

# Fuel cell bus deployment with the example of JIVE project

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ZERO EMISSION

JIVES / MEHRLIN  
projects

**POLIS** | ANNUAL  
CONFERENCE  
**2019**  
CITIES AND REGIONS FOR TRANSPORT INNOVATION

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# Why go for fuel cell buses?



## High daily range

350+ km without refuelling



## Operational flexibility

...no need for new street infrastructure, refuelling in <10 min



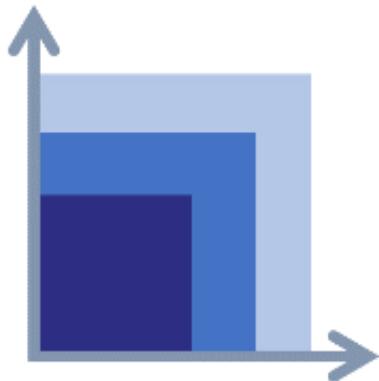
## Zero tailpipe emissions

Only water emitted and CO<sub>2</sub> emissions savings – linked to hydrogen production source



## Comfort for passengers and drivers

...due to reduced noise levels and smooth driving experience



## Scalability

The refuelling infrastructure is readily scaled up to accommodate growing fleets



**A concrete answer to ambitious policy targets set for transport decarbonisation**

# Hydrogen as 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

Decarbonize end uses



Help decarbonize **transportation**



Help decarbonize industrial energy use

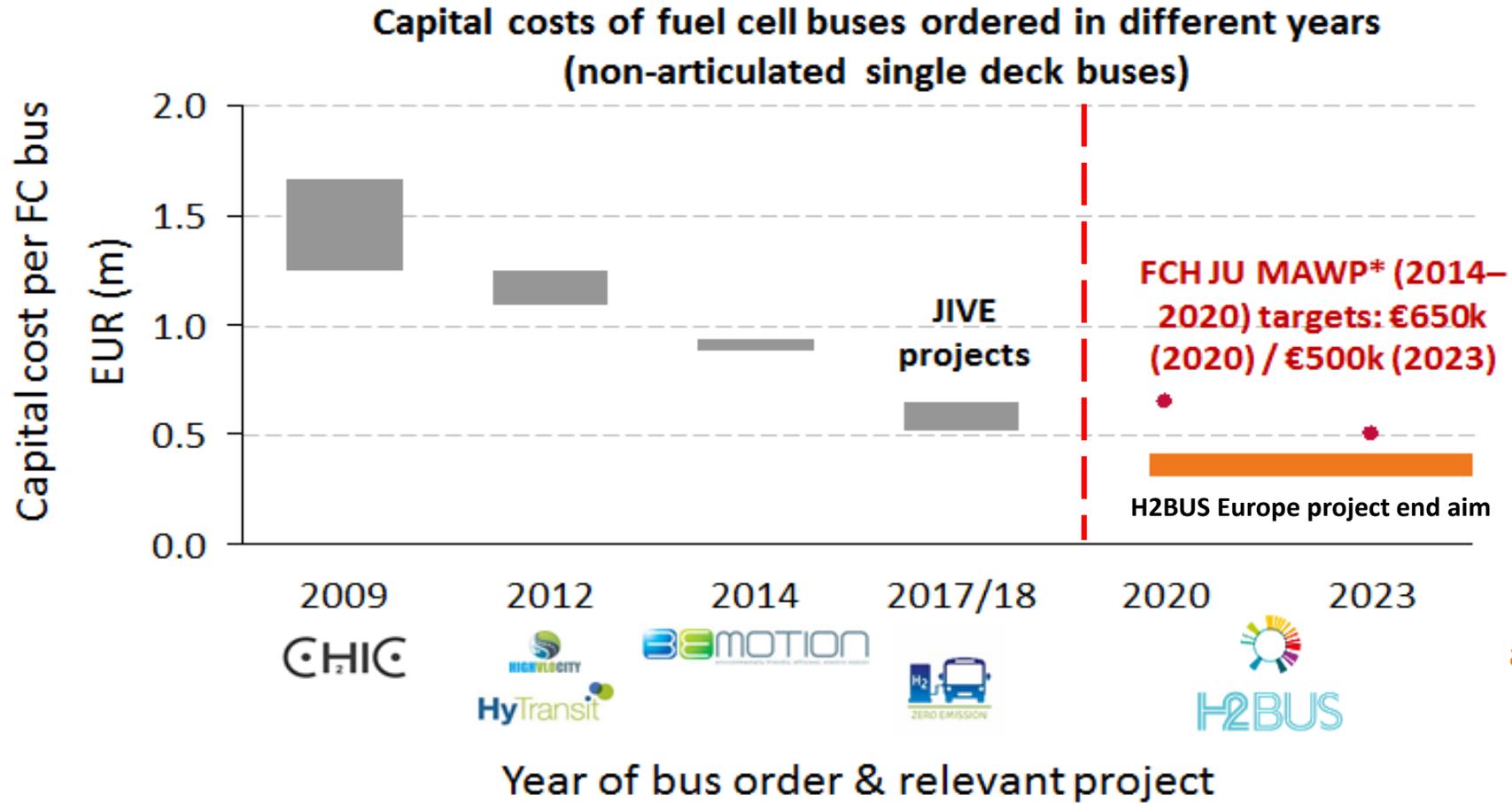


Help decarbonize **building heat and power**



Serve as renewable **feedstock**

# While fuel cell bus costs have fallen significantly, further reductions will be needed for commercially viable offers



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

# JIVE projects: deployment sites and objectives



## DEPLOYMENT SITES

- Aberdeen, UK
- Akershus, NO
- Auxerre, FR
- Birmingham, UK
- Bolzano, IT
- Cologne, DE
- Dundee, UK
- Gatwick Airport, UK
- Groningen, NL
- Herring, DK
- London, UK
- Pau, FR
- Reykjavik, ISL
- Rhein-Main, DE
- Rotterdam, NL
- South Holland, NL
- Sweden, SE
- Toulouse, FR
- Wuppertal, DE



\*Hydrogen Refuelling Station



## 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**

# While the first JIVE buses are still to be deployed, progress has been made in terms of procurement and contracting



- **To date, 10 cities/regions have placed bus orders, from 5 different suppliers:**

City	Number of Buses	Supplier	Size
Aberdeen	15	Wrightbus	12m
Auxerre	5	Safra	12m
Bolzano	12	Solaris	12m
Cologne	35	Van Hool	12m
Groningen	20	Van Hool	12m
London	20	Wrightbus	12m
Pau	8	Van Hool	18m
Rhein-Main	11	ebeBus	8/11 12m, 3/11 18m
Toulouse	4	Safra	12m
Wuppertal	10	Van Hool	12m

**Capex target of <€650k/bus for JIVE (base vehicle, non-articulated) and <€ 625k/bus for JIVE 2 met by several different suppliers**

- **Tenders on-going in other cities**

# 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



## Non European OEMs active in the fuel cell bus sector



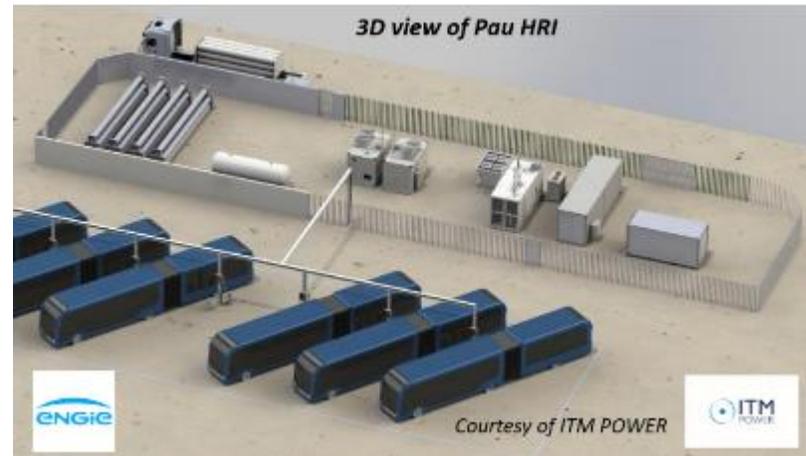
# Infrastructure suppliers are also responding to associated demand for Hydrogen Refuelling Stations (HRS)



- HRSs are sites of hydrogen generation, compression and storage. They are the sites at which buses are refuelled.
- Hydrogen can be generated mainly by water electrolysis or natural gas reformation.
- Hydrogen production beginning at sites across Europe, with a number of HRSs to become fully operational by the end of 2019.



Source: SMTU



Source: ITM/Engie

## REFUELLING STATIONS





## Joint procurement framework in the UK

- Provide vehicles with a common specification (with option to tailor buses according to specific needs)  
→ **standardisation and economies of scale.**
- Enable other cities and bus operators to procure buses under similar terms – mechanism for rapid purchase of FC buses.
- The framework is live for four years from 2018.



## Joint procurement strategy within the German cluster:

- Common technical specifications identified
  - 45 buses for Cologne region and Wuppertal
  - Upcoming similar exercise within JIVE 2
- Aggregating demand – interest for 500 buses by 2023



# FC bus orders in France – overview



- Toulouse have ordered 4 SAFRA buses to run at Toulouse-Blagnac airport
- Auxerre ordered 5 SAFRA buses
- The UGAP buyers group has announced a target to procure 1000 fuel cell buses by 2024



Source: SAFRA

- Pau will be the first city in France to receive fuel cell buses
- They will be used in Bus Rapid Transit (BRT), system, a world premiere with fuel cell vehicles
- The vehicles will start commercial operation from December 2019.
- Procurement of whole solution: HRS+bus+energy supply

# Broader lessons learned from Bus Joint Procurement



- Joint procurement has been effective in **aggregating demand & stimulating markets from supply side**



- However it is a complex process. Numerous lessons have been learned:
  - **Only look at joint procurement if you operate in similar environment**
  - **Early engagement with operators** is critical; Identify potential deployment bus depots and routes; Set and agree roles/responsibilities
  - **Engage with potential suppliers/OEMs.** Use engagement to align expectations
  - In **tender development**, agree standard specs
  - Make sure you understand what you want/what market can offer
  - Provide the suppliers with **realistic timescales**
  - At point of **contract award**, re-evaluate the operators' requirements in terms of bus specs and approach to maintenance



# Wider lessons learned from HRS Procurement



## Procuring hydrogen as a fuel

- It is possible to obtain a **long-term (ten-year) contract for hydrogen supplies**
- Specify for outputs (fill times, amount of H<sub>2</sub>) not for inputs
- Some are now just procuring H<sub>2</sub> at the nozzle – not the full HRS.
- **Need to procure HRS / H<sub>2</sub> supplies in parallel with buses** – fuel costs are a critical element of the total cost of ownership



Best practices reports in the making  
(Jan 2020)

## Procuring the HRS

- Buyers should not expect HRS suppliers to understand the constraints of a bus depot. **Site visits** with potential suppliers **are crucial**.
- Don't expect PTOs to do HRS procurement, at least not without support. Not their area of expertise.
- In many cases the **local partners** would be better placed to procure a contractor for site preparation works (rather than the HRS provider having to do this).

# Thank you for your attention

Project coordination:

**elementenergy**

Project dissemination:



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# FC bus procurement – lessons learnt

