HRS used by ZEFER vehicles since April 2018

Project Progress

The customer value proposition



Availability

FCEV: 99%
HRS: 98%



25%

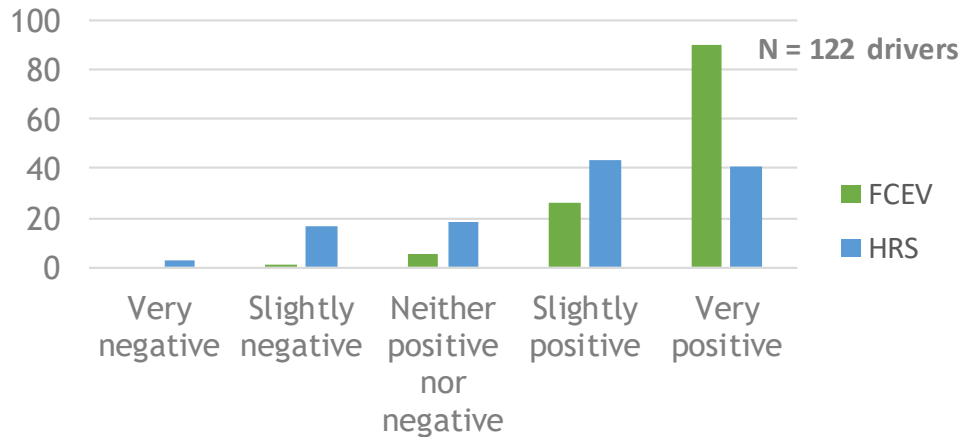
50%

75%

HRS: 96.5%* FCEV: >99%

FCEV: >98%
HRS: >98%

Experiences with FCEV and HRS within the ZEFER project



- FCEVs have **exceeded driver and operator expectations** in terms of reliability and performance.
- Long ranges** and **quick refuelling times** are essential to elevating the value of FCEVs above zero-emission alternatives.
- HRS have provided a good foundation for the ZEFER deployments but **limited infrastructure networks** and challenges with **reliability** have prevented the full operational advantages of FCEVs being realised.

*Average availability of H2ME and ZEFER HRS since 2016

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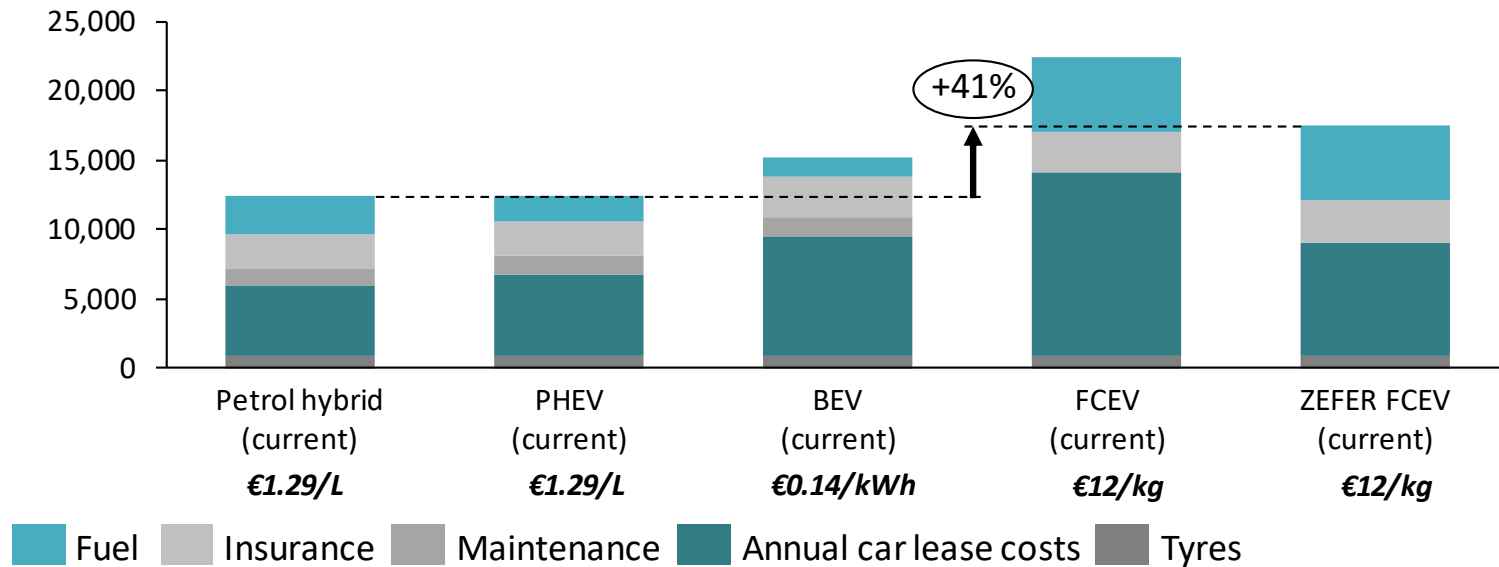
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Project Progress

Today's business case

Taxi TCO compared to alternatives (€/yr)

Annual Cost (Euros) **45 000 km annual mileage, 4 year lease period**



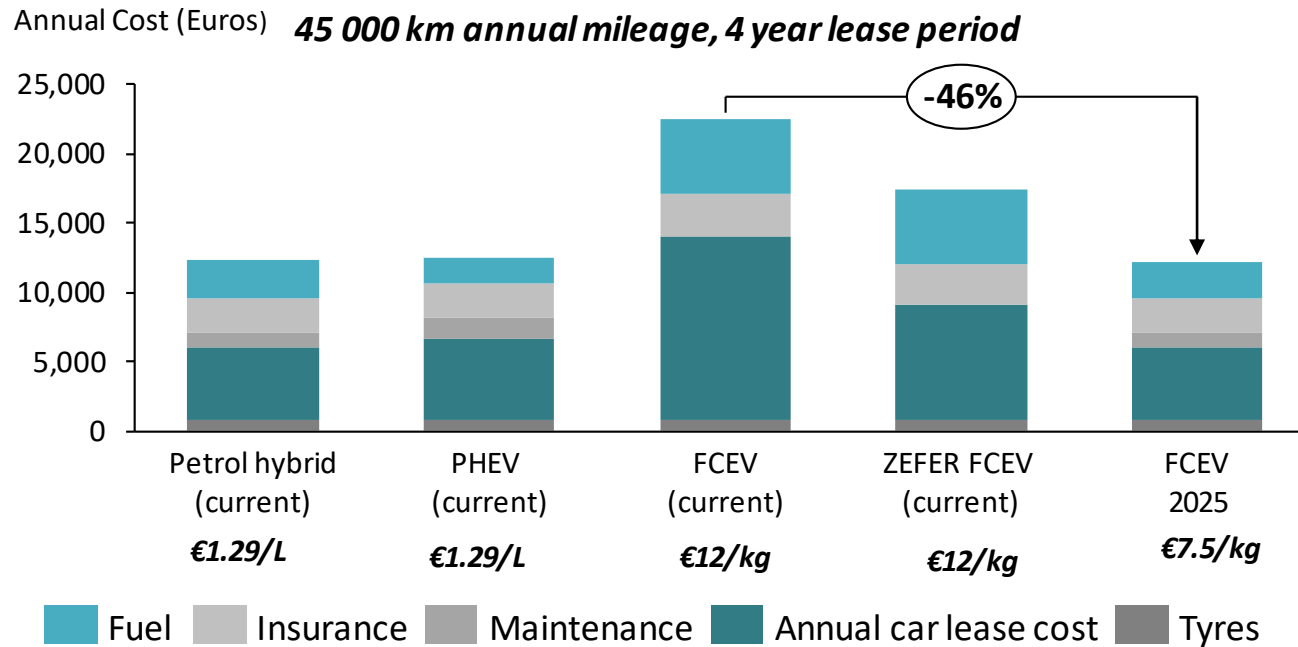
- To make a commercial case for fleet operators the TCO of an FCEV is required to **reach parity with current petrol hybrids**.
- ZEFER funding has been vital in reducing the TCO premium of FCEVs from c. 80% to c. 40% above petrol hybrids.
- Although prices still remain above parity, the operational advantages of FCEVs lead to **positive externalities** for operators which can be monetised.

*Maintenance for FCEVs (current) is included in lease costs

Project Progress

The 2025 business case

Taxi TCO compared to alternatives (€/yr)



- By 2025 it is widely expected that **FCEVs can reach parity with petrol/diesel hybrids¹** and that hydrogen costs can be reduced to **€7.50/kg or below** as a result of scaled demand.
- 2025 prices will bring the TCO of FCEVs **below parity with current incumbents** and into competition with modern battery-electric equivalents.
- An unsubsidised business case is just **one generation away** and there is appetite for scaled uptake from ZEFER partners.

*Maintenance for FCEVs (current) is included in lease costs
1 – Price target in OEM roadmaps

ZEFER / STEP



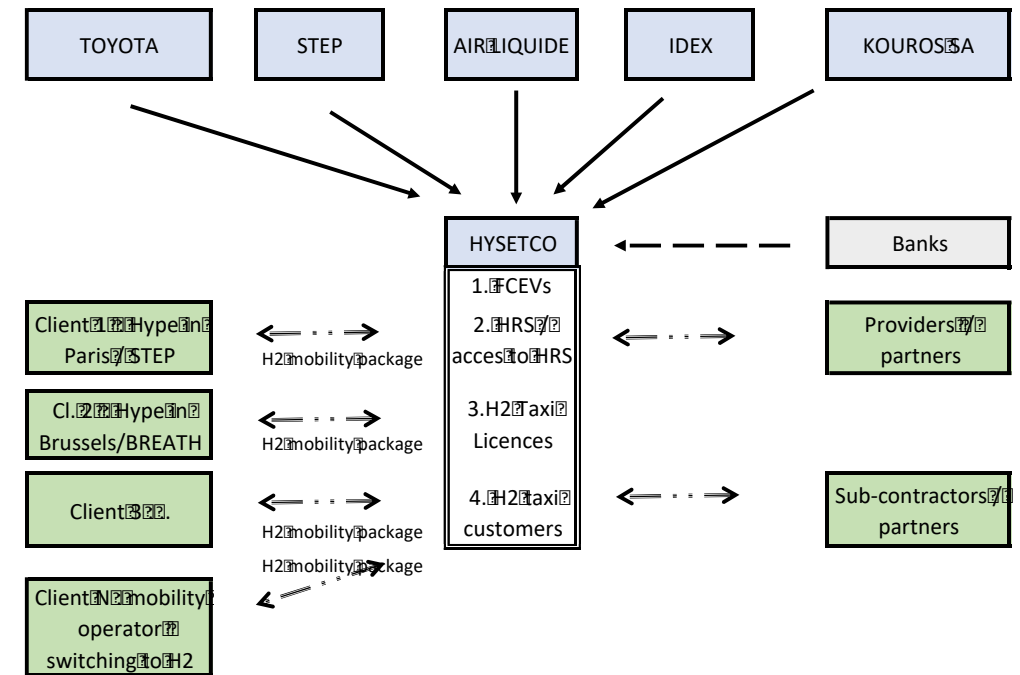
- STEP launched the Hype Fleet in 2015 with its first 5 FCEVs: FCEVs is a solution for the future of ZE transport, and notably in the short term for taxis/PHVs:
 - the advantages of EV without the constraints or compromises of BEVs,
 - 500km driving autonomy
 - 3-5 minutes refueling time
- The Hype Fleet: Initial scale-up with ZEFER in Paris 2018: + 60 Mirai
 - ZEFER allowed us to enter into constructive business discussions with OEMs
 - End of 2019: 110 Toyota Mirai (and 4 Nexos) ; 2021 : 600 Mirai (1 & 2)
- Experience :
 - Positive experience from drivers and clients
 - Challenges : high costs of FCEVs and H2, developing the HRS network in accordance to the fleet deployment, aligning the interest of Hydrogen-linked companies
 - need for a fully integrated strategy, and accelerate scale up : HysetCo

ZEFER / HYSETCO

In 2018 STEP initiated the JV HysetCo, to ease and accelerate the transition towards hydrogen mobility, quickly joined by Air Liquide and Toyota, and financial partners.

HysetCo is first targeting the urban taxi / PHV market, with a fixed cost monthly package including:

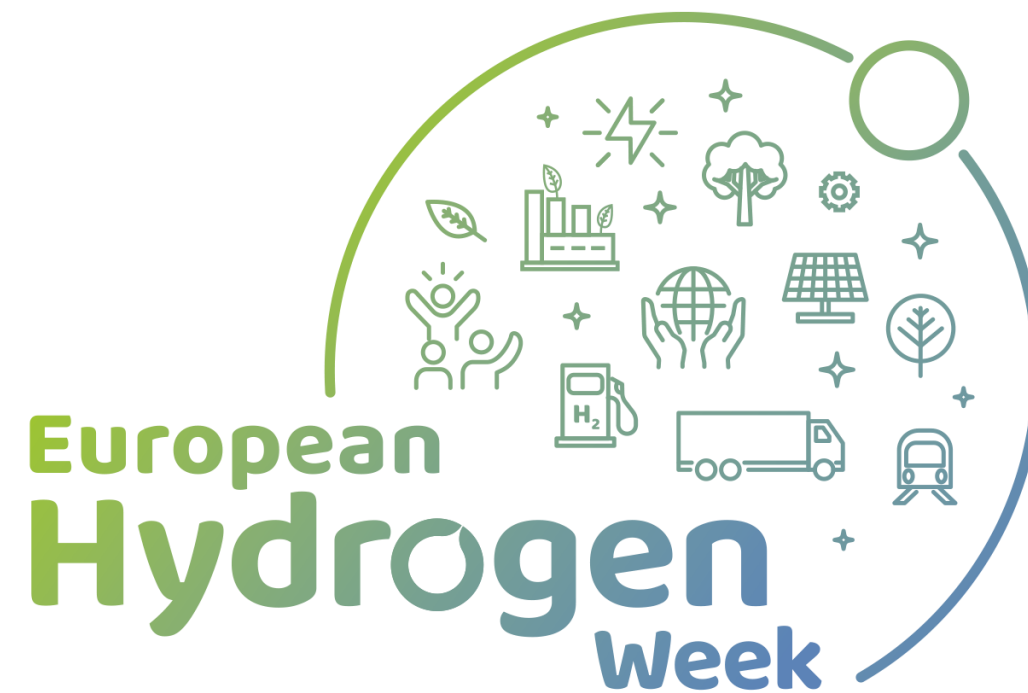
- Access to H2 / HysetCo HRS network
- Access to FCEVs and maintenance
- Access to final taxi /PHVs customers (through Hype booking app)



ZEFER / HYSETCO

- Scale up plans in Paris :
 - 2021: 600 FCEVs and 4 large scale HRS (1t/day)
 - 2024: HRS network further development (20 HRS), and 10 000 FCEVs (20% of the Parisian Taxis/PHVs market) + LDV, buses, boats,...
- Expansion in other major polluted cities
 - replicate the Hype / HysetCo model, notably across Europe
 - Increasing interest in the H2 ZE short term solution from many municipalities/cities, especially when BEVs can't do the job.





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Business case assumptions

- Business case analysis is based on figures across the ZEFER project and Element Energy's internal databases.
- The following assumptions were used to create the TCO models displayed above.

Assumption	Note	Petrol hybrid	Plug-in hybrid (PHEV)	Tesla model 3	Current FC vehicle	ZEFER FC vehicle	FC vehicle 2025
Annual mileage (km)		45,000	45,000	45,000	45,000	45,000	45,000
Lease cost (€/vehicle/yr)	Excluding VAT	5,207	5,909	8,629	13,239	8,239*	5,207
Car maintenance costs (€/yr)		1,123	1,404	1,404	-	-	1,123
Insurance costs (€/yr)		2,500	2,500	3,000	3,000	3,000	2,500
Tyre costs (€/yr)		800	800	800	800	800	800
Fuel consumption (l, kWh or kg per 100 km)		4.71 litres (60 mpg**)	3.14 litres (90 mpg**)	21.45 kWh	1.00kg	1.00kg	0.75kg
Fuel prices (€ per l, kWh or km)	Excluding VAT	€1.29/litre	€1.29/litre	€0.14/kWh	€12/kg	€12/kg	€7.5/kg

*Maintenance for FCEVs (current) is included in lease costs

**Based on NEDC test cycles