



# Fuel cell buses in Europe: from demonstration to commercialisation



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# WHAT IS HYDROGEN?

## A zero emission fuel

Renewable electricity

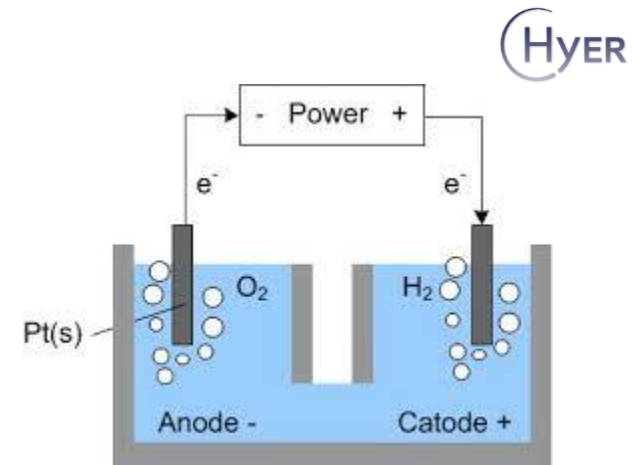


Hydrogen production



Hydrogen applications

- Hydrogen is a gas which is used as a fuel: the fuel cell converts hydrogen into electricity in the vehicle
- Hydrogen can be produced from renewable electricity → zero emissions during energy production + during use



Potential for complete decarbonisation of the transport system – well to wheel

Medium & light duty transport



Heavy duty transport



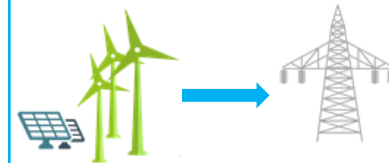
Maritime applications



Stationary applications

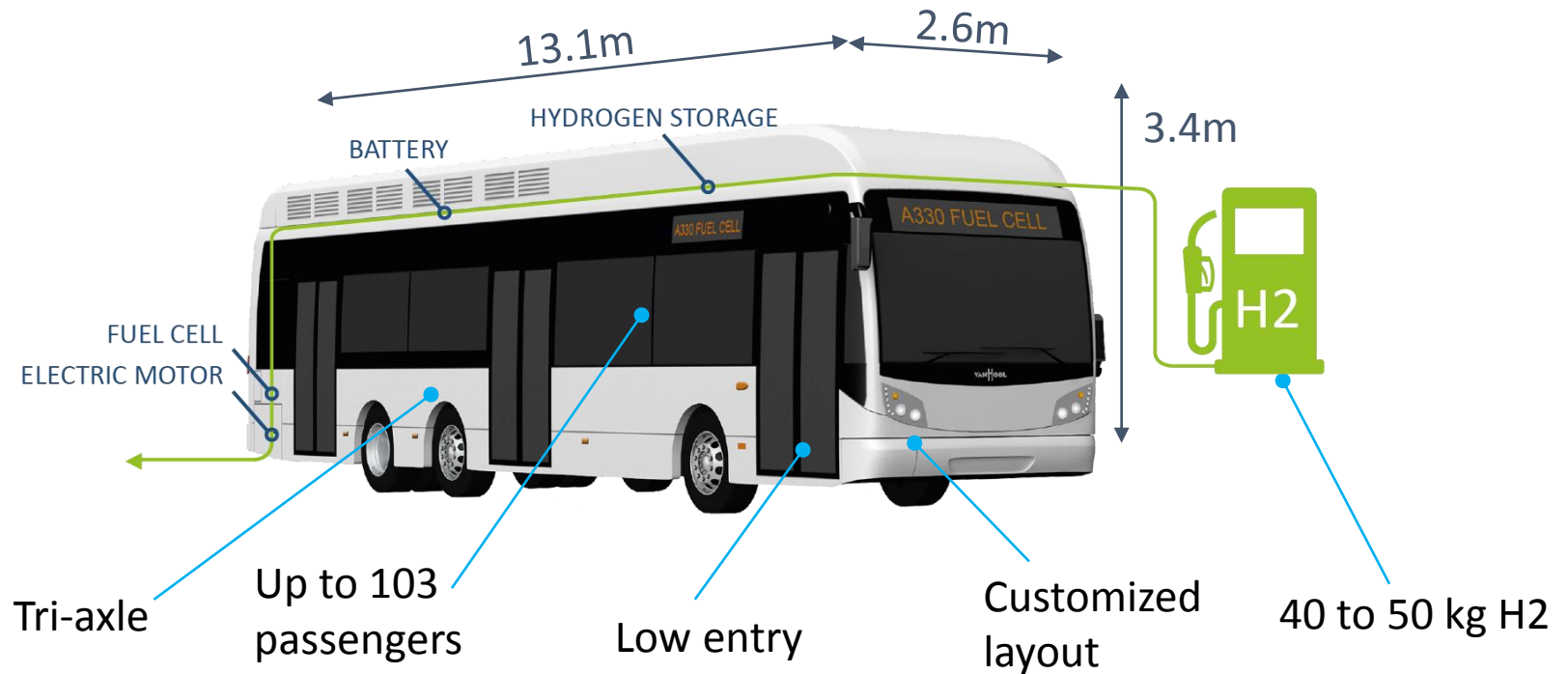


Energy systems



# FUEL CELL BUS – SPECIFICATIONS

## Van Hool A330



# WHY FUEL CELL ELECTRIC BUSES?

Fuel cell electric buses are a zero-emission solution ready for commercialisation



ONLY EMIT WATER  
VAPOUR



REDUCING CO2 EMISSIONS  
AND IMPROVING AIR QUALITY



REDUCED NOISE AND  
VIBRATION LEVELS



PASSENGERS AND DRIVERS  
ENJOY THE BUSES



LARGE RANGE WITH ONLY 1  
REFILL A DAY (<12 MINUTES)



READY FOR MARKET  
DEPLOYMENT



**From greenhouse gas  
emissions to clean cities**

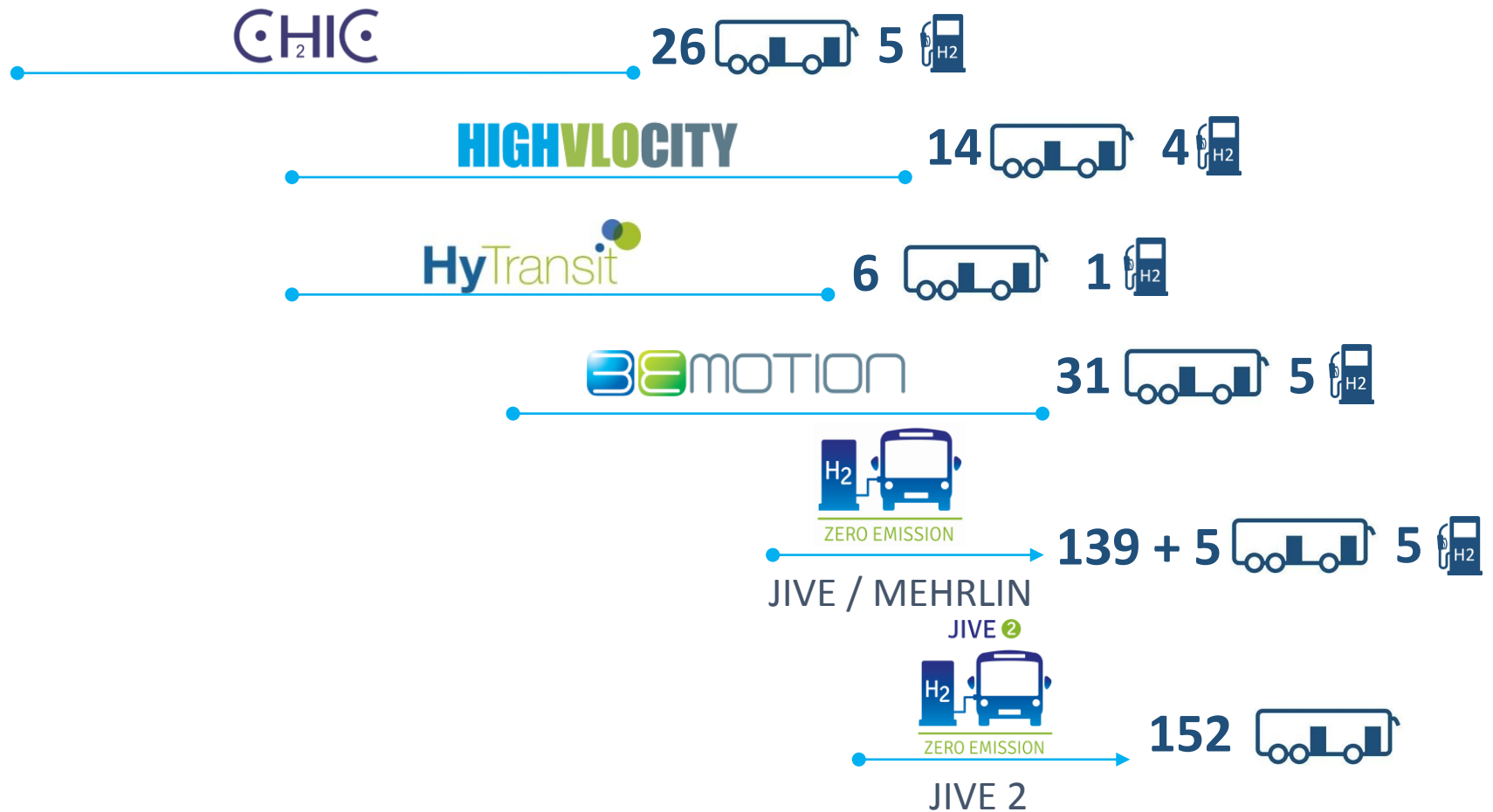


# PROJECTS ACROSS EUROPE

Funded by the FCH-JU



FUEL CELLS AND HYDROGEN  
JOINT UNDERTAKING



2011



NOW

2020

# THE ABERDEEN BUS PROJECT

## An innovative public-private partnership

Europe's largest fuel cell electric bus fleet to date: 10 buses in total

- 4 buses 
- 6 buses 
- 1 production & refuelling station – 100% green hydrogen
- Dedicated bus maintenance facility





# POLICY BACKGROUND

## Developing a hydrogen economy

**Strategic aim** : to become '*a world-class energy hub leading a low carbon economy and at the forefront of hydrogen technology in Europe*'

### Local drivers

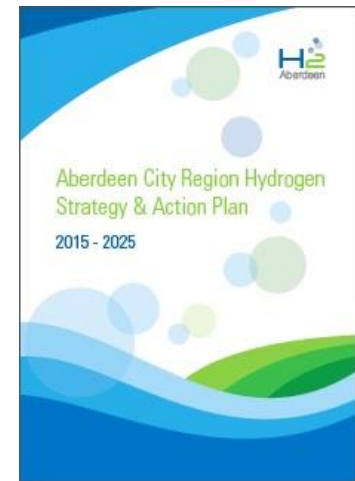
- High pollution levels in some areas of the city centre
- Highly skilled workforce in energy sector (oil and gas industry)
- Accustomed to the use of hydrogen in industrial processes
- Production of excess renewable energy (wind)

### Policy drivers

- Reduce cross-sector greenhouse gas emissions by 42% by 2020 and 80% by 2050 (Scotland)
- Aberdeen City and Region Hydrogen Strategy 2015-2025

### EU level

- Presidency of HyER (Hydrogen, Fuel Cells and Electro-mobility in European Regions) since 2015



# PROJECT FUNDING



Total budget: £19m



£8.3m

EU  
FUNDING



FUEL CELLS AND HYDROGEN  
JOINT UNDERTAKING



+

£6.7m

NATIONAL  
FUNDING

Innovate UK



SGN  
Your gas. Our network.



+

£4m

LOCAL  
FUNDING





# ACHIEVEMENTS SO FAR

## Operational details

More than

KM  
DRIVEN **1 million**

**9-10**

KG HYDROGEN  
PER 100 KM

**>98%**

**>87%**

BUS  
AVAILABILITY

**10**

BUSES IN FULL  
OPERATION

AVAILABILITY  
OF STATION

**10-12**

mins refuelling time

Around

TONNES OF CO2 SAVED\*

**150**



\*COMPARED TO EURO VI VEHICLES

# FIRST CONCLUSIONS

## Lessons learned

- Zero emissions
- Flexible solution, well adapted to Aberdeen's routes
- Inform bus drivers / passengers about the buses
- Manage expectations about technology and define roles clearly
- Refuelling stations: mature and reliable technology
- Very good customer & drivers acceptance
- Can easily be scaled up

## Challenges

- Technical availability not quite at the level of conventional fuel buses
- Maturity of supply chain
- Cost of vehicles
- Cost of infrastructure/ hydrogen production
- Training of drivers / technicians is essential
- Introduction of new technologies in general

# WHAT'S NEXT?

## High ambitions



10 more buses will be deployed in Aberdeen in 2019 through the EU-funded JIVE 1 (but political approval for 20 more buses)  
→ Joint procurement exercise in the UK

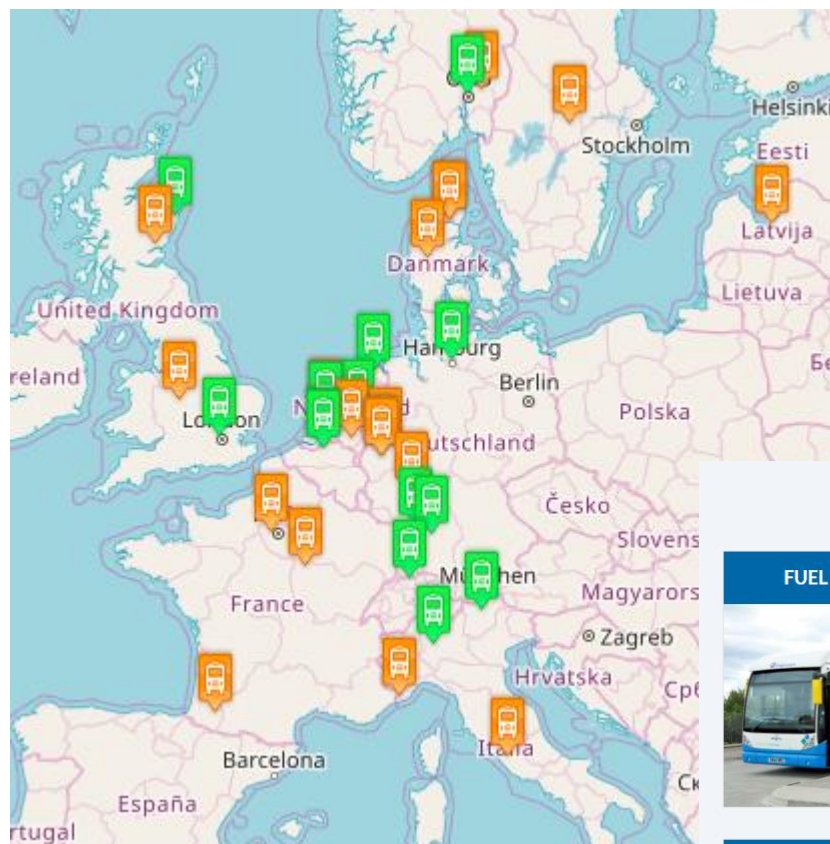
But the fuel cell buses project also enabled the City Council to deploy more hydrogen powered vehicles in Aberdeen:



... and more to come!

# FOR MORE INFORMATION...

[www.fuelcellbuses.eu](http://www.fuelcellbuses.eu)



## Everything you want to know about fuel cell buses in Europe!

### FUEL CELL ELECTRIC BUSES KNOWLEDGE BASE

All you want to know about fuel cell electric buses in Europe.

#### FUEL CELL ELECTRIC BUSES



#### HYDROGEN REFUELLING STATIONS



#### PERFORMANCE DATA



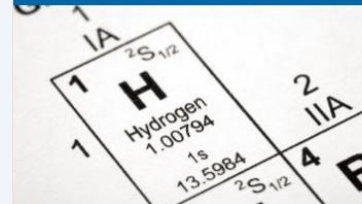
#### START TO IMPLEMENT



#### FRAMEWORK



#### HYDROGEN AND FUEL CELLS



# THANK YOU FOR YOUR ATTENTION!

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[@Fuelcellbus](https://twitter.com/Fuelcellbus)

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**FUEL CELLS AND HYDROGEN**  
JOINT UNDERTAKING



**Hy**Transit