



# Hydrogen Europe

## Hydrogen as an Enabler

18 February 2019

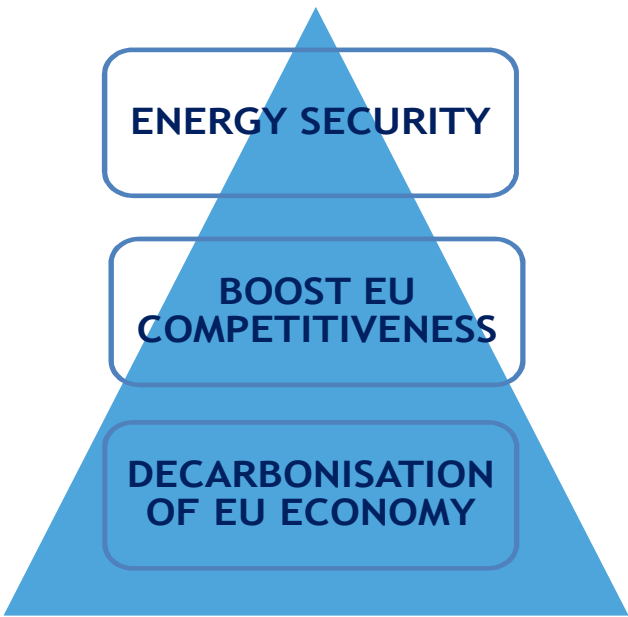
@ FSR Workshop, Brussels

Didier Stevens, Member of the Board

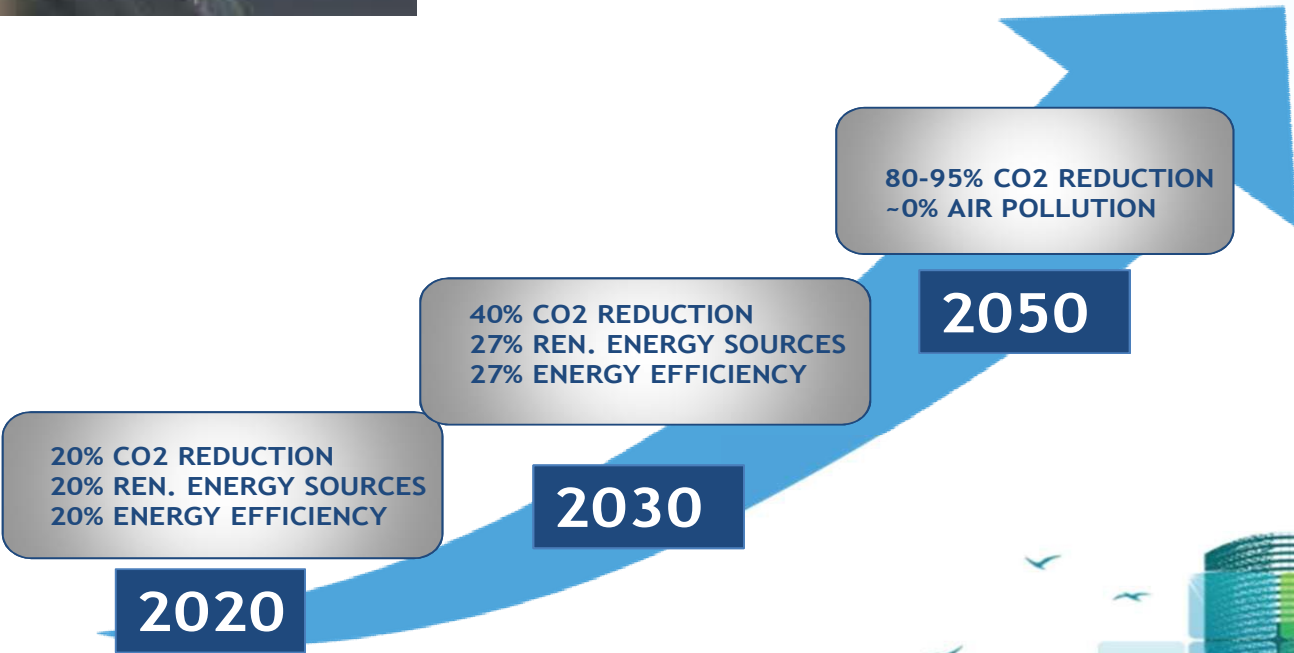


# Europe's decarbonised vision & reality

## EU CLIMATE AND ENERGY FRAMEWORK

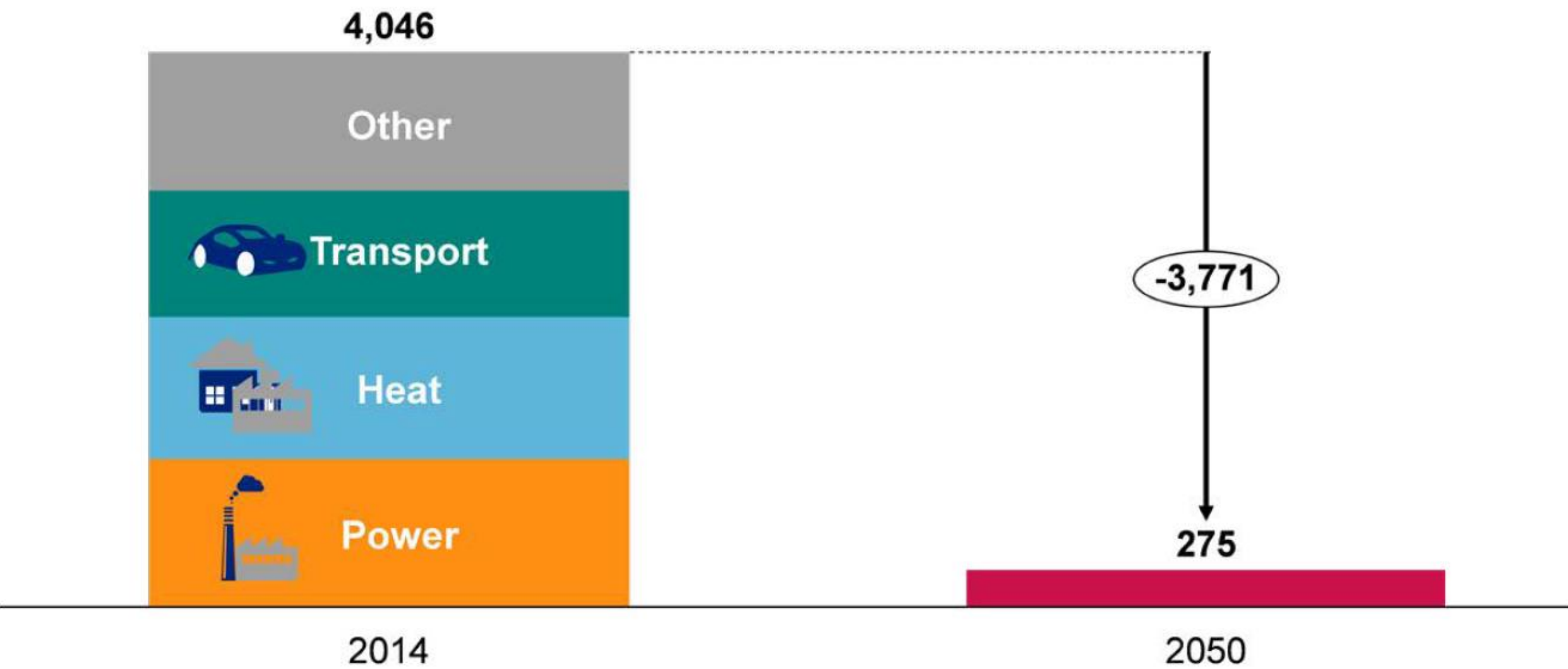


*“I want to reform and reorganise Europe’s energy policy in a new European Energy Union.”*



# Europe's decarbonised vision & reality

FIGURE 1 – THE SCALE OF EUROPE’S DECARBONISATION PROBLEM (MtCO<sub>2</sub>e)



Sources: Poyry point of view, fully decarbonising europe’s energy system by 2050, May 2018



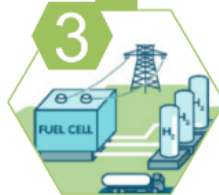
# The solution for decarbonisation

Enable the renewable energy system —————> Decarbonize end uses

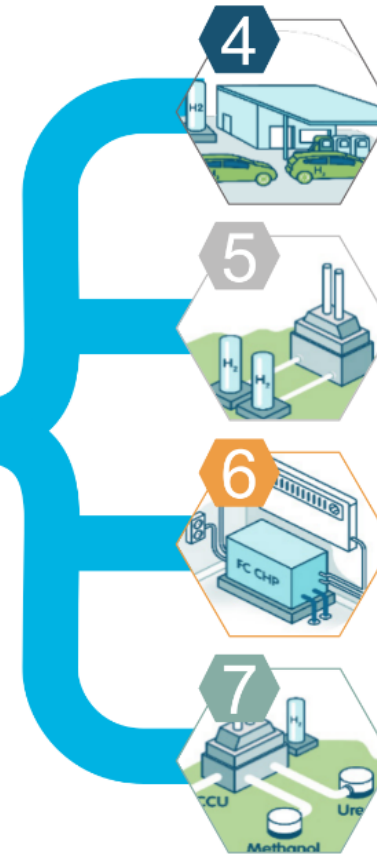
Enable **large-scale renewables integration** and **power generation**



**Distribute** energy across sectors and regions



Act as a **buffer** to increase system resilience



Help decarbonize **transportation**

Help decarbonize **industrial energy use**

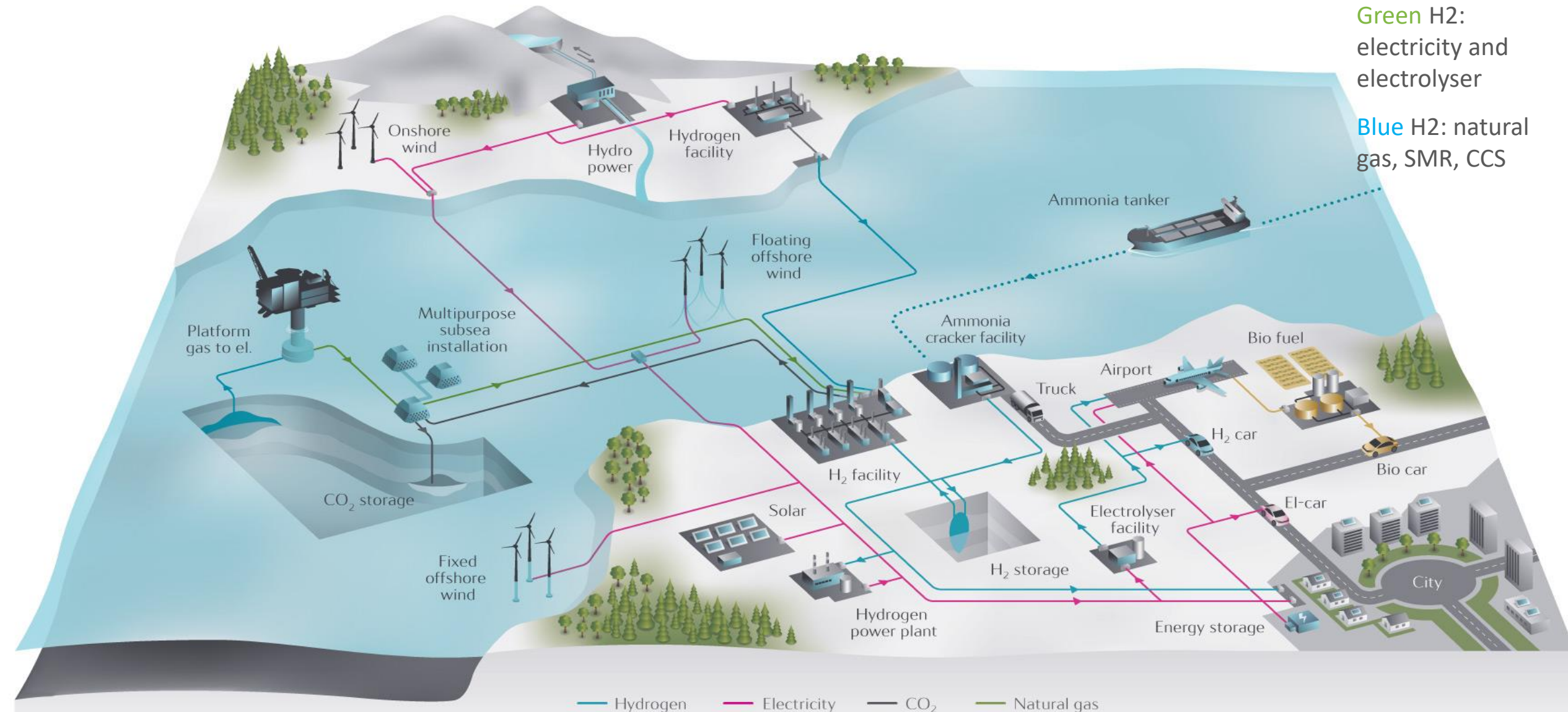
Help decarbonize **building heat and power**

Serve as renewable **feedstock**

# Hydrogen Production >> Green & Blue

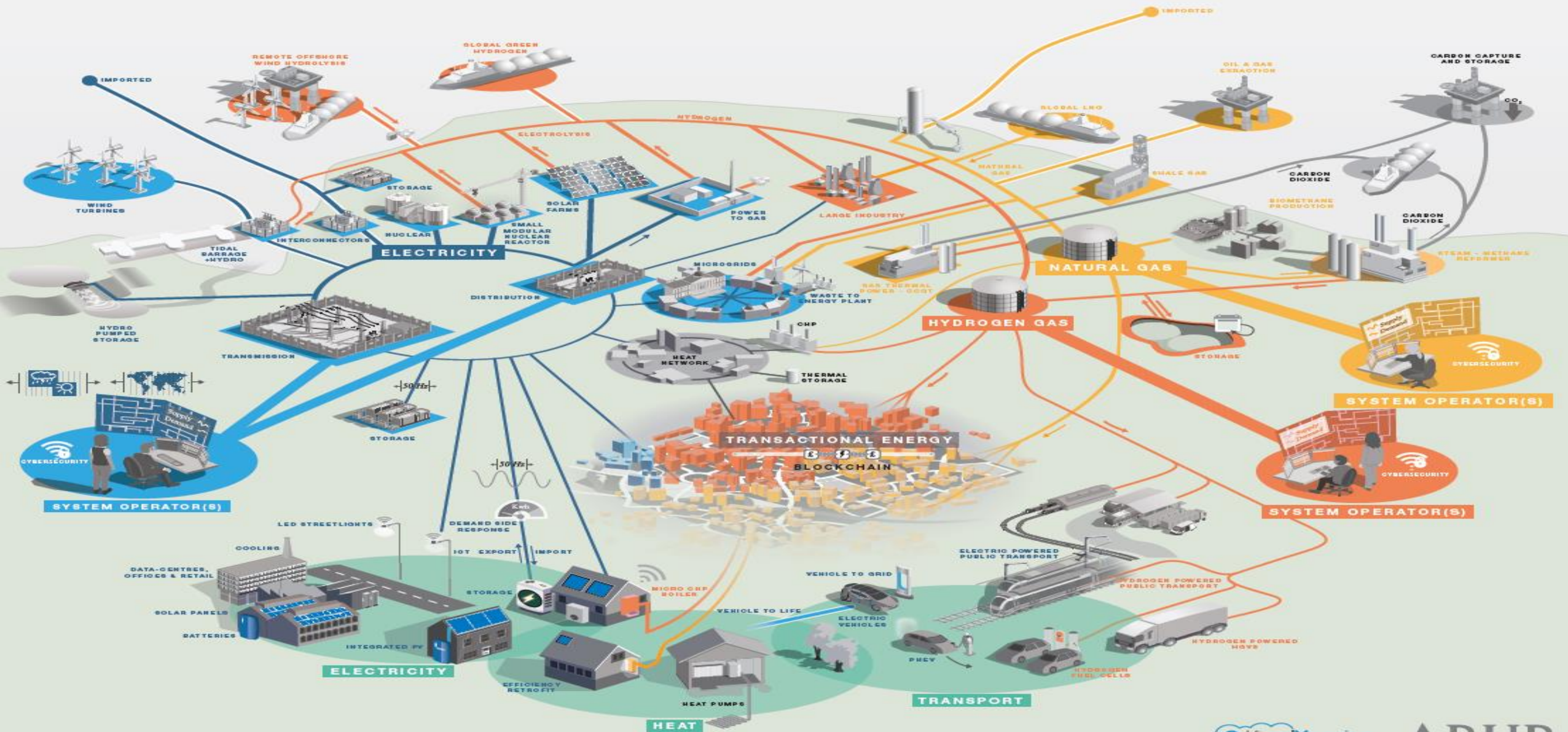
**Green H<sub>2</sub>:**  
electricity and  
electrolyser

**Blue H<sub>2</sub>:** natural  
gas, SMR, CCS

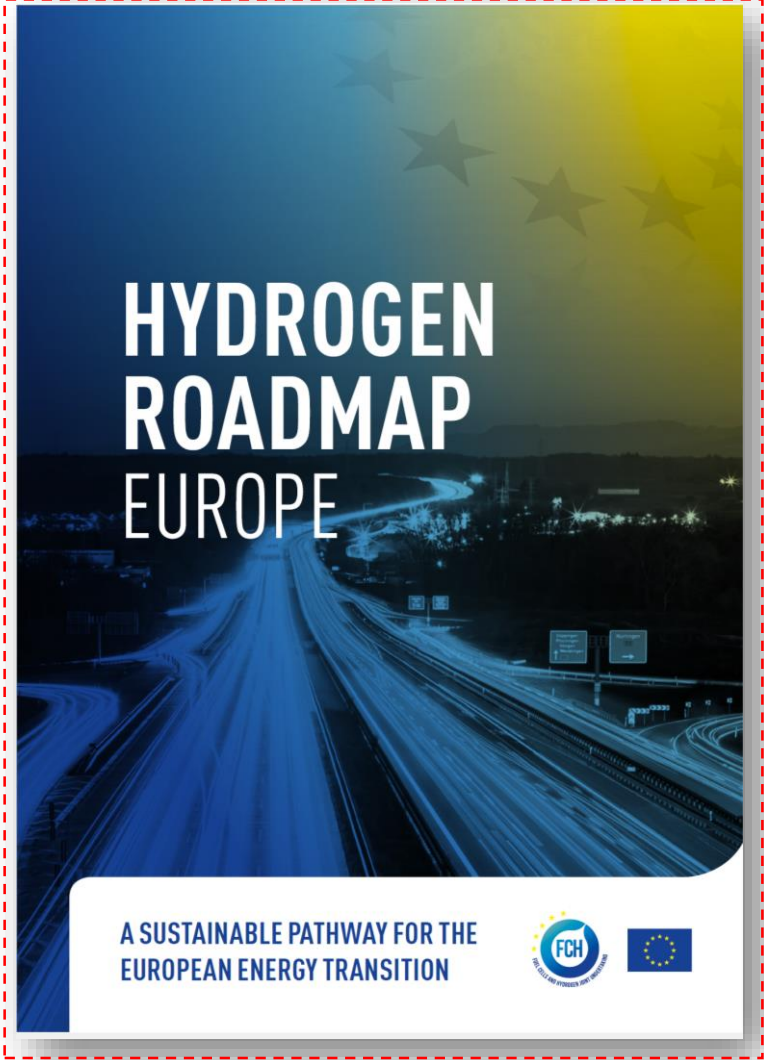
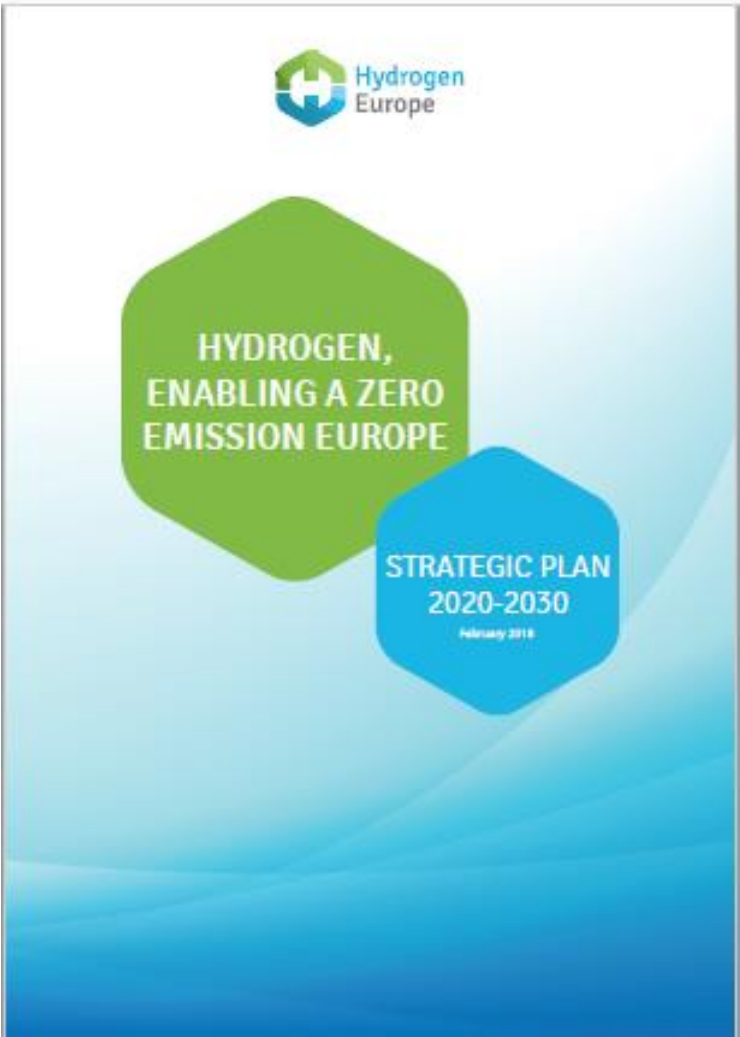




# Sectoral Integration = System Efficiency









# Hydrogen Roadmap for Europe

BESIDES CO<sub>2</sub> ABATEMENT, DEPLOYMENT OF THE HYDROGEN ROADMAP ALSO CUTS LOCAL EMISSIONS, CREATES NEW MARKETS AND SECURES SUSTAINABLE EMPLOYMENT IN EUROPE

## 2050 hydrogen vision



~24%

of final energy  
demand<sup>1</sup>



~560 Mt

annual CO<sub>2</sub>  
abatement<sup>2</sup>



~EUR 820bn

annual revenue  
(hydrogen and  
equipment)



~15%

reduction of local  
emissions (NO<sub>x</sub>)  
relative to road transport

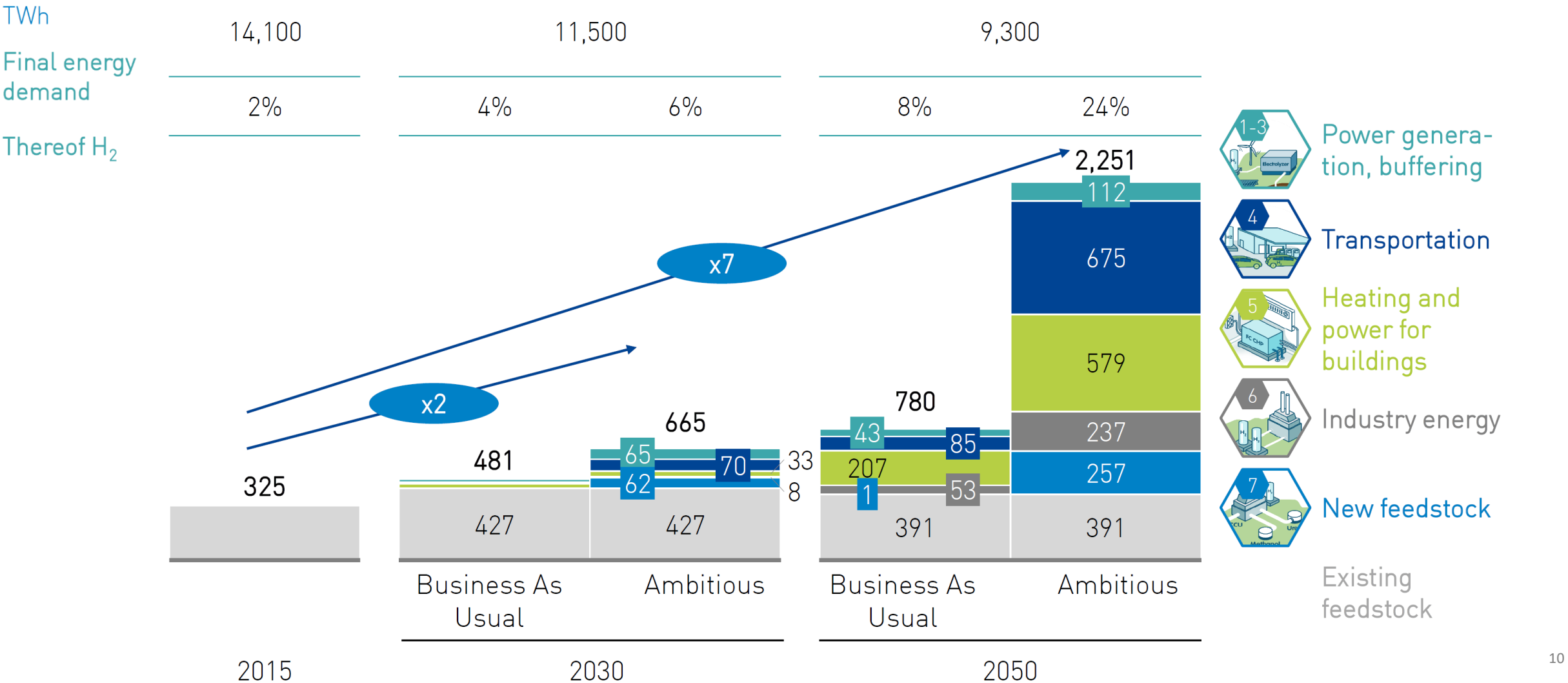


~5.4m

jobs (hydrogen,  
equipment, supplier  
industries)<sup>3</sup>

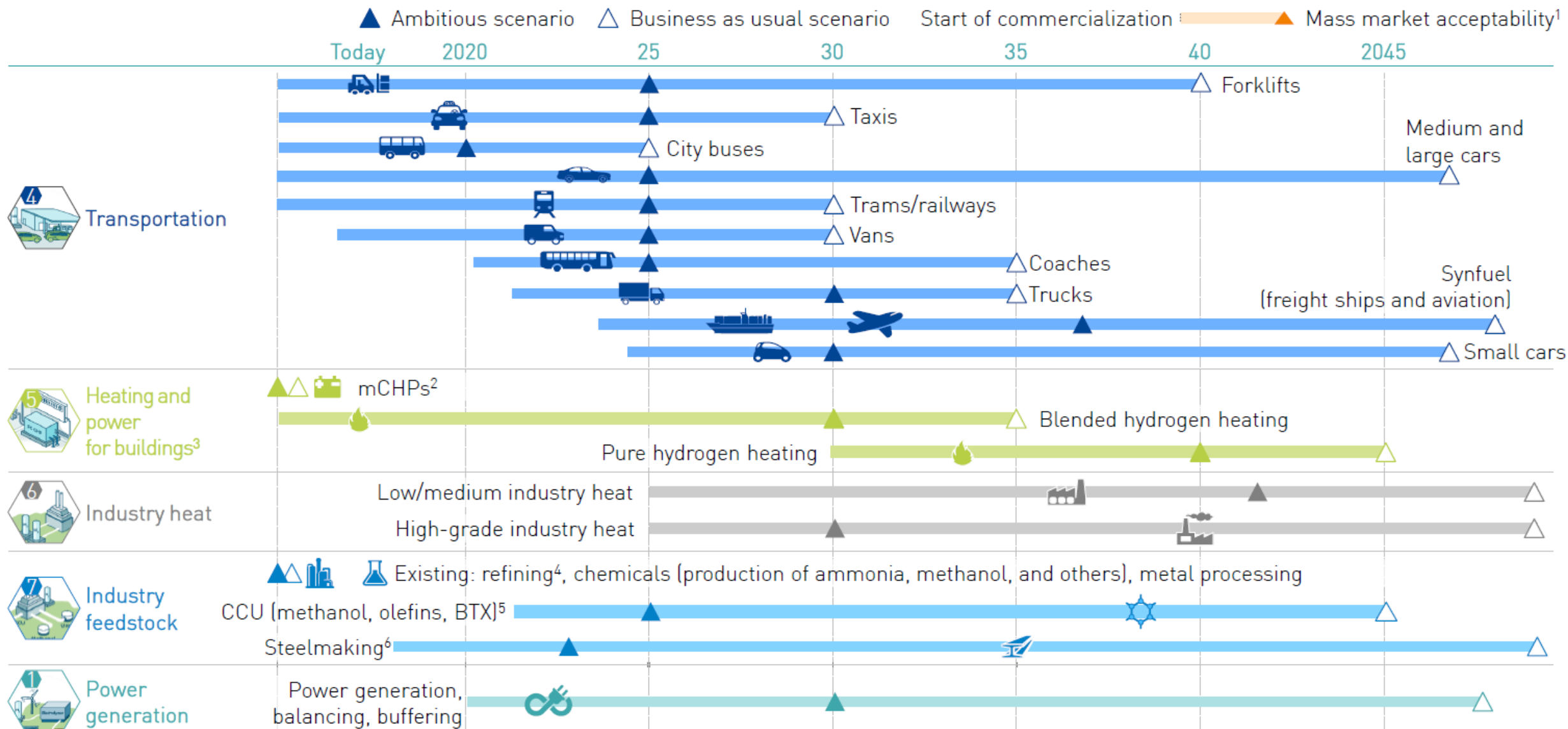
# Hydrogen Roadmap for Europe

HYDROGEN COULD PROVIDE UP TO 24% OF TOTAL ENERGY DEMAND, OR UP TO ~2,250 TWH OF ENERGY IN THE EU BY 2050



# Hydrogen Roadmap for Europe

## HYDROGEN TECHNOLOGY EXISTS AND IS READY TO BE DEPLOYED

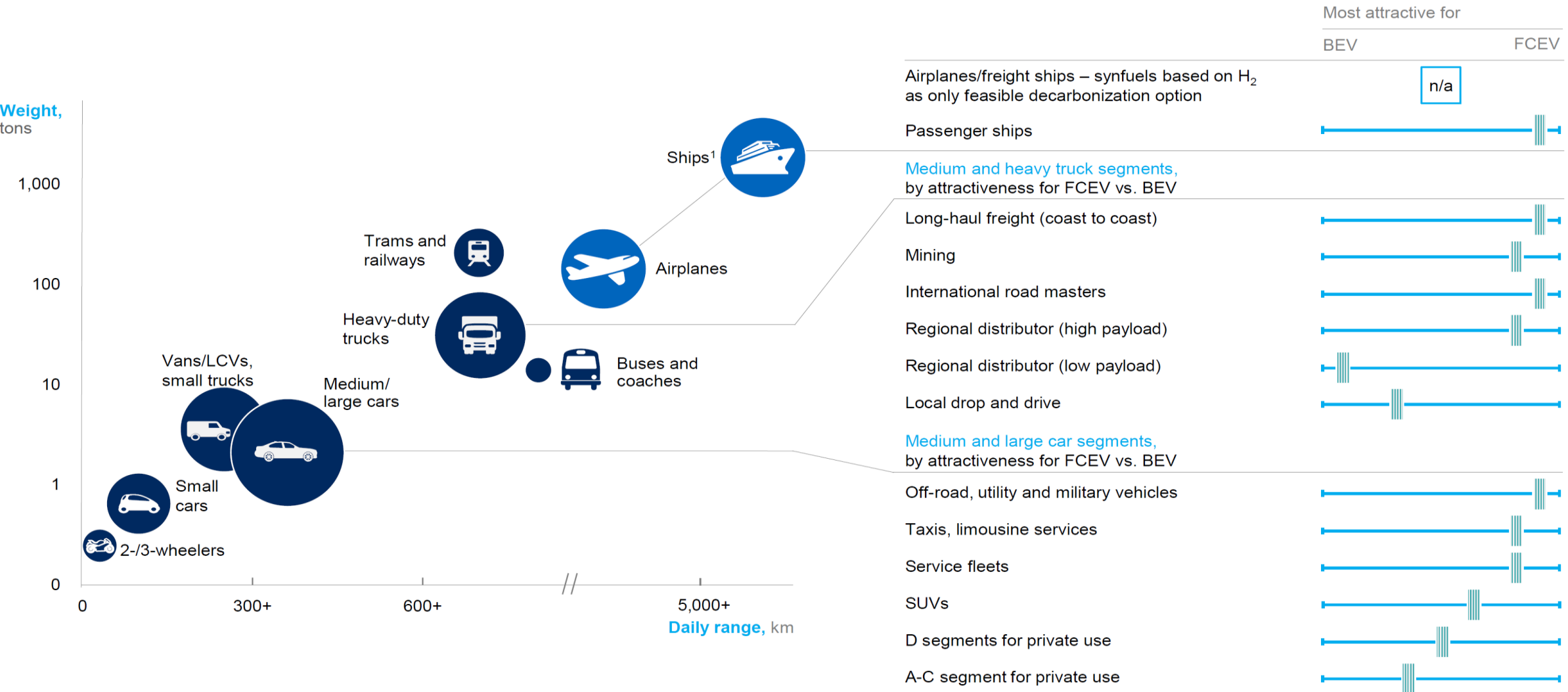




# Hydrogen Roadmap for Europe: Transport

## FCEVs as most efficient decarbonisation level for long-distances and heavy payloads

Bubble color representing FCEV or synfuel application of H<sub>2</sub>    Bubble size roughly representing the annual energy consumption of this vehicle type in 2050



1 H<sub>2</sub>-based fuels or fuel cells

# Hydrogen Roadmap

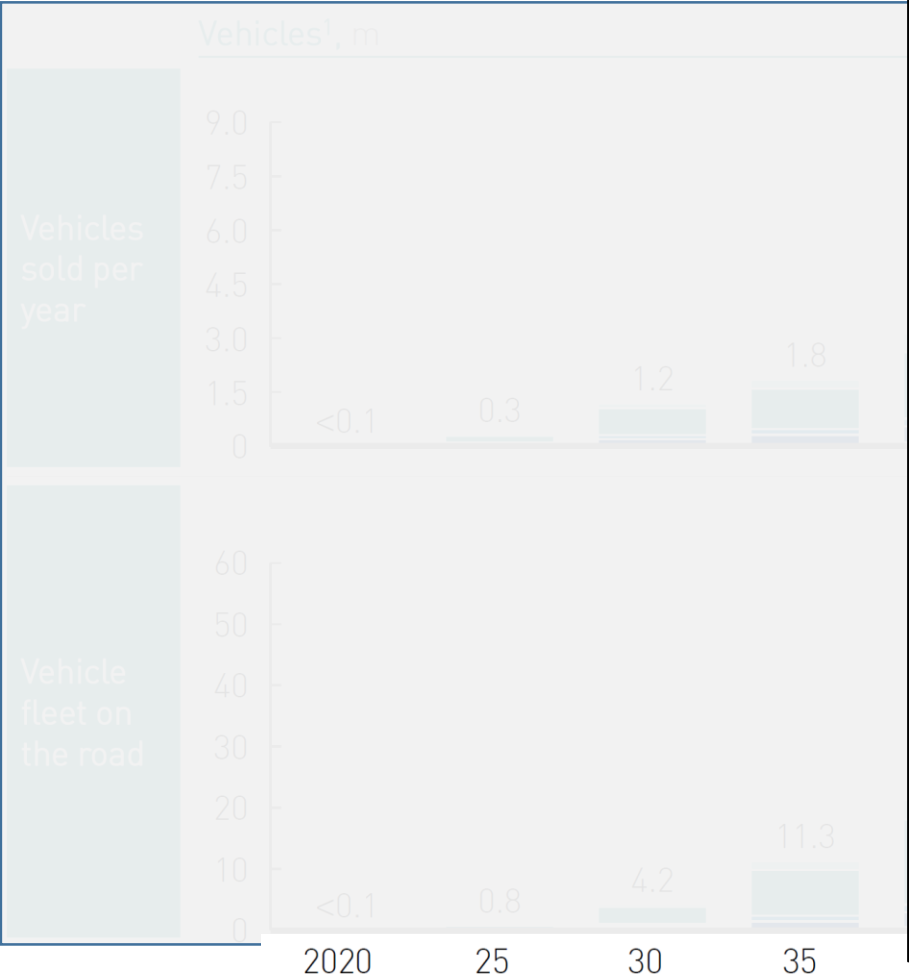
FCEV share in respective segment



CARS ARE MANUFACTURED IN THE G  
PENETRATIONS IN COMMERCIAL FLE

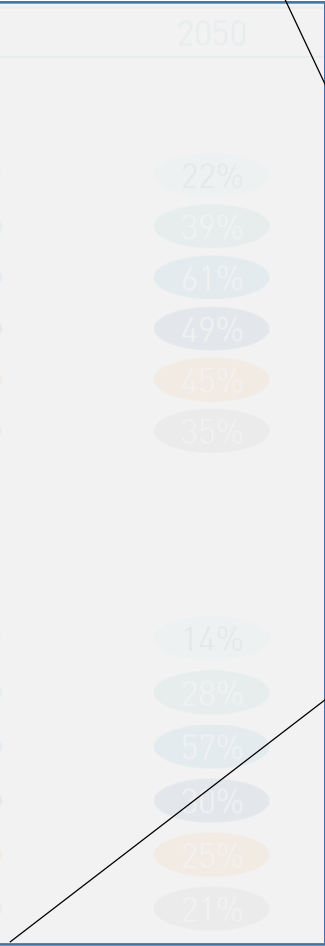
IFICANT

re in respective



	2030	2050
	2%	22%
	5%	39%
	14%	61%
	8%	49%
	6%	45%
	1%	35%

	0%	14%
	2%	28%
	8%	57%
	3%	30%
	2%	25%
	<1%	21%



# Hydrogen Roadmap for Europe



EXAMPLE FOR TRUCKS: HYDROGEN FUEL CELL POWERTRAINS ARE A TECHNICALLY ADVANCED ZERO EMISSION TECHNOLOGY AND COST COMPETITIVE FOR HEAVY TRANSPORT



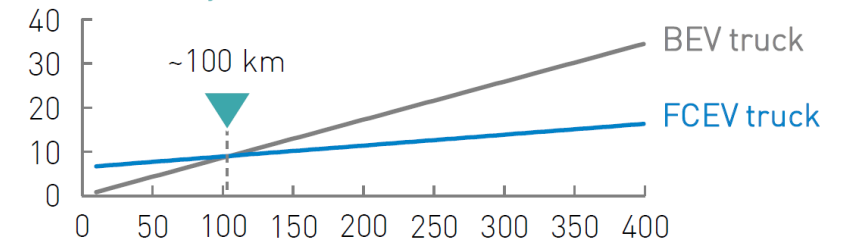
FUEL CELLS  
FOR HEAVY  
TRANSPORT

1



FCEV powertrains for trucks are cost competitive with BEV from 100 km range

Powertrain system cost, '000 EUR



Energy capacity converted to range, km

2



Hydrogen refueling is 15 times faster than fast charging

After 10 minutes refueling/recharging time



90%

FCEV truck

vs.



10%

BEV truck

of ~1000 km range

3



Recharging infrastructure ...

requires  
**10-15x**  
less space

and

creates  
**flexible**  
instead of peak load

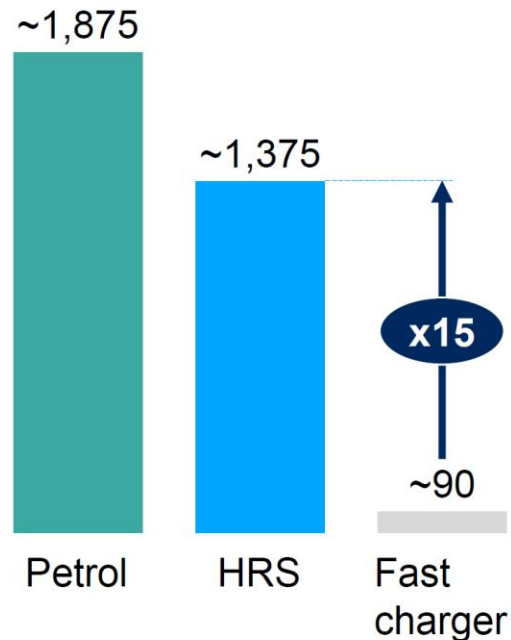


# Hydrogen Roadmap for Europe: Transport

A HRS is able to refuel ~15 times more vehicles than a fast charging station, leading to significantly less space requirements and offsetting the higher installation costs of a HRS

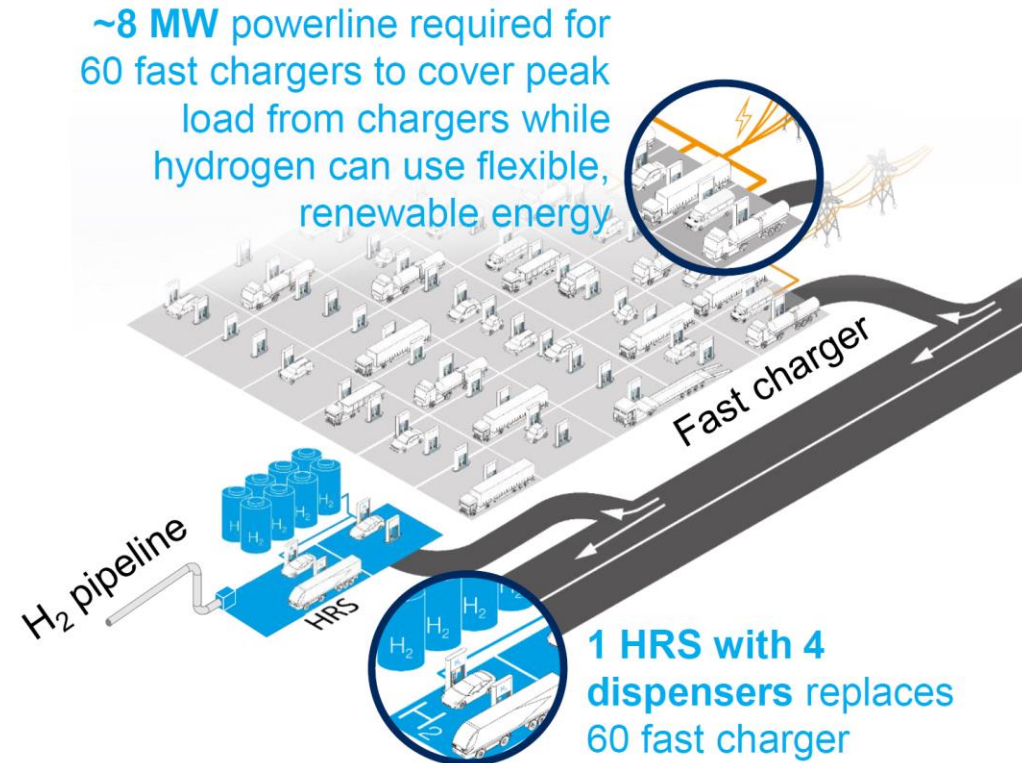
## Refueling speed

Km/15 minutes of refueling



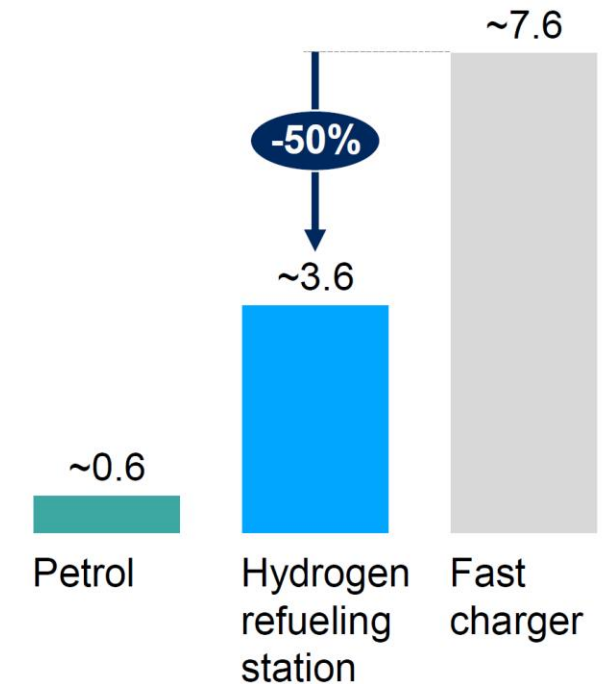
Hydrogen refueling is 15x faster than fast charging

## Space requirements



## Investment costs per refueling

EUR/refueling

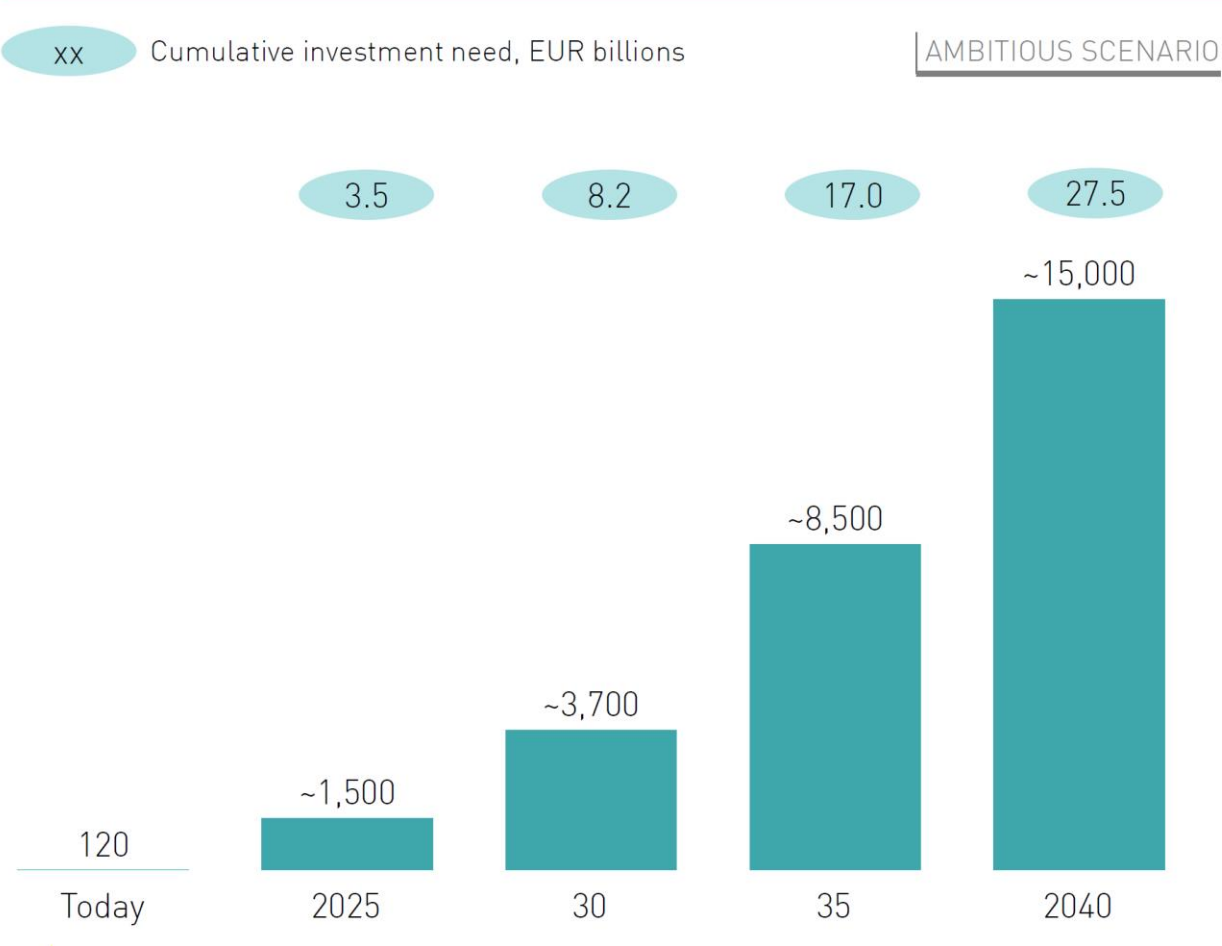


Hydrogen refueling is half as capital-intensive as fast charging

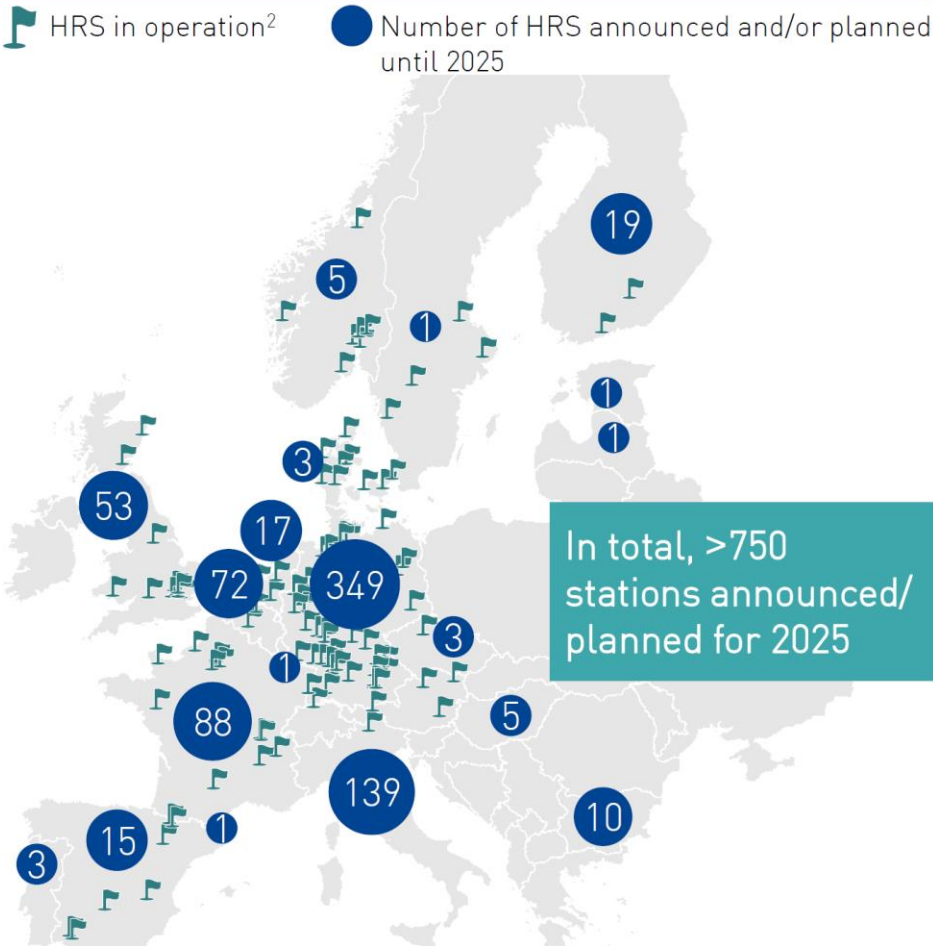
# Hydrogen Roadmap for Europe: Transport

THE EQUIVALENT OF ~3,740 REFUELING STATIONS WOULD BE REQUIRED BY 2030, IMPLYING INVESTMENT NEEDS OF EUR ~8.2 BN

Required large HRS<sup>1</sup>, number



Current and planned HRS in Europe

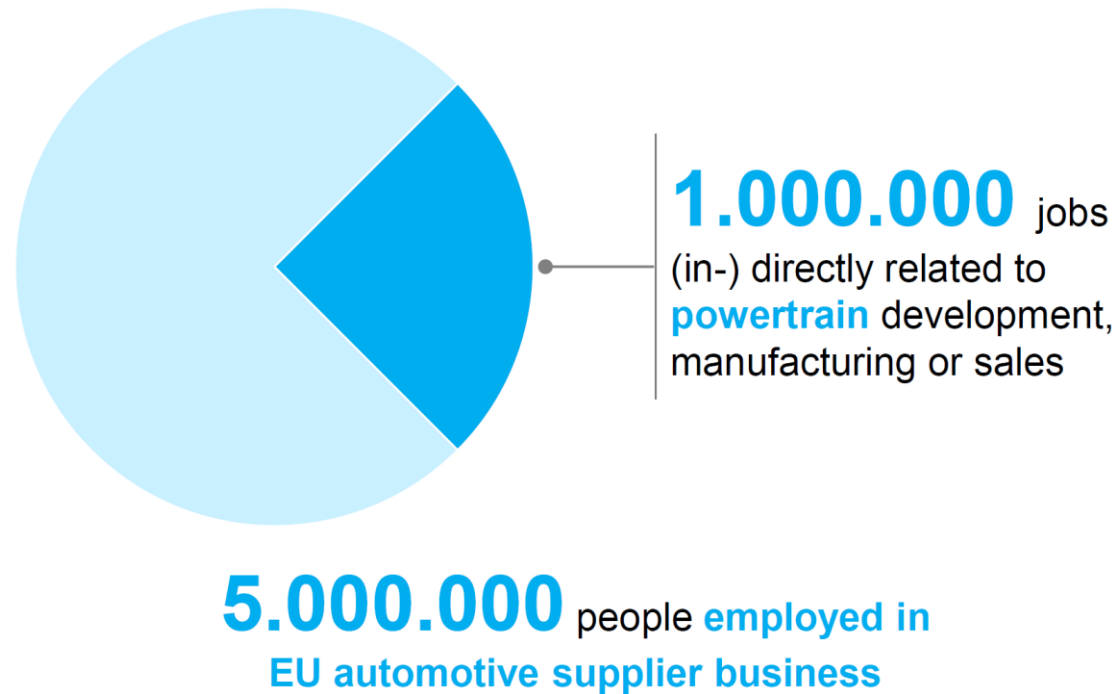


# Hydrogen Roadmap for Europe: Transport

EU powertrain industry as important driver of economic growth and employment rates

## Employees in the EU automotive supplier industry

Number



In BEVs, **30% of value creation** lies in the battery – an industry that is heavily dominated by 5 Korean, Japanese and Chinese companies and requires very low labor force

**Development of fuel cells and powertrains** requires advanced engineering expertise, which is an ideal fit to **European industry structure** with many mid-sized suppliers and **skill set** in system development and integration





# Shift happens! Hydrogen enables you.



**THANKS**  
*for your attention!*

## Contacts

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