



FCH JU STAKEHOLDER FORUM: 2016-11-23

SESSION 3: HOW DID THE FCH JU CONTRIBUTION IMPACT THE SECTOR?

DR. FRANK KOCH: *STATUS AND PLANNED ACTIVITIES IN THE BUS MARKET*

STATUS AND PLANNED ACTIVITIES IN THE BUS MARKET

- Why Fuel Cell Electric Buses?
- Fuel Cell Buses in Europe today
- CHIC: a success story
- Bus commercialisation study
- FC Bus Networking Activities
- JIVE and MEHRLIN
- First procurement activities
- New Bus Fuel
- Status FC buses
- Next steps and recommendations

WHY FC ELECTRIC BUSES?

High daily ranges

... of 300 km on average without refuelling

Full route flexibility

... not bound to any required infrastructure on the route

Fast refuelling

... down to 7 minutes possible – Also several refuelling cycles per day possible

High passenger comfort

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

Close to technology maturity

... with more than ten years and 5.5 m km of operational experience in Europe



Battery Bus with FC-Range-Extender in Ha

WITH SUPPORT FROM FCH JU FUEL CELL BUSES WELL PRESENT IN EUROPE TODAY!

EU-funded fuel cell bus projects

CHIC

- ✓ Aargau, CH - 5 FC buses (2011)
- ✓ Bolzano, IT - 5 FC buses (2013)
- ✓ London, UK - 8 FC buses (2011)
- ✓ Milan, IT - 3 FC buses (2013)
- ✓ Oslo, NO - 5 FC buses (2013)
- ✓ Cologne, DE* - 4 FC buses (2011/2016)
- ✓ Hamburg, DE* - 6 FC buses (2011/2016)

High V.L0-City

- ✓ Antwerp, BE - 5 FC buses (2015)
- ✓ Aberdeen, UK - 4 FC buses (2015)

HyTransit

- ✓ Aberdeen, UK - 6 FC buses (2015)



EU-funded fuel cell bus project

3Emotion

- ✓ Cherbourg, FR - 5 FC buses (2017)
- ✓ South Rotterdam, NL - 2 FC buses (2017)
- ✓ South Holland, NL - 4 FC buses (2017)
- ✓ London, UK - 2 FC buses (2017)
- ✓ Antwerp, BE - 3 FC buses (2017)
- ✓ Rome, IT - 5 FC buses (2017)

Current national/regional-funded fuel cell bus projects

- ✓ Stuttgart, DE* - 4 FC buses (2014)
- ✓ Frankfurt, DE* - 1 FC bus (2016)
- ✓ Arnhem, NL* - 3 FC buses (2017)
- ✓ Groningen, NL* - 2 FC buses (2017)

84 FC buses in total!

CHIC - A SUCCESSFUL EXAMPLE OF AN FCH JU FUNDED PROJECT

What?

56 fuel cell electric buses and their refuelling infrastructure¹

Where?

Aargau (CH), Bozen (IT), Cologne (DE), Hamburg (DE), London (UK), Milan (IT), Oslo (NO), Whistler (CA)

When?

Between 2010 and 2016 (post-2016 under discussion)

How much?

€25.9 million EU co-financing (Fuel Cells and Hydrogen Joint Undertaking - FCH JU), total budget of €81.8 million

CHIC
partners

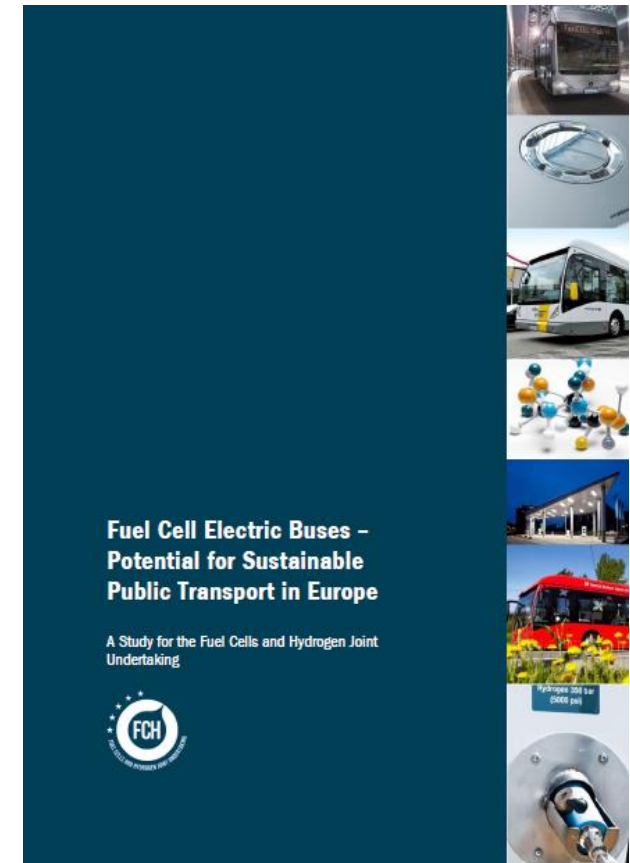


¹ + 4 internal combustion engine H₂ buses in Berlin

FUEL CELL BUS STUDY: GREAT POTENTIAL FOR SUSTAINABLE PUBLIC TRANSPORT IN EUROPE

The fuel cell bus commercialisation study (September 2015) highlighted the great potential offered by fuel cell buses to address public transport needs

- A coalition from industry (buses, components, infrastructure, gas) provided input to the FCH JU study
- The following steps to enhance the commercialisation of fuel cell buses are suggested:
 - cell buses-
 - Continue work to reduce costs of buses (purchasing and maintenance costs) and hydrogen refuelling infrastructure
 - Engage with bus operators to deliver large-scale demonstration projects



The study can be found on the FCH website: <http://fch-project.eu/info-centre/publications> or on the FCH JU website

- Secure match funding from public sources

COMMERCIALISATION OF FUEL CELL BUSES IN EUROPE - COST PROJECTIONS

Purchase costs for fuel cell buses are expected to decrease significantly by 2030

Two scenarios envisaged:

- Fuel cell systems developed specifically for use in heavy-duty vehicles ("heavy-duty pathway" - HD)
- Fuel cell systems developed for fuel cell cars adapted to buses

- The study also highlighted that a regulatory framework for fuel taxation is essential for the commercialisation of fuel cell buses

Results of the study show:

- HD: The overall costs for FC buses are expected to decrease to a cost premium of 11-18% compared to diesel buses in 2030
- AU: the costs for FC buses are expected to decrease further, FC bus purchasing prices are expected to reach regulatory target levels of 12m

NETWORKING PROCESS IN EUROPE

- To enhance the achieved expertise and to realize economies of scale the regional cluster activities started and will be continued and widened

Focus

- Joint Procurement

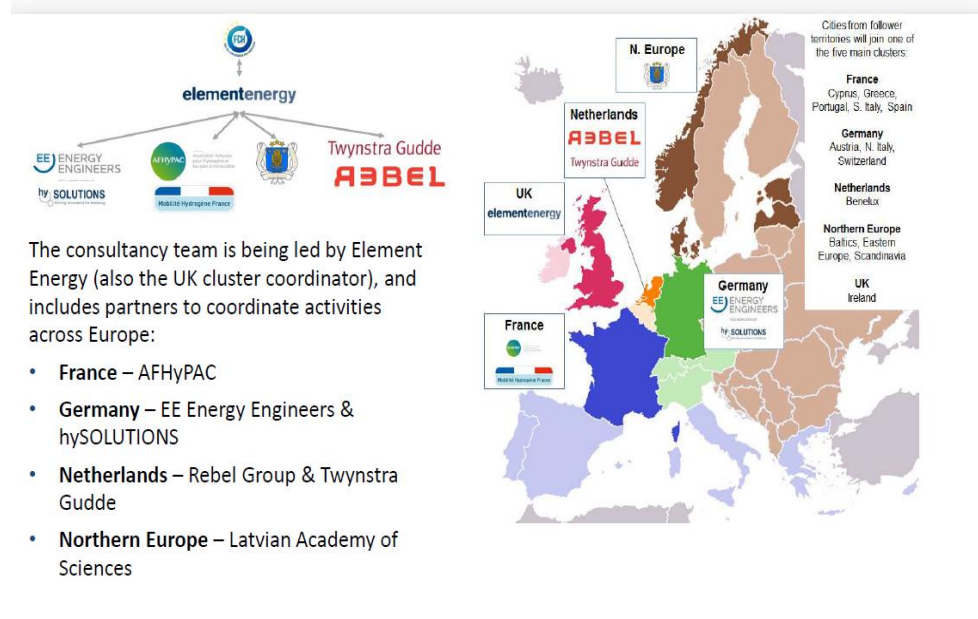
- Priority List of cities/locations
- Materialise the joint procurements

- Co-Financing

- Support until business plan at the locations
- Identify more funding sources
- Involve more OEMs

- Knowledge sharing and outreach

- Achieve self-sustainability
- Plan beyond subsidised phase



Collected demand for 700-1.000 buses in Europe

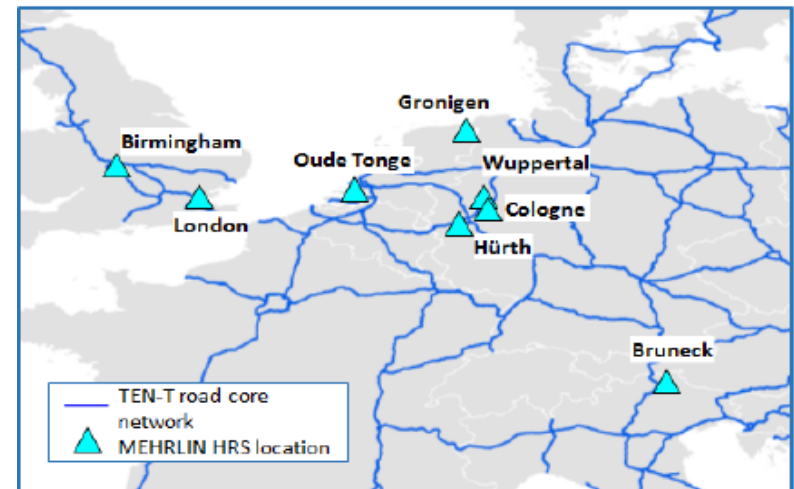
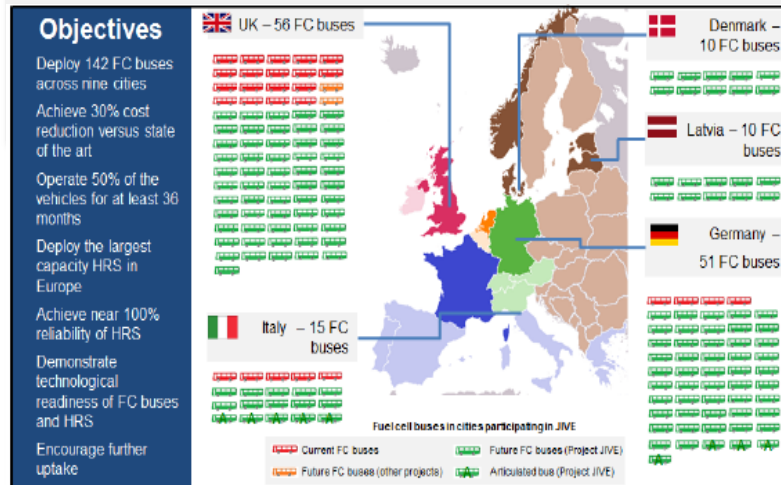
JIVE AND MEHRLIN PROJECTS AS NEXT STEPS TOWARDS THE MARKET

JIVE (Joint Initiative for hydrogen Vehicles across Europe)

- 142 FC Buses across nine cities
- Demonstrate technological readiness of FC buses

MEHRLIN

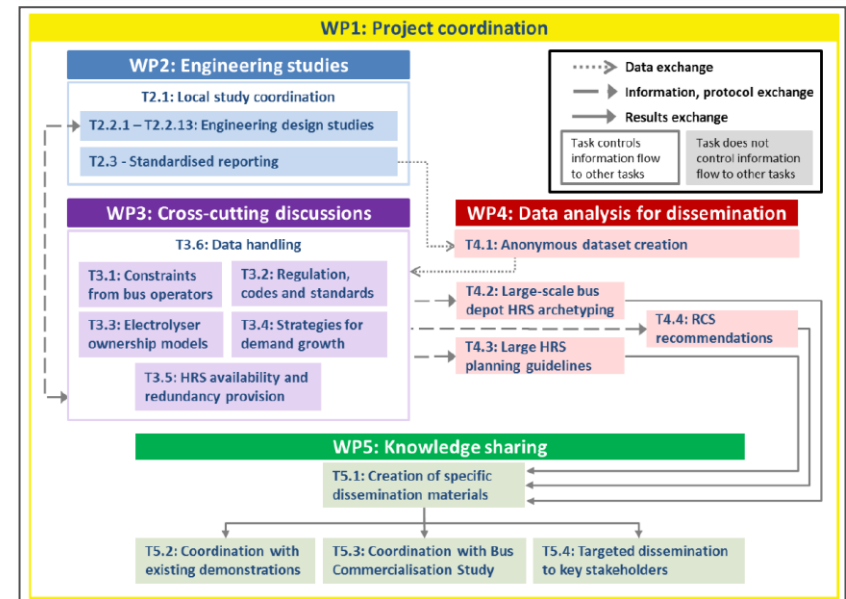
- 8 large hydrogen refuelling stations across Europe
- Integrated in urban nodes and TEN-T network



- Based on the regional clusters first procurement activities have been started (RFI Request for information)
- Initial interest to deliver vehicles is confirmed with a variety of European OEMs
- Evidence that manufacturers meet the economic targets still to be provided
- Manufacturers confirm their willingness to ramp up production capacity in response to orders
- Lead times for buses depending on rate of production per OEM
- Different vehicle concepts (e.g. Range-Extender) to be integrated in next call to integrate more manufacturers

New BusFuel

- Study for identification of concepts for large scale hydrogen infrastructure on bus depots (100++ buses)
- Production on the premises as well as delivery concepts (by-product)
- 11 European regions with different concepts
- Including regulations, codes and standards as well as business-models
- Harmonization with bus commercialisation activities
- Targeted dissemination to



STATUS FUEL CELL BUSES

- Transition Process to a growing number of buses in the market successfully started
- Projects have created a high interest in the fuel cell technology for buses and a growing awareness for their benefits
- Funding from FCH JU as well as national programs have been a major driving force to install the projects

Progresses

- Successful combination with regional cluster networks
- Immediate implementation of bus study in market related activities
- Strong political support activated
- Integration of UITP as relevant stakeholder
- Combination with National funding schemes
- Active role of FCH JU

Challenges

- Limited number of interested regions in Europe (hot spots)
- No clear commitment from mayor bus OEMs and missing indication on concepts and delivery dates etc.
- Insufficient funds compared to potential interest (infrastructure)
- Prices for vehicles and infrastructure still very high

NEXT STEPS, RECOMMENDATIONS

- Illustrate the benefits of the fuel cell bus technology by optimized communication and dissemination activities to safe and widen support from regions
- Support European political activities such as Commissioner Bulc's initiative for joint procurement of clean buses and blending of funds with EIB grants
- Setup of European platform for the evaluation of different bus concepts together with bus industry (with administrative support from EU)
- Safeguard continuity of funding for FC buses at appropriate level and for sufficient time until market
- Integrate new concepts such as battery bus range-extender in the general discussion as well as in the funding mechanism at appropriate level
- Connect funding (not only in FCH JU) to KPIs with industry and initiate target/actual comparison

Thank you very much for your attention!

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