Fuel cell buses

HyTRANSIT and HighV.LO-City

Geert Van Hecke
Head of Sales Public Transport, Van Hool

&

Valentine Willmann
EU Policy, Projects & Partnerships Manager, HyER

www.fuelcellbuses.eu

Programme Review Days 2019
Brussels, 19-20 November 2019

PROJECTS OVERIVEW

European Hydrogen Transit Buses in Scotland

- **Call year:** 2012
- **Call topic:** SP1-JTI-FCH.2011.1.1 - Large-scale demonstration of road vehicles and refuelling infrastructure IV
- **Project dates:** January 2013 – March 2019
- **% stage of implementation 01/11/2019:** 100%
- **Total project budget:** 17 850 708.85 €
- **FCH JU max. contribution:** 6 999 999 €
- **Partners:**

Cities speeding up the integration of hydrogen buses in public fleets

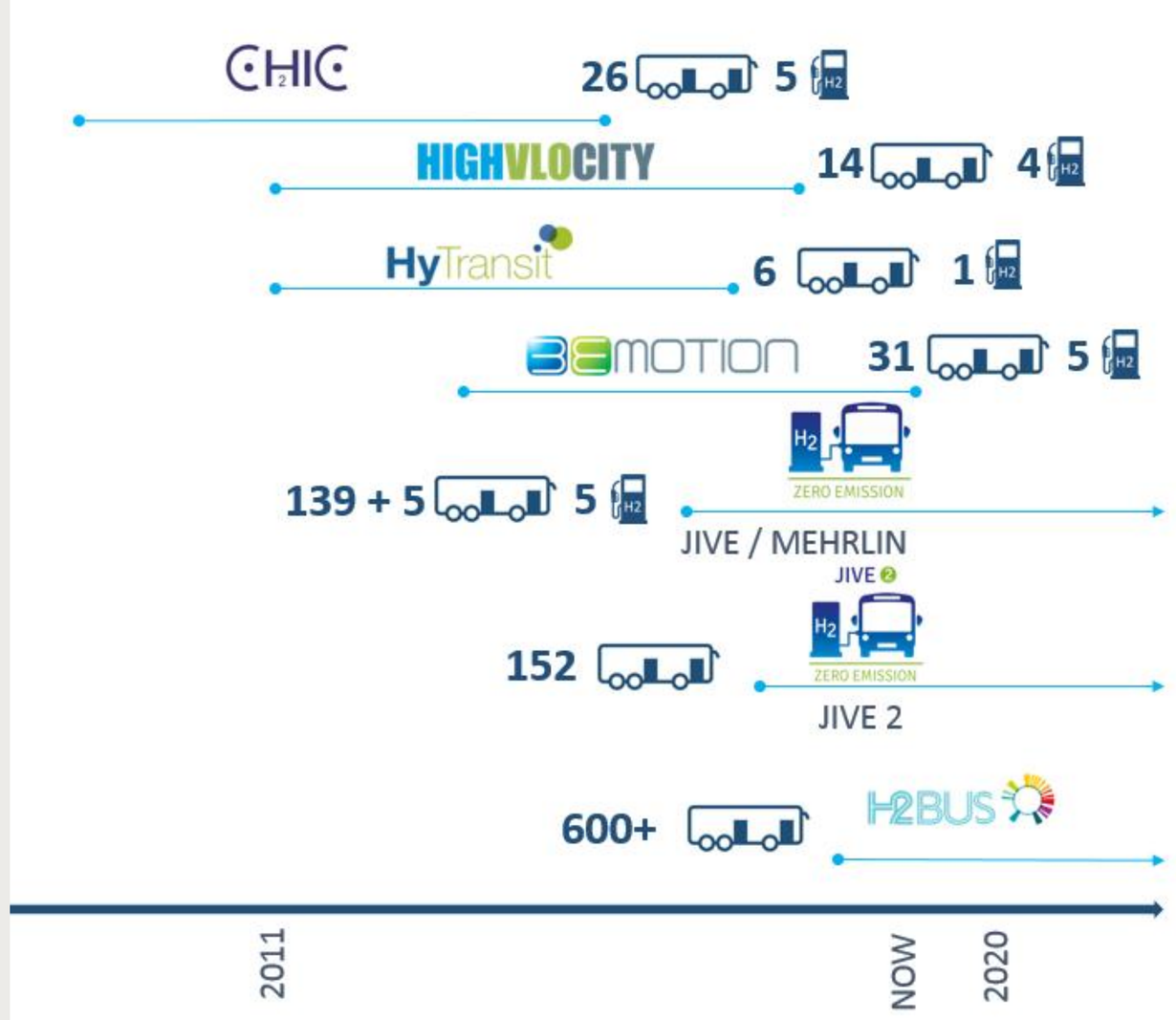
- **Call year:** 2011
- **Call topic:** SP1-JTI-FCH.2010.1.1 - Large-scale demonstration of road vehicles and refuelling infrastructure III
- **Project dates:** January 2012- December 2019
- **% stage of implementation 01/11/2019:** 97%
- **Total project budget:** 30 494 110,49 €
- **FCH JU max. contribution:** 13 491 724 €
- **Partners:**

PROJECT CONTEXT

PROJECTS ACROSS EUROPE

From small fleets to large scale deployment

- High V.LO-City + HyTransit part of a series of FCH-JU funded projects in Europe
- Projects were part of early deployment projects: small fleets of buses deployed in several cities across Europe
- Contributed to the move towards large scale deployment projects: 10+ buses per fleet in JIVE/JIVE 2, 100 buses per fleet in H2Bus



Co-funded by the FCH-JU

PROJECT SUMMARIES

The projects deployed:

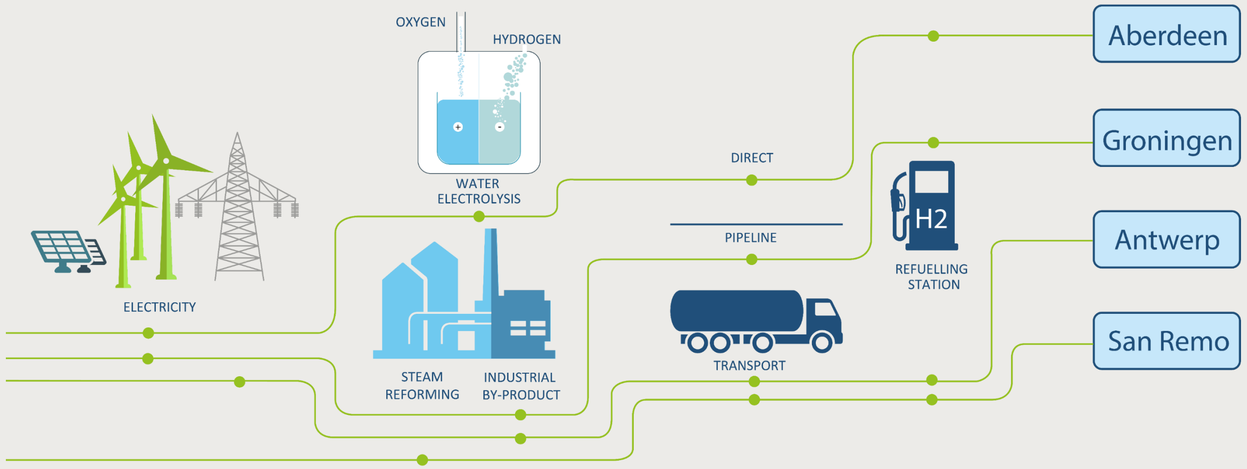
HyTransit: 1 state of the art production and refueling station + 6 buses (Aberdeen)

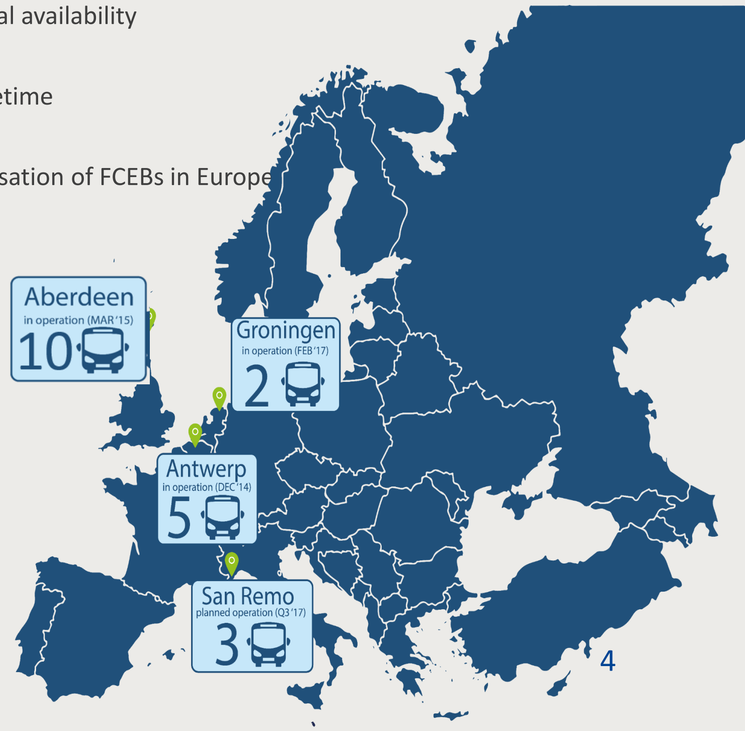
High V.LO-City: 2 state of the art production and refuelling stations (Antwerp and San Remo) + 14 buses (2 in Groningen, 3 in San Remo and 5 in Antwerp)

→ Expose the buses and the stations to real world operation
→ Focus on state of the art production & refuelling station in HyTransit

Both projects had similar objectives:

- **KG/100 KM** — Reduce hydrogen consumption to 7-9kg/100km
- **€/KG** — Reduce the cost of hydrogen production
- **TCO** — Reduce the total cost of ownership of the buses
- Increase overall operational availability
- Further increase of bus lifetime
- Contribute to commercialisation of FCEBs in Europe

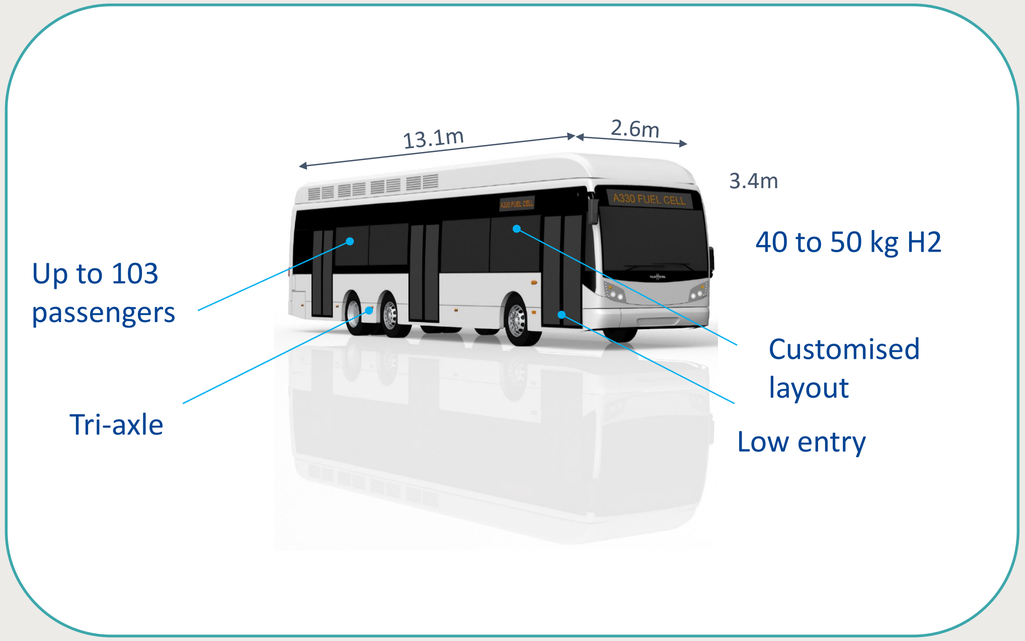




PROJECT SUMMARIES

Buses – VAN HOOL A330 FUEL CELL

All buses deployed through the project were state of the art Van Hool A330 fuel cell buses



10 buses deployed in Aberdeen in 2015: largest fleet in Europe

Tri-axles configuration allows for distribution of additional weight of hydrogen storage, fuel cell and battery over tri axles and therefore guaranteeing similar passenger capacity

PROJECT SUMMARIES

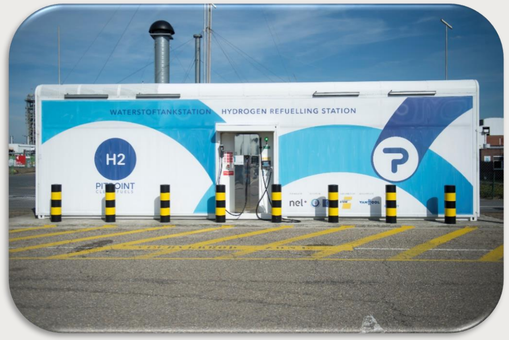
Refuelling stations

Aberdeen - Kittybrewster

STATE OF THE ART 1MW STATION

PROD UP TO 360KG/DAY – 460KG STORAGE

Antwerp



SUPPLY THROUGH PIPELINE

TO BE RELOCATED AT BUS DEPOT

Groningen – Delfzijl

SUPPLY THROUGH PIPELINE

LOCATED NEAR CHEMICAL PLANT

San Remo

SUPPLY THROUGH TUBE TRAILERS

IN THE FUTURE: ON SITE ELECTROLYSER

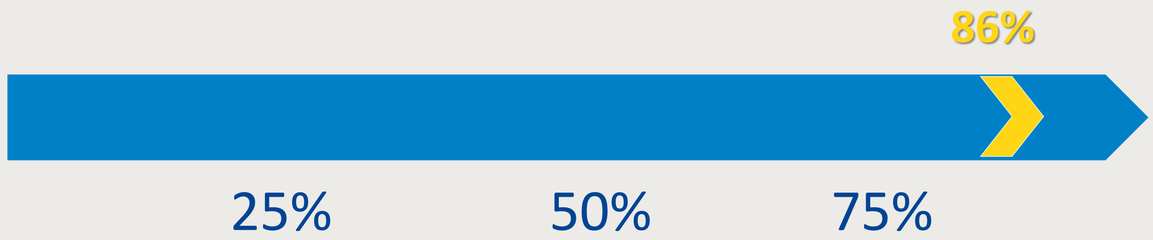
Kittybrewster station: busiest station on Europe at the beginning of the project → up to 300kg dispensed every day

PROJECT RESULTS

For the HyTRANSIT project – 6 Aberdeen buses + refuelling station

Technical availability of buses

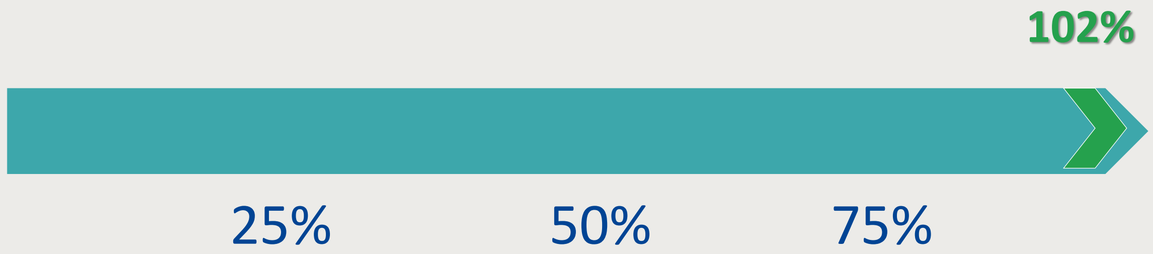
KPI: 90%



Project results
78%

Technical availability of refuelling stations

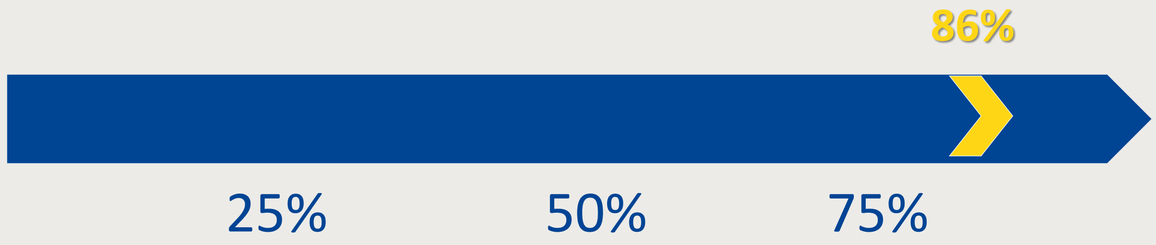
KPI: 98%



99.5%

KM driven

KPI: 1,6m km



1,378,129 km at the end of 03.2019

High V.LO-City results: expected to be similar, except lower bus availability for some sites

PROJECT RESULTS

Other key results – for both projects

Capital costs reduction: CAPEX price of buses halved between start and end of project

Antwerp: **95,3% technical availability** of bus achieved in 2018

More than **1,944t of CO2** saved so far compared to Euro VI vehicles

FUEL CELL BUSES	*MAWP target*	*Projects target*	*Projects results*
Refuelling time	10 minutes	10 minutes	Average between 10-12 minutes
Refueling capacity		300kg/day	Achieved for 2 sites out of 4 so far
Fuel consumption	10kg/100km	10kg/100km	Achieved for 1 site so far, other to be evaluated

CHALLENGES

- Technical failures / **lower technical availability than expected**
  → improved during the second half of the project, after the teething period
  → expected to improve with new generation of buses

- **Delays in supply chain**
  → mitigation: spare parts stored on site by the operators
  → Will improve as more buses are deployed in Europe

- **Impact of external factors on the performance of the buses**: lack of drivers for instance
  → training is key, before and during the introduction of buses

- Issues encountered to collect data. Results are sometimes incomplete due to **data losses**
  → data has to be retrieved manually, use reliable data loggers

- **Location of refuelling stations** and distance to drive to refuel
  → refuelling infrastructure should be located at a reasonable distance from bus depot

LESSONS LEARNED

Introduce FC buses smoothly: introduction of a new technology can cause operational stress

Manage expectations about technology, especially in a commercial environement

Training of drivers: essential before but also during the project

An on site HRS manager is key to ensuring high availability of the station

Stations are more efficient if they are used at full capacity

Direct relationship beween operator and bus manufacturer is vital to ensure the quick resolution of any problems

Refuelling station **should be located close to the bus depot** to ensure the operation is efficent

Bus operators are happy to continue to use the technology providing a reasonable price of hydrogen can be established

Very good customer acceptance: drivers and passengers enjoy the buses which are quieter than conventional fuel buses

COMMUNICATIONS ACTIVITIES

Material produced

- Dissemination strategies
- Common slide pack for both projects
- Leaflets, posters, pop ups
- Videos produced at local level
- Newsletters, websites social media

→ Effort to maximise synergies with other projects
→ Consistency in messages disseminated

HighVLOCity

Fuelcellbus

Websites:

http://highvlocity.eu/

https://www.fuelcellbuses.eu/

Dissemination events

- Project presentations + events organised
- Bus demonstrations at local level+ in Europe
- Common mid term conference: organised by the HyTransit, High V.LO-City and NewBusFuel projects

Aberdeen Hydrogen Transport Summit
Aberdeen 15-17 March 2017

Final conference High V.LO-City project: 27.11.19 in Groningen
Visit https://www.fuelcellbuses.eu/highvlocity-finalconference

SYNERGIES WITH OTHER PROJECTS

Maximising outreach and impact

Interactions with projects funded under EU programmes

- Close collaboration with other FC bus projects in Europe
- Definition of common dissemination messages
- Ensuring good coverage of events / conferences in the sector in Europe

- HECTOR project → applying lessons learned from bus sector to other heavy duty applications

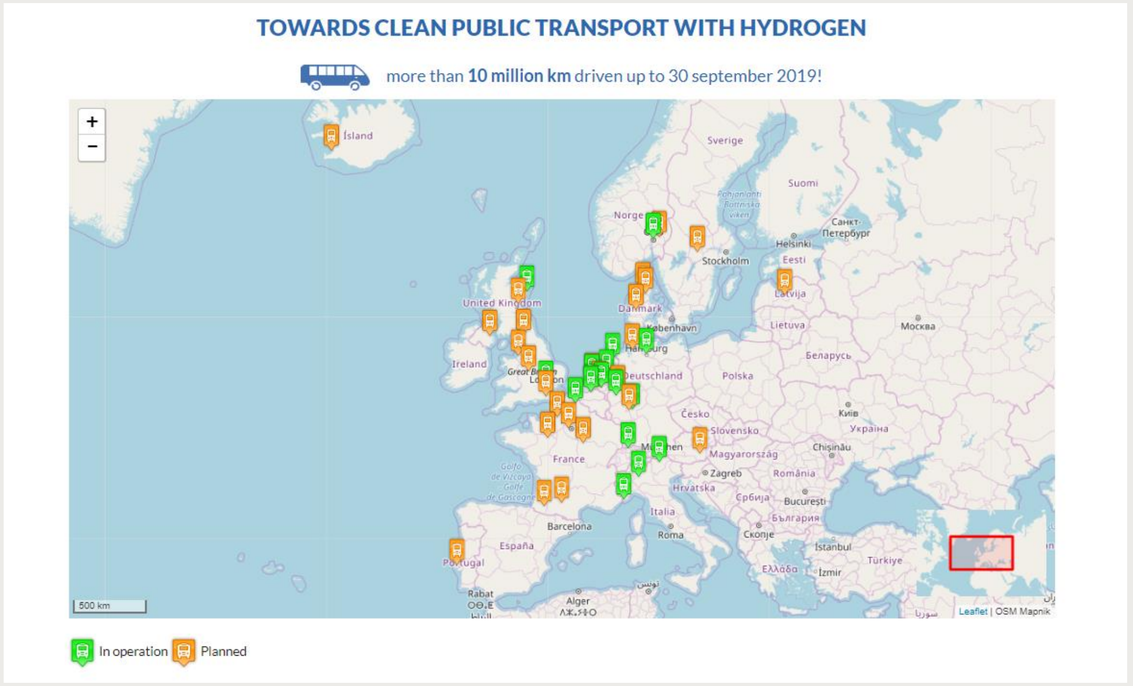
Interactions with local, national and international-level projects and initiatives

- H2 Aberdeen & Aberdeen H2 Bus project
  → common branding

SYNERGIES WITH OTHER PROJECTS

Fuel Cell Buses website

- Knowledge base for fuel cell buses in Europe
- Set up by the High V.LO-City project, content and updates provided by all ongoing FCH-JU funded fuel cell bus projects



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RESULTS AND EXPLOITATION

- 2 sites in the project, Aberdeen and Groningen, have already ordered more buses following the successful demonstrations

- In these two cities, the projects have helped creating hydrogen ecosystems at the local level – in both cases the buses were the first vehicles deployed

Exploitation of results at European level:

- Contributed to increase the number of FC buses deployed in Europe
- Contributed to the reduction of capital costs
- Learnings used to shape follower projects

→ Contributed to the commercialisation of fuel cell buses in Europe

Fuel cell buses

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Geert Van Hecke – Van Hool

geert.van.hecke@vanhool.com

Valentine Willmann - HyER

valentine@hyer.eu

Coordinator High V.LO-City: Flip Bamelis, flip.bamelis@allengineering.be

Coordinator HyTransit: Mark Griffin Mark.Griffin@boc.com

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