

Joint Initiative for hydrogen Vehicles across Europe

Project overview & update on recent
activities

Stockholm, Sweden

11th June 2019

Element Energy Ltd

Madeline Ojakovoh

madeline.ojakovoh@element-energy.co.uk

The JIVE projects will demonstrate nearly 300 fuel cell buses in 20 different cities across Europe



ZERO EMISSION



DEPLOYMENT SITES

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

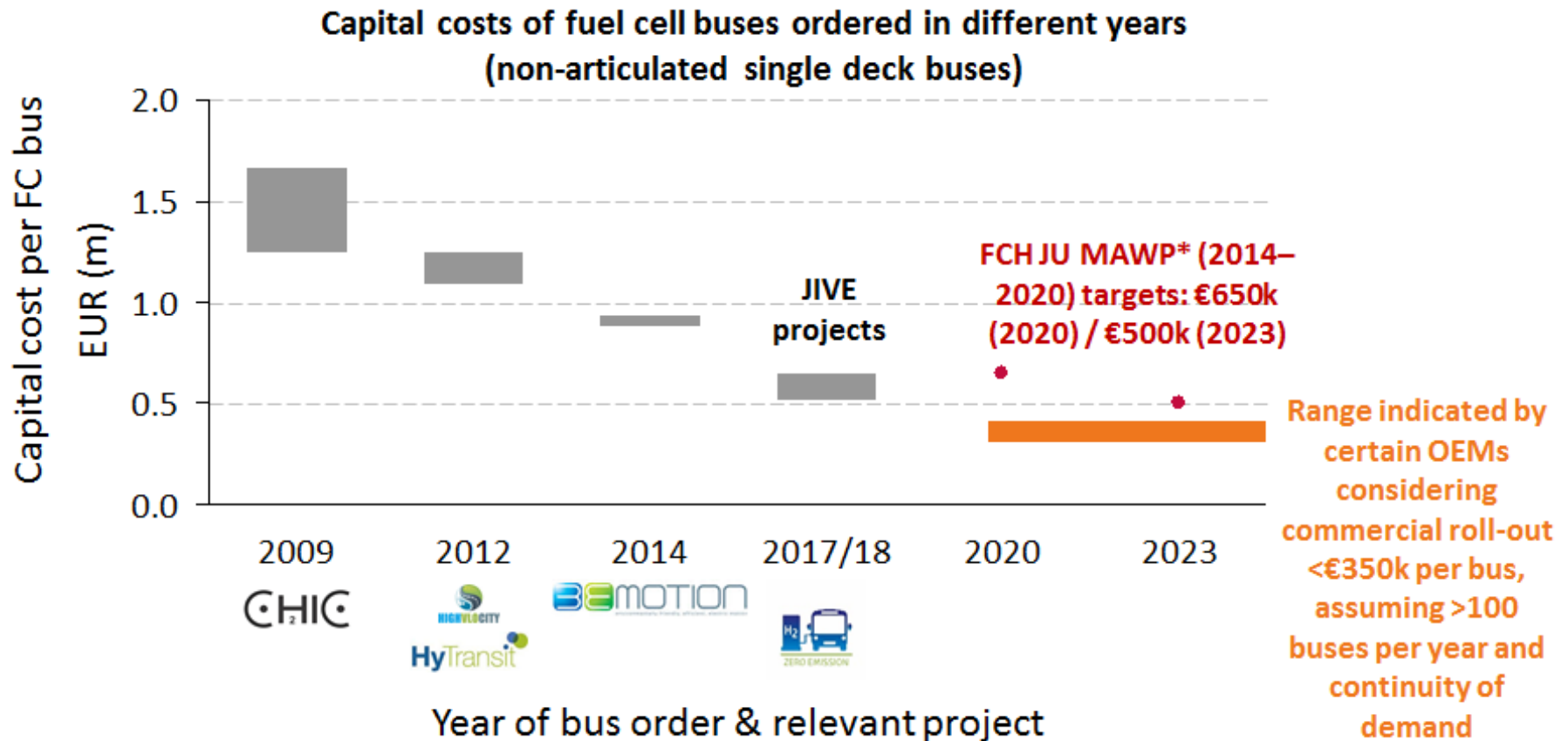


*Hydrogen Refuelling Station

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



* **FCH JU MAWP** is the Fuel Cells and Hydrogen Joint Undertaking's Multi-Annual Work Plan, the document that sets out the work plan and strategic targets for the second phase of the FCH JU's programme of research and innovation.

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



- **Established a joint procurement framework** in the UK cluster with two manufacturers meeting the conditions
- **Bus orders** placed by several cities:
 - Bolzano (12 Solaris buses)
 - Cologne (30 Van Hool buses)
 - London (20 Wrightbus double deck buses)
 - Rhein-Main (11 buses from ebe EUROPA)
 - Pau (8 Van Hool buses (5 in JIVE 2))
 - Wuppertal (10 Van Hool buses)
- **Longer bus operations planned** – most projects planning for 10 years of operations (compared to 2–3 years in previous small scale demo projects)
- **Tenders on-going** in several other cities
- **Stimulation of the fuel cell bus market in Europe**

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

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



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

ALEXANDER
DENNIS



ebeEUROPA



DAIMLER
EvoBus



rampini



Safra



ŠKODA



SOLARIS



URSUS
BUS



VANHOOL



VDL
BUS & COACH



WRIGHTBUS



Other non European OEMs active in the fuel cell bus sector

FOTON



YUTONG



TATA



TOYOTA



HYUNDAI



NEW FLYER



The first JIVE buses from Van Hool will begin operation this year in Cologne, Wuppertal & Pau



- **Cologne & Wuppertal** will be the first cities to receive buses in JIVE this summer.
- The buses, (30 for Cologne, 10 for Wuppertal) are 12m buses from Van Hool

- **Pau** will receive first of a kind 18 m buses from Van Hool in autumn 2019
- They will be used in Bus Rapid Transit (BRT), system, a world premiere with fuel cell vehicles

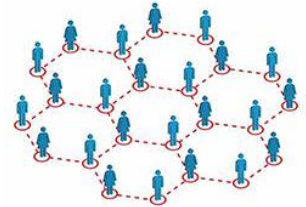


The early phase of JIVE has also exposed several challenges associated with FC bus deployment



Key risks and challenges in JIVE

- **Joint procurement exercises: not always the most appropriate model** to facilitate the commercialisation of fuel cell buses – linking projects has downsides as well as benefits
- **Multiple sources of funding** – means FCH 2 JU funding is well leveraged, but this adds complexity and timescale challenges
- **Need to procure HRS / H₂ supplies in parallel with buses** – fuel costs are a critical element of the total cost of ownership
- **Achieving affordable maintenance costs** for FC buses and finding an appropriate risk sharing approach given the uncertainty over lifetime costs
- Challenge for cities / operators to commit to ordering large fleets without full certainty over lifetime costs – **“all-in” offers may be attractive to early adopters**

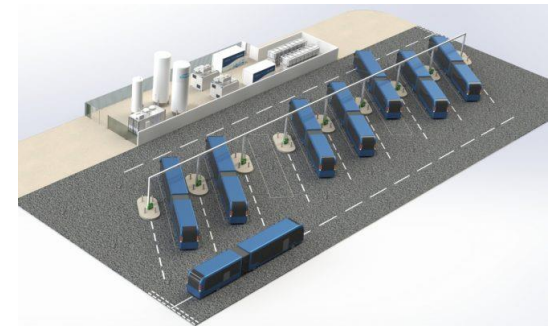


What happens after JIVE?



The commercial phase...

- The JIVE projects are beginning to show results and a number of cities and organisations are now looking at how to move to the next commercial phase.
- There are some important ingredients to move beyond JIVE:
 - **Scale of bus demand**
 - **Scale of demand at a depot**
 - **Access to low cost energy**
- Achieving this will require continued commitment to **zero emission policies**, without prejudice against hydrogen...
- ... and willingness from operators to **commit to large scale fleets**, ideally in concerted procurements.
- **Projects and plans are emerging** for the next phase of deployment in the early 2020s.



The next phase: H2Bus Europe will deploy 600 buses in Denmark, Latvia & the UK, at more affordable prices



Single Deck - 12 m

€ PRICE <375k RANGE >450 km* EXTENDED >675 km*



Articulated - 18 m Deliveries from 2021

€ PRICE <465k RANGE >520 km* EXTENDED >750 km*



Double Deck - 10.9 m

€ PRICE <410k RANGE* >310 km* EXTENDED* >420 km*



*Dependent on duty circle

HYDROGEN
PRICE
5-7 EUR/KG*

*Dependent on local factors.
Achievable at depots of +100 FCEBs and electricity price <€40/MWh.

Fossil parity means that the cost of driving 1km with a fossil-based polluting bus is equal to driving 1km in an FCEB. This is already achievable today in several markets.

Follow the JIVE projects at the upcoming ZEB conferences



ZEB 2019: SAN FRANCISCO



26–27th September 2019

ZEB 2020: PARIS



European and international public transport operators have **complimentary registration** to all ZEB conference events (up to two registrations per organisation). Please contact poppy.rivett@element-energy.co.uk for further details.



ZERO EMISSION



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.