FEV CONSULTING

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HYDROGEN

AN ENABLER FOR CLEAN TRANSPORT OR UTOPIA?

FPC2022

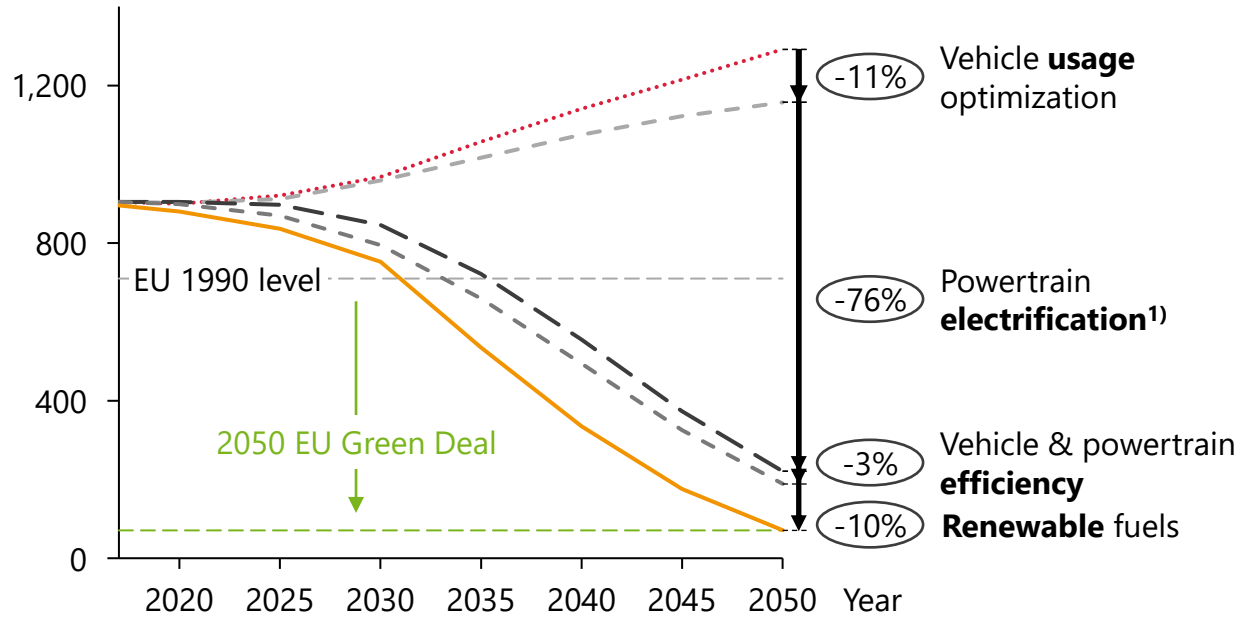
CONFERENCE PRESENTATION

Hydrogen is required as an energy carrier for on-road transport to achieve CO_2 emission reduction targets

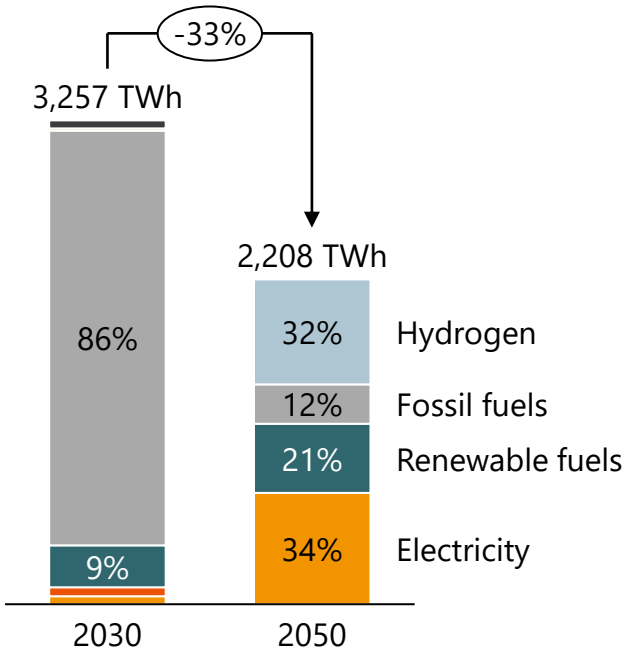
HYDROGEN AS AN ENERGY CARRIER

ROAD TRANSPORT CO_2 EMISSIONS

in million tons CO_2



FINAL ENERGY CONSUMPTION



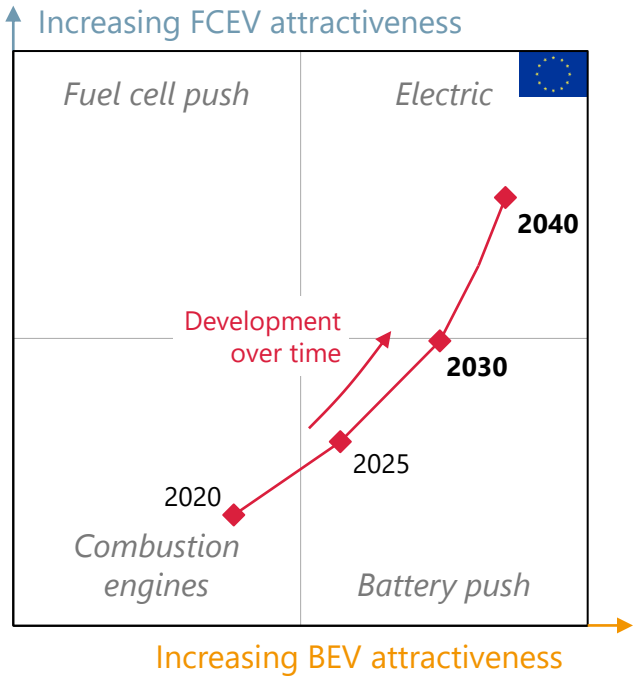
21 MEGATONS

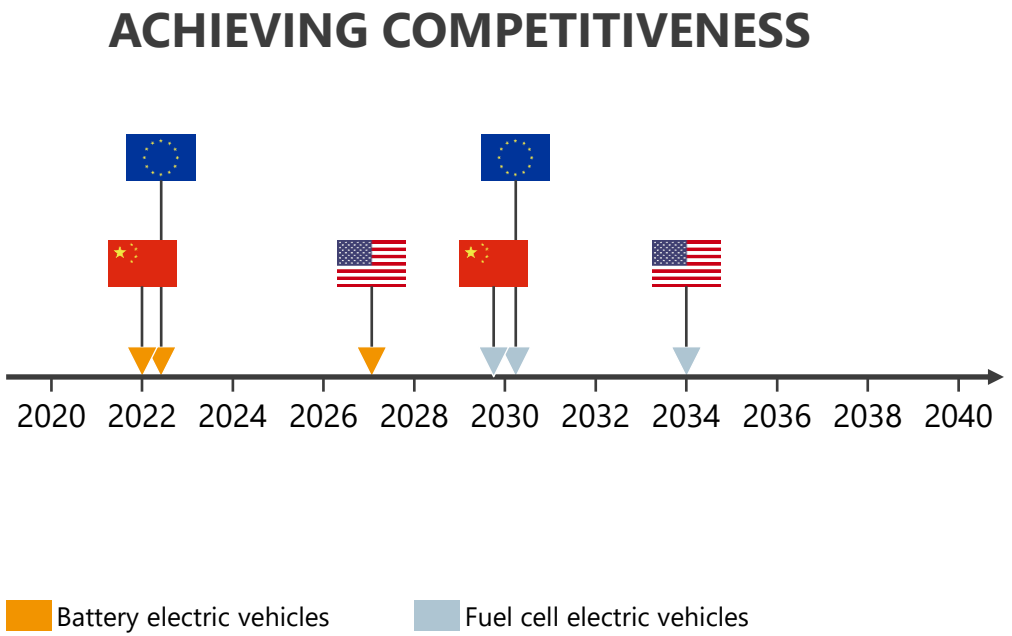
H_2 O_2 OF CLEAN HYDROGEN REQUIRED FOR EUROPEAN ON-ROAD TRANSPORT IN 2050

1) Including all zero-tailpipe emission powertrains (fuel cell and H_2 ICE)
Source: FEV

Battery-electric passenger cars have the current momentum, but fuel cell electric vehicles are expected to gain attractiveness from 2030 onwards

ZERO EMISSION VEHICLE INDEX DEVELOPMENT





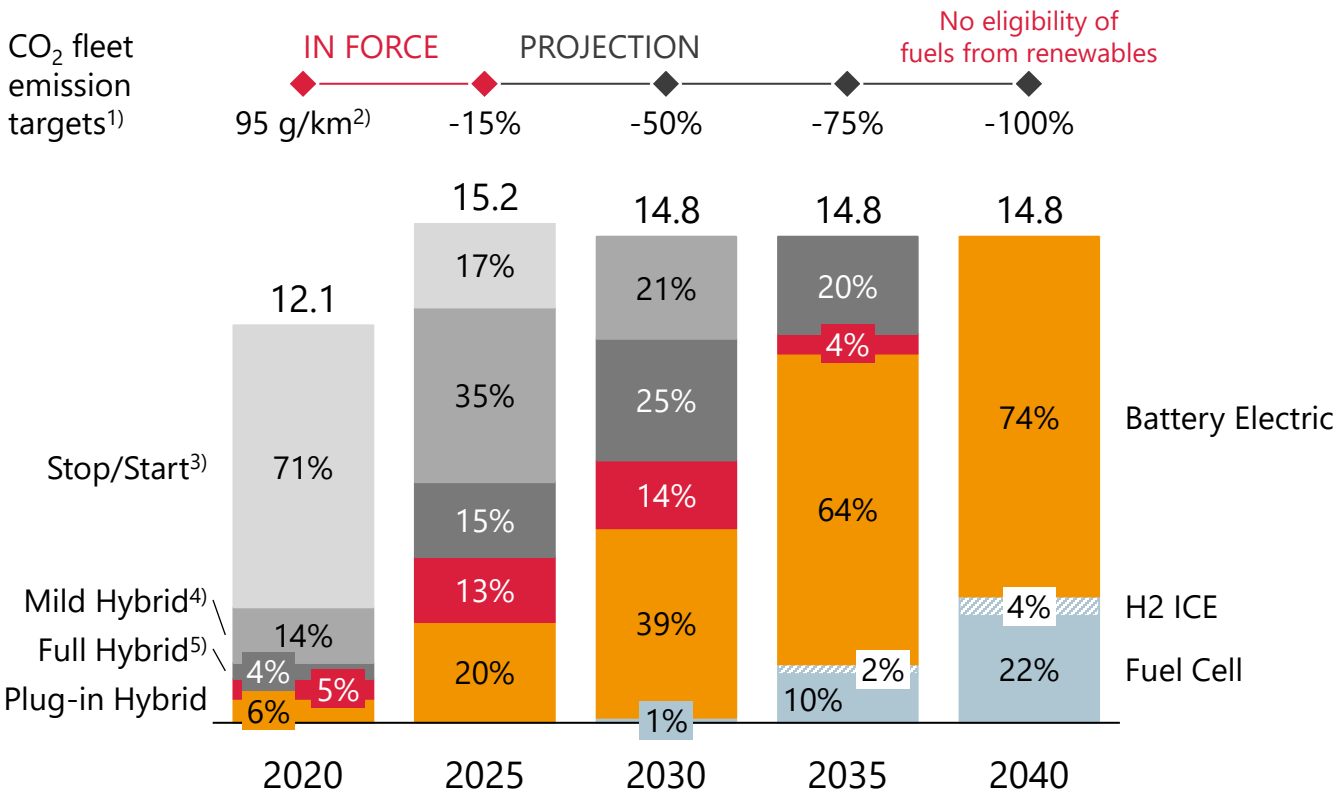
Source: FEV

In Europe we expect passenger car sales to completely shift to zero-emission vehicles in the 2030s

PASSENGER CAR ELECTRIFICATION SCENARIOS – VEHICLE SALES FORECAST

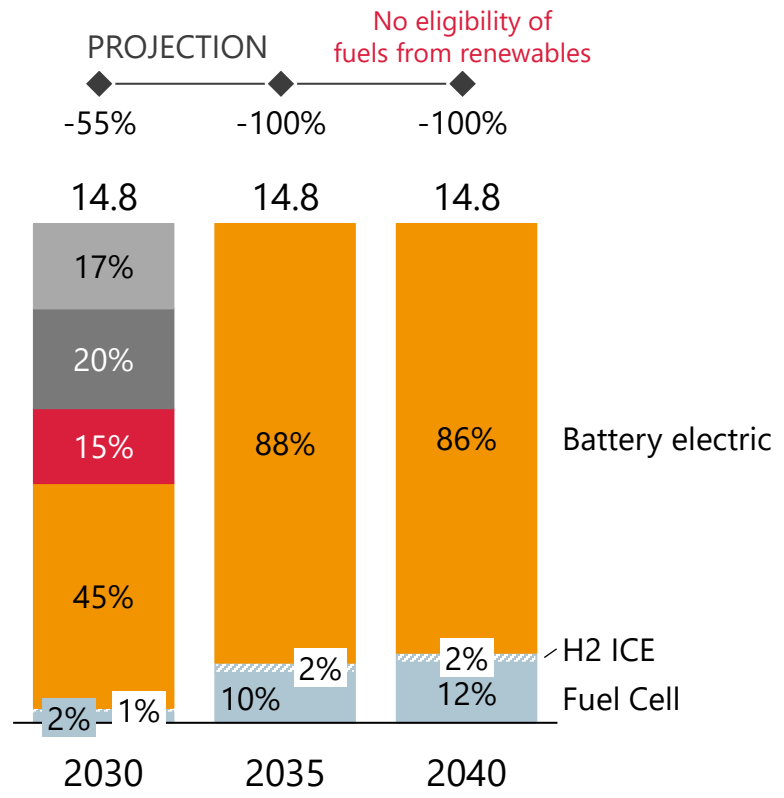
MODERATE TRANSFORMATION SCENARIO

Sales in million units



ACCELERATED ("FIT FOR 55") SCENARIO

Sales in million units



1) 2021 target according NEDC; 2025+ targets **tailpipe** CO_2 emissions values in reference to 2021 WLTP CO_2 emissions
2) In 2020 target must be achieved by 95% least emitting vehicles within each automaker's fleet, 100% compliance for 2021
3) Stop/Start and 12 V energy management; 4) 12 V and 48 V mild hybrids; 5) Includes 48 V hybrids with full hybrid functionalities
Source: FEV

There are certain customer groups which are expected to have a better match to fuel cells, if their main concerns can be dissolved

FUEL CELL VEHICLE CUSTOMER GROUPS

Always seeking for new technology

Vehicle availability

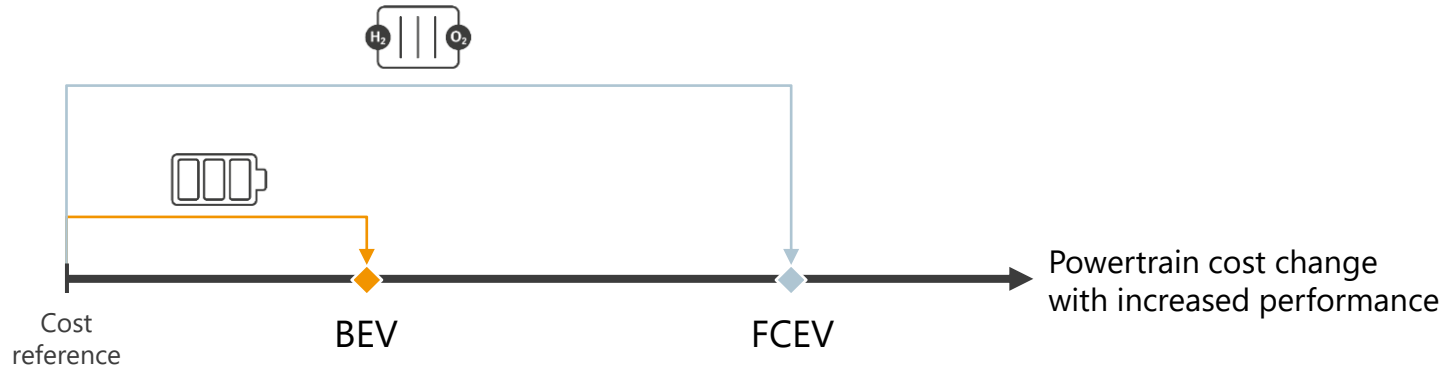
May not have sufficient access to electric charging points

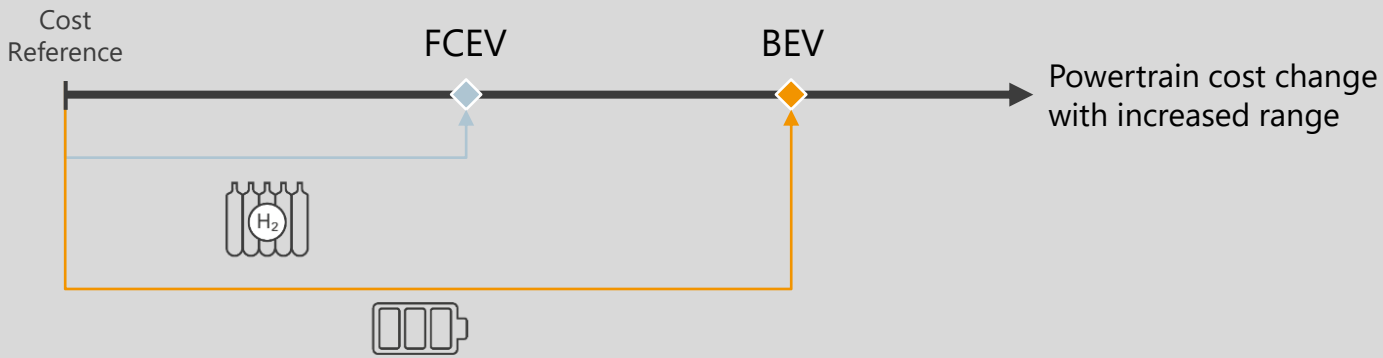
Hydrogen cost & availability

Required flexible usage of vehicles for regularly long-driving distances

Hydrogen range & refueling time

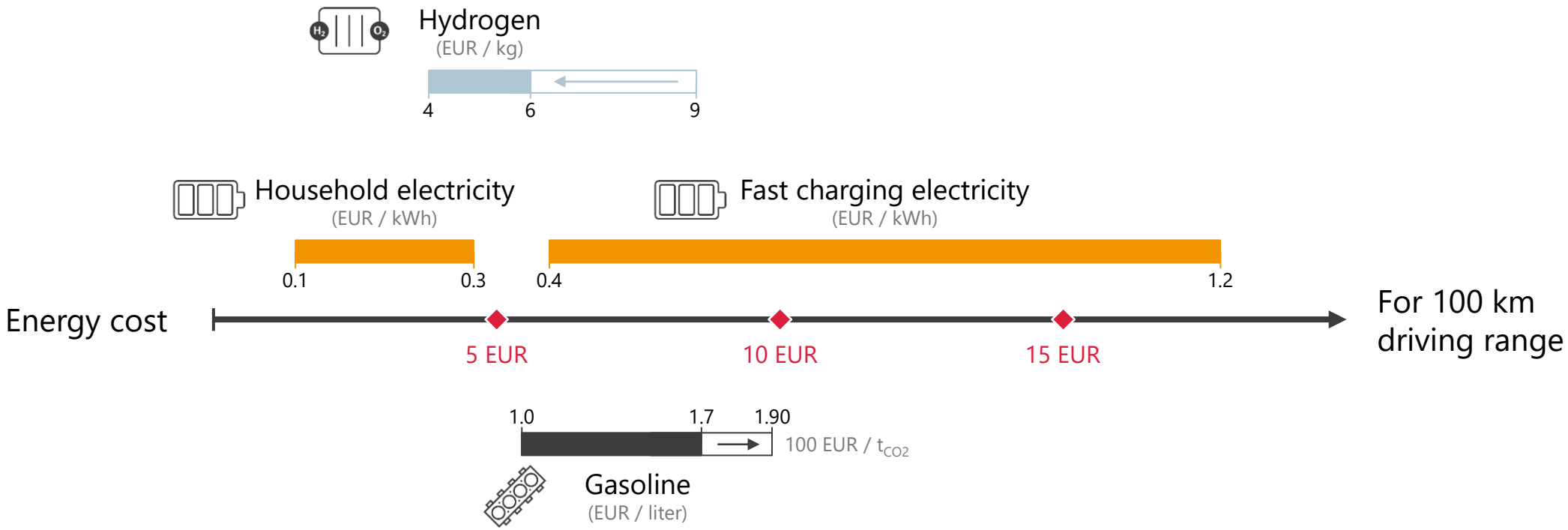
Fuel cell electric vehicles show their benefits especially for long-range applications, rather than for high performance cars





Besides purchasing cost, passenger car customers tend to make refueling cost an additional buying criteria

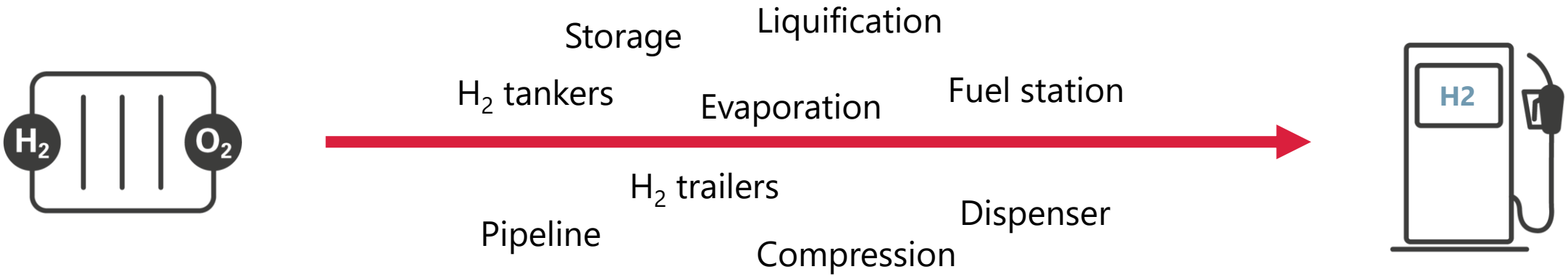
MOBILITY COST



Source: FEV

How can the supply chain for green Hydrogen be managed?

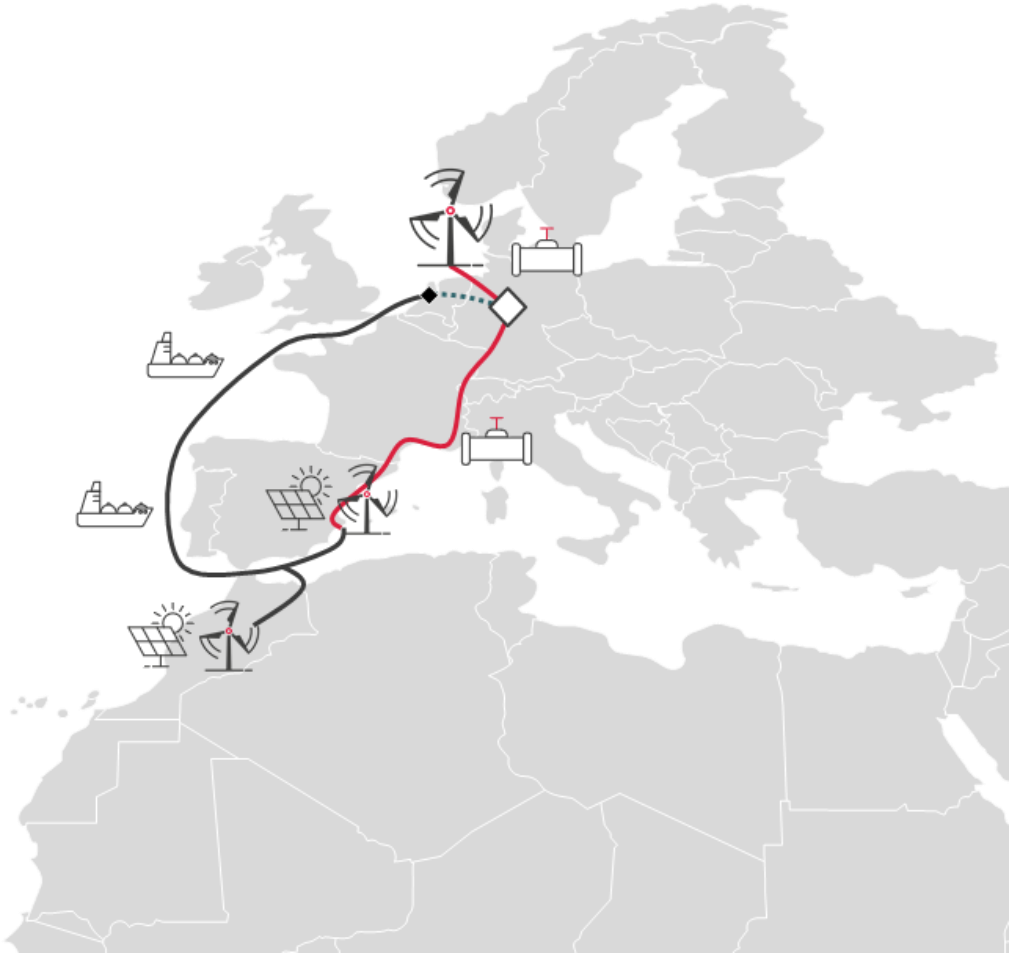
HYDROGEN SUPPLY CHAIN OVERVIEW

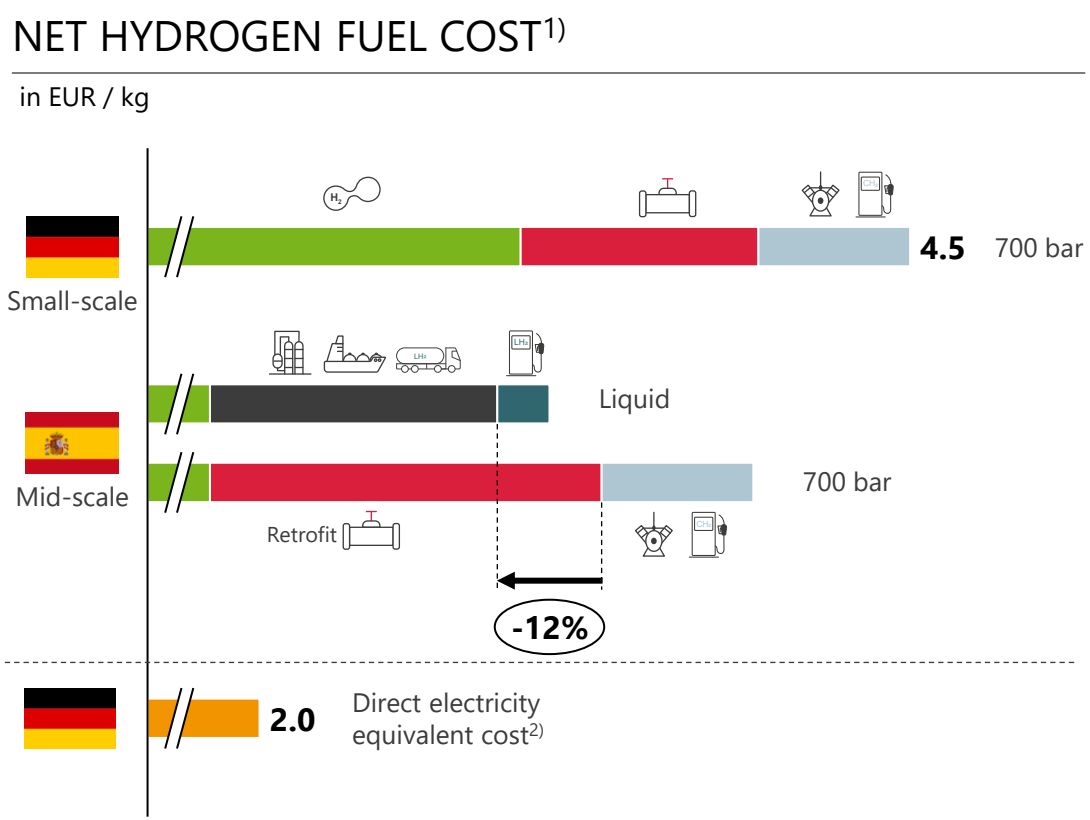


- Where can Hydrogen be produced?
- How to transport Hydrogen to the fuel pump?
- Which cost will different types of Hydrogen and the supply chains imply?

Local production but also large-scale transport of Hydrogen will be required in the future

GREEN HYDROGEN COST COMPARISON





1) Cost at dispenser without taxes; 2) Assuming 85% transport & charging efficiency, normalized to equivalent energy; Distribution cost include intermediate storage
Source: FEV

Beside the distribution via fuel stations, there can be alternative supply solutions which can help to accelerate the usage of Hydrogen

ALTERNATE HYDROGEN SUPPLY SOLUTIONS

Hydrogen refueling stations

Mobile Hydrogen refueling stations

Hydrogen micro-grids

CONCLUSION

“We are determined to tackle climate change and turn it into an opportunity for the EU. Clean hydrogen is a perfect mean to achieve our goals.”

Ursula von der Leyen 2021

CONTACT DETAILS

Thank you for your kind attention!

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