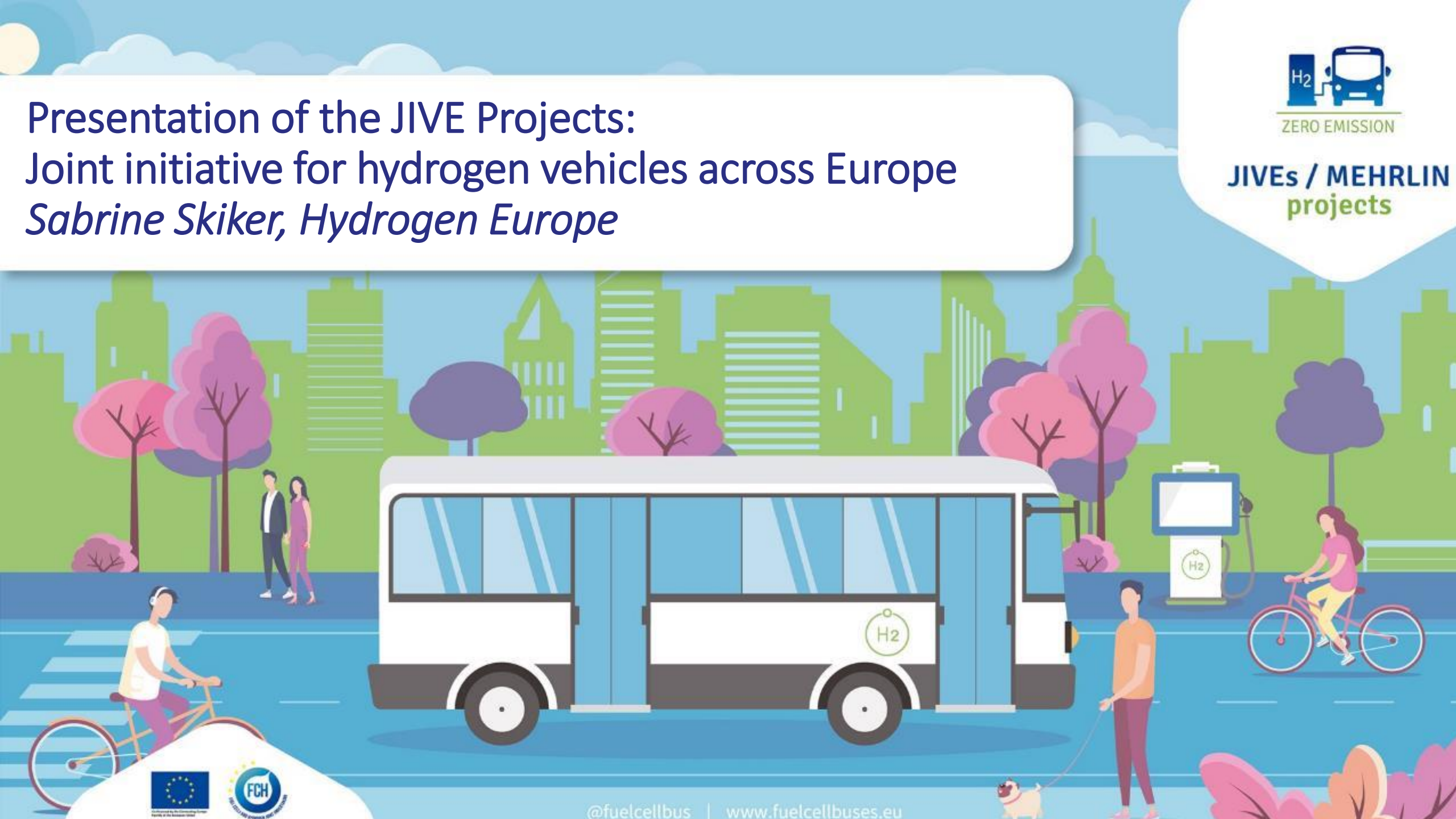
Presentation of the JIVE Projects:
Joint initiative for hydrogen vehicles across Europe

Sabrine Skiker, Hydrogen Europe

ZERO EMISSION

JIVEs / MEHRLIN projects




Hydrogen Europe

Agenda

- Background & context
- JIVE – overview & progress to date
- Lessons learnt

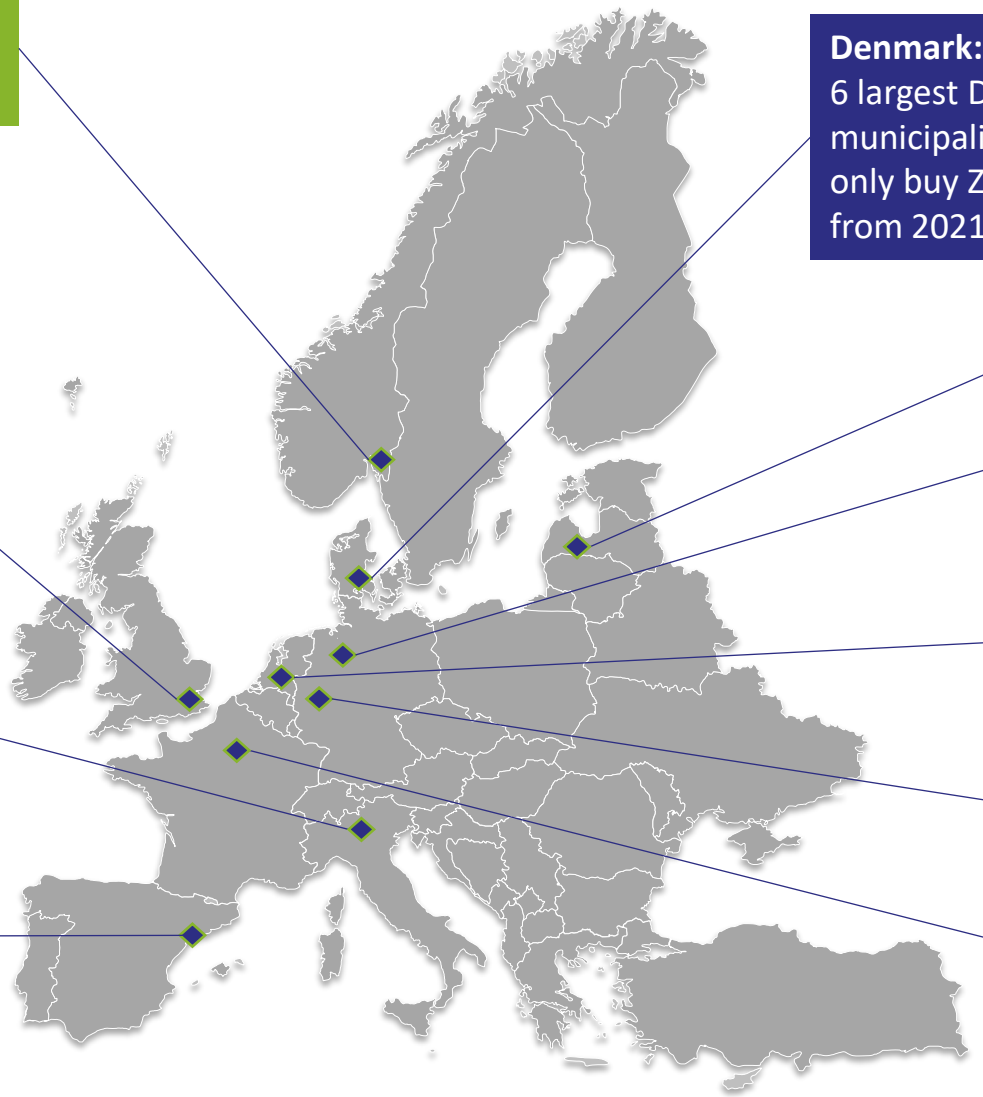
Local political commitments could create a market for thousands of new zero emission buses per year across Europe from the 2020s

Norway *(15,600)*:
All new buses procured from 2025 to be ZE

London *(9,500)*:
From 2020
All new single deck buses to be ZE
All single deck buses in central London to be ZE
From 2025
All new single and double deck buses to be ZE

Milan *(1,200)*: Only ZE buses to be procured from 2025

Barcelona *(1,100)*:
Only ZE buses to be procured from 2025



Denmark:
6 largest Danish municipalities to only buy ZE buses from 2021

Riga *(560)*:
All buses to be ZE 2025

Hamburg *(1,000)*:
All buses procured from 2020 must be ZE

The Netherlands *(10,000)*:
All new buses procured from 2025 to be ZE

Cologne region*(500)*:
All new buses procured from 2030 to be ZE

Paris *(6,850)*:
All new buses procured from 2025 to be ZE

ZE = zero emission; *approximate urban bus fleet size indicated in brackets ( )*

Relevant legislation at European level

- The **Directive on Alternative Fuels Infrastructure** (2014/94/EU): mandatory targets for alternative fuels infrastructure deployment (but hydrogen infrastructure targets are optional. Review expected in Q1 2021.

- The **Clean Vehicle Directive** (2019/1161): incl. min. public procurement targets per Member State for 'clean' buses:
  - Between 24-45% from 2021-2025;
  - Between 33-65% from 2025-2030.

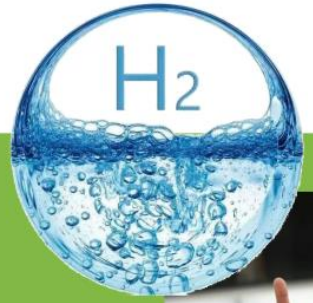
→ Half of the minimum target for the share of clean buses must be fulfilled by procuring zero-emission buses

Hydrogen momentum at European level

A **Hydrogen Strategy** for a climate neutral Europe

#EUGreenDeal

- Targets for renewable hydrogen production in Europe:
  - 6 GW by 2024; 40GW by 2030.
- On mobility: Local city fuel cell buses are seen as key for the uptake of hydrogen in ‘Phase 1’ (2020-2024).



“Next Generation EU should invest in Hydrogen.”
Ursula von der Leyen @State of Union speech, September 2020

“H2 rocks, and I am committed to making it a success!”
Frans Timmermans- Executive Vice-President for the European Green Deal

Hydrogen plans at national level – 2030 investment plans

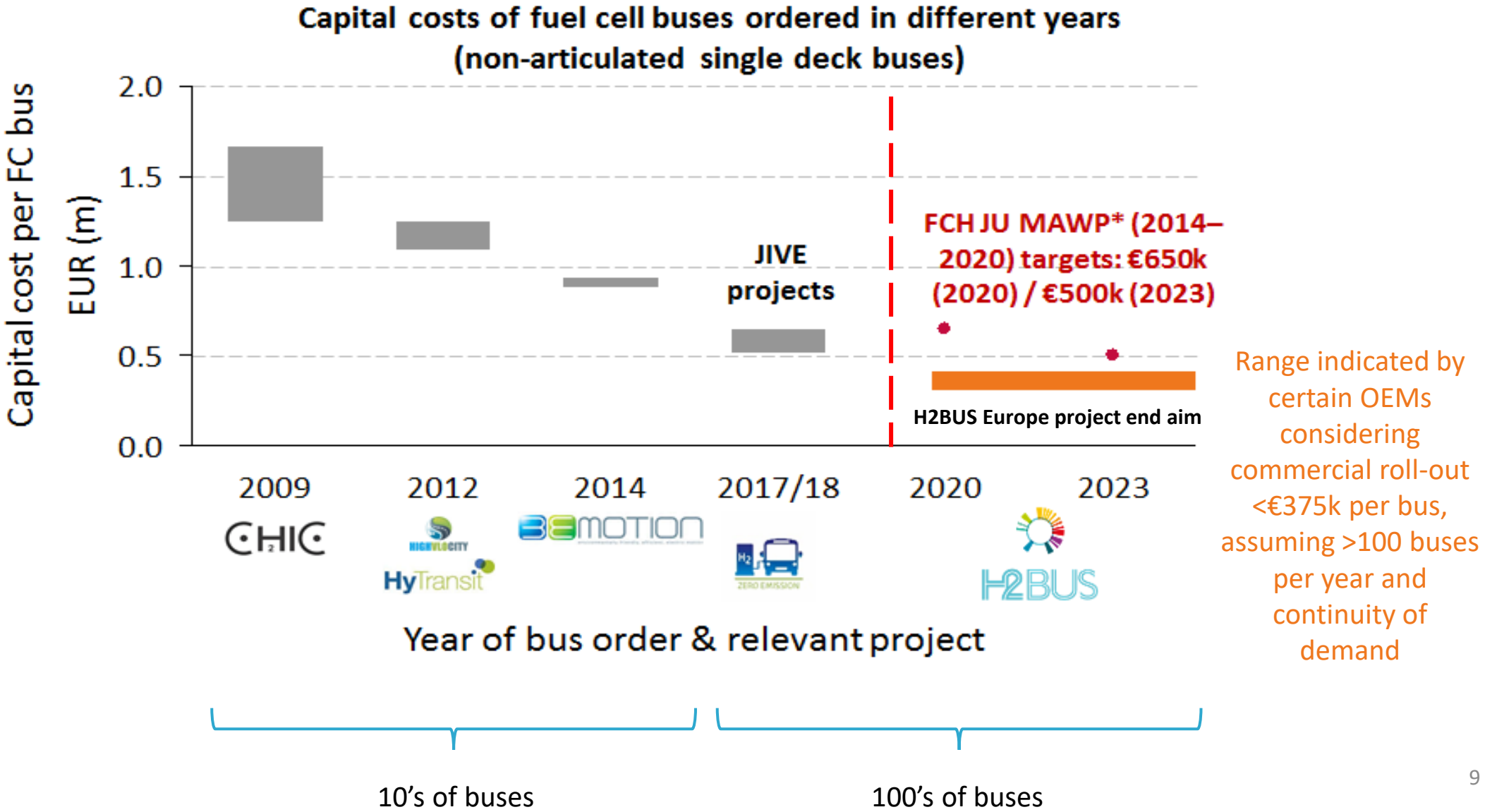
Germany 	€7bn (+ €2bn external partnerships)
Spain 	€8.9bn
France 	€7.2bn
Portugal 	€1bn
Italy 	€4bn
Austria 	€2bn

JIVE projects: deployment sites and objectives

Objectives:

- **Deploy nearly 300 buses &** associated infrastructure
- **Stimulate the market for FC buses** in Europe by creating demand for hundreds of vehicles
- **Lower the prices** of fuel cell buses using joint procurement and economies of scale
- Demonstrate routes to achieve **low cost renewable hydrogen**

CAPEX fuel cell buses over the different years



Range indicated by certain OEMs considering commercial roll-out <€375k per bus, assuming >100 buses per year and continuity of demand

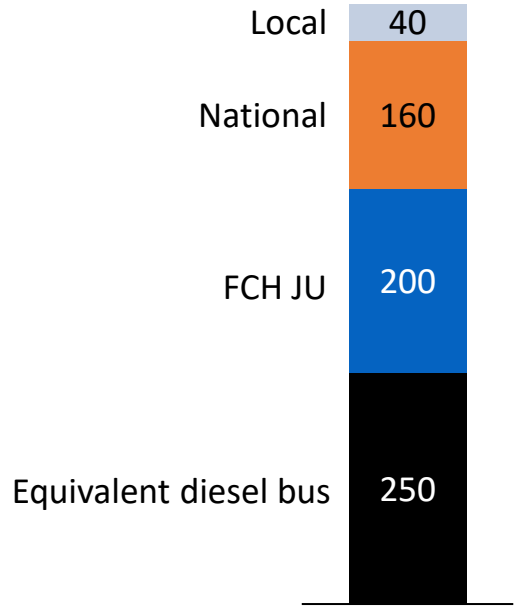
Each local project within the JIVE programme relies on funding from multiple sources

- Funding for a large-scale FC bus project was made available under the FCH JU's 2016 Annual Work Plan.
- The FC bus topic included a price ceiling (€650k for standard buses and €1m for articulated vehicles), and a cap on funding: "*The funding per vehicle cannot exceed €200k per standard bus (12/13.5 m), €250k per articulated bus (>18m), provided they are equipped with a full power FC system of at least 50kW*".
- Projects had to secure additional funding from other sources to give good leveraging of EU funding.

In addition, on the HRS side, 6 locations were awarded Connecting Europe Facility (CEF) funding (MEHLIN project)

Illustrative funding strategy for covering the capex of a FC bus in JIVE

Values in €k per bus*



* NB this excludes operating costs and costs associated with hydrogen refuelling infrastructure

OEMs in Europe are responding to the growing demand for FC buses and preparing to offer new solutions

European bus OEMs with fuel cell buses demonstrators / offering fuel cell buses for sale

CAETANOBUS

ebe EUROPA

DAIMLER EvoBus

Optare

rampini

Safra

ŠKODA

SOLARIS

URSUS BUS

VANHOOL

VDL BUS & COACH

WRIGHTBUS

Non European OEMs active in the fuel cell bus sector

FOTON

YUTONG

TATA

TOYOTA

HYUNDAI

HYZON MOTORS

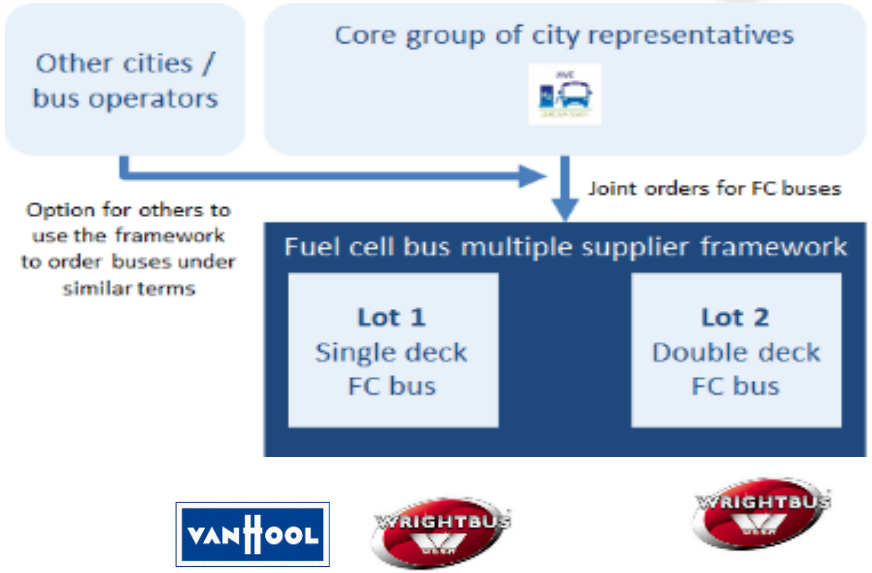
NEW FLYER

Source: Element Energy (based on public announcements). Note: lists are not exhaustive.

Joint procurements strategies

UK

- The aim of the **Joint Procurement Framework** is to create a buying option for vehicles with a common specification (including tailoring according to specific needs)
- The effect is to create **standardisation and economies of scale** – consolidated call off orders can be placed.
- Additionally this allows a mechanism for **rapid purchase** of FC buses (as standard terms are set).
- The framework is live for four years from 2018.



Germany

- **Joint procurement strategy within the German cluster:** joint technical specifications for the two sites were identified.
- **Aggregating demand:** there is now interest for 500 buses by 2023, fuelled by support from NOW through the *HyLand* national funding programme.

Emerging conclusions/lessons learnt

- Joint procurement: effective in **stimulating markets:** FCB below the JIVE / JIVE 2 target prices now available (provided volumes)
- **Multiple sources of funding** – means well leveragedFCH 2 JU funding, but adds complexity and timescale challenges
- **Need to procure HRS / H_2 supplies in parallel with buses** – fuel costs: a critical element of the TCO
- **Early engagement** with operators/OEMs key
- H2: possibility to obtain a **long-term contract for hydrogen supplies**
- HRS: Buyers should not expect HRS suppliers to understand the constraints of operating a bus depot → **Site visits** with potential suppliers are crucial
- Challenge to commit to ordering large fleets without full certainty over lifetime costs – **"all-in" offers may be attractive to early adopters**

Source: fuelcellbuses.eu

Source: Pitpoint

Thank you for your attention

Project coordination:

elementenergy

Project dissemination:

Hydrogen Europe

The JIVE and JIVE2 projects have received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 735582 and 779563.

This Joint Undertaking receives support from the **European Union's Horizon 2020** research and innovation programme, Hydrogen Europe and Hydrogen Europe Research. The **MEHRLIN** project is co-financed by the **European Union's Connecting Europe Facility.**

@fuelcellbus
www.fuelcellbuses.eu

Sabrine Skiker
EU Policy Manager, land transport
s.skiker@hydrogeneurope.eu