HFC market activation and synergies in the fuel cell bus sector

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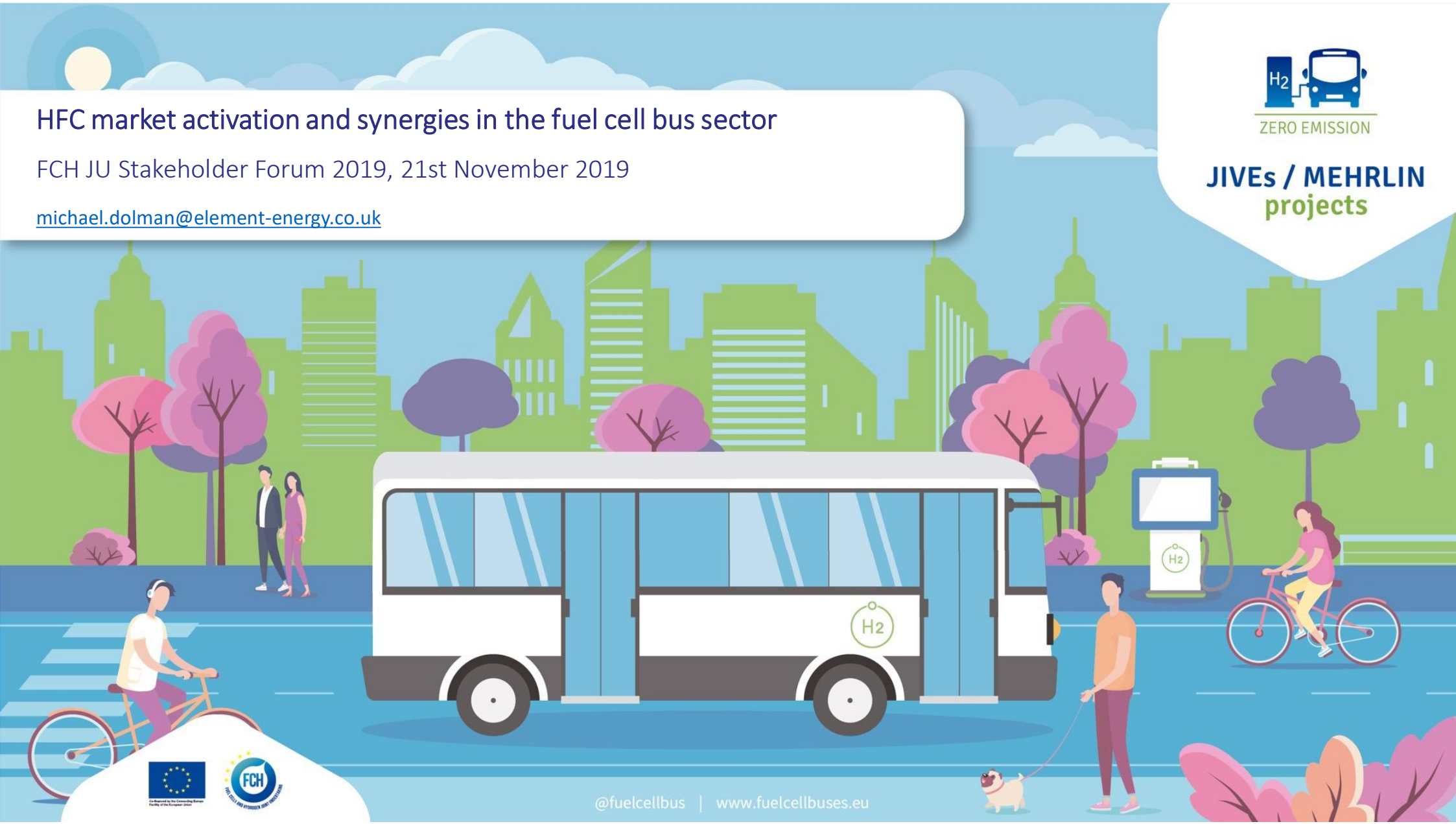
ZERO EMISSION

JIVEs / MEHRLIN projects



FCH JU funding is supporting major trials across the transport sector

Cars / vans

Hydrogen Mobility Europe

- 49 refuelling stations
- >1400 cars, and vans
- €170m total cost
- €67m funding
- > 40 organisations

A major European activity!

ZEFER

Buses

ZERO EMISSION

JIVE & JIVE 2: nearly **300 buses** in **20 cities**

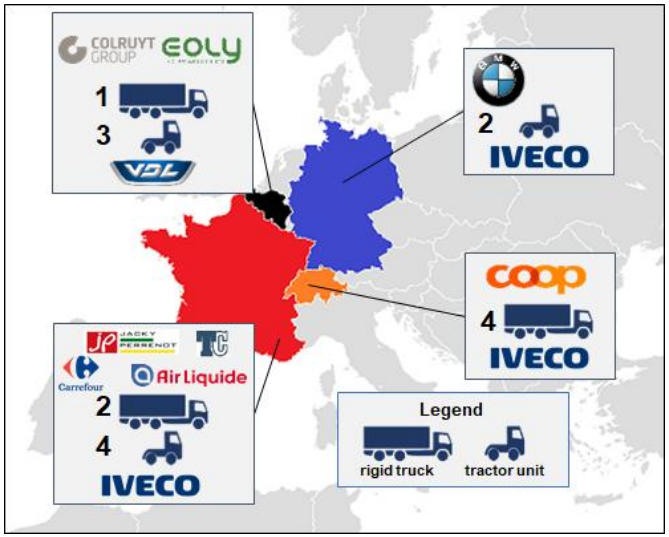
Builds on previous successful demonstrations:

CHIC HyTransit

BEMOTION HIGHVLOCITY

Trucks

H2HAUL



Together, the *JIVE* projects will demonstrate nearly 300 fuel cell buses in over 20 different cities across Europe

Joint Initiative for hydrogen Vehicles across Europe

Objectives

- Deploy large fleets of FC buses and associated refuelling infrastructure
- Achieve a maximum price of €625k for a standard fuel cell bus (JIVE 2)
- Validate large scale fleets in operation
- Enable new entrants to trial the technology
- Demonstrate routes to low cost renewable H_2
- Stimulate further large scale uptake

Benelux Cluster (50 FC buses)

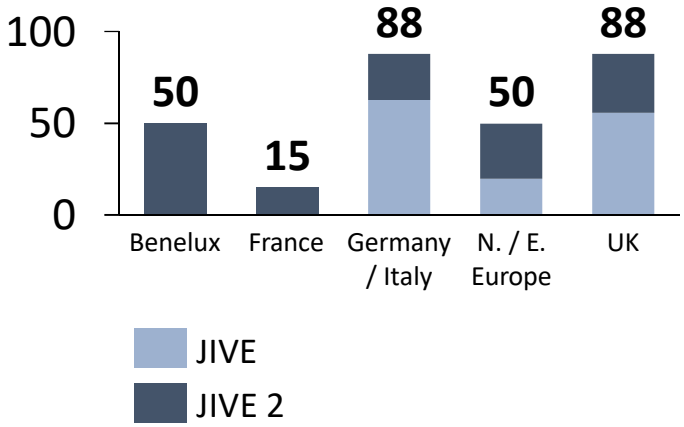
France Cluster (15 FC buses)

Germany / Italy Cluster (88 FC buses)

Northern / Eastern Europe Cluster (50 FC buses)

UK Cluster (88 FC buses)

Number of FC buses to be trialled under the JIVE and JIVE 2 projects by geographic cluster



Total = 291 new FC buses for Europe

The JIVE project began in 2017; JIVE 2 began in 2018. Both projects are funded by the FCH 2 JU.

European bus OEMs with fuel cell programmes

ALEXANDER DENNIS

CAETANOBUS

ebe EUROPA

rampini

Safra

ŠKODA

URSUS BUS

VANHOOL

VDL BUS & COACH

SOLARIS

DAIMLER EvoBus

WRIGHTBUS

Source: Element Energy (based on public announcements). Non-exhaustive.

Customers in JIVE have now ordered from five of these suppliers (<€650 / €625k price) – further orders due soon

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JIVE vehicles are now starting to be delivered

JIVE programme – selected highlights and growth opportunities

Aberdeen is seeking to implement a large-scale renewable hydrogen hub based on anchor demands for FC bus fleet

Brighton & Hove Buses has committed to opeate a fully zero emission fleet in Brighton by 2030 (c. 300 buses)

Go-Ahead aims to opeate a zero-emission bus fleet by 2035 (>4,500 buses in the UK)

FC buses selected in open tender for a new zero emission route in **Pau**

FC buses deployed under the JIVE programme will account for nearly **20% of RVK's total fleet in the Cologne region**

JIVE – key successes and impact

- **Stimulation of market** – growing number of OEMs developing / offering FC buses
- **Successfully lowered FC bus price** – vehicles now available within the projects' price targets (€625k per bus for JIVE 2)
- **Longer term contracts** – e.g. ten-year fuel supply agreements in some cases => moving from trials towards standard operations
- **Foundations for larger scale, lower cost deployment** – e.g. H2Bus Europe
- **Basis of planning larger scale use of hydrogen as a transport fuel** – e.g. Aberdeen Hydrogen Hub

The above would not have been achieved without the support of the FCH JU and others such as Connecting Europe Facility (CEF)

Technology development process

Concept	Feasibility	Verification	Demonstration	Commercialisation
Idea generation	Lab tests Model tests	Prototyping Independent evaluations	Real-world trials Customer feedback	Full scale production Market development

The FCH JU supports a wide range of technologies at various stages of the research, development, and demonstration process

Technology development process

Idea generation	Lab tests Model tests	Prototyping Independent evaluations	Real-world trials Customer feedback	Full scale production Market development

Several HFC technologies are starting to transition from large-scale demonstration towards commercialisation

A new phase of deployment requires a new approach to policy making

- **Barriers to commercialisation** remain => **need for on-going public sector support** for the sector
- Increased importance for roll-out support - CEF, EIB and other financial incentives at a European level
- Importance of support schemes which explicitly enable a move to scale
- Member States will need to start to pick up the impetus
  - **Sustained support programmes** (no more competitions)
  - Consider **lifetime costs** (not just capex)
  - **Results-based support** (i.e. support units delivered rather than capex)
  - **Technology-neutral schemes** (ultimately more popular)
  - Regulate for zero emissions

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.

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Co-financed by the Connecting Europe Facility of the European Union

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