



4th International E-Bus-Conference

FCH JU: Helping to make FCB today's reality



www.fch-ju.eu

- 18 November, Hamburg
- Enrique Giron, Project Manager

Strong public-private partnership with a focused objective



Industry Grouping
More than 70 members
~ 50% SME



European Union
represented by the
European Commission



Research Grouping
Over 60 members

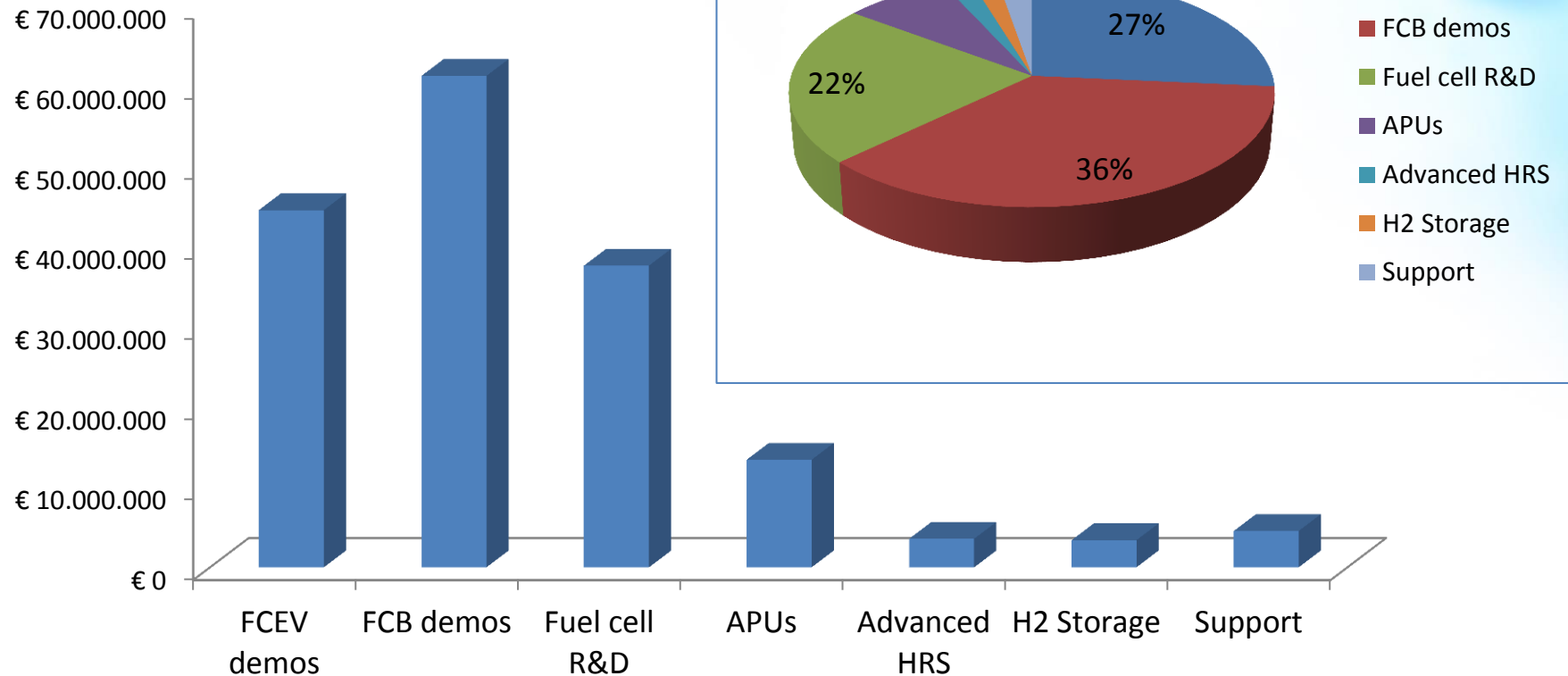


Objective: accelerate the development of technology towards market deployment

FCH JU Funding for Transport

Total FCH JU support:

- 168M€ for 32 projects
- 61M€ for FCB demos



FCH JU Demo Projects

H2MOVES

19 FCEVs/ 1 station

HYTEC

40 FCEVs/ 2 stations

SWARM

90 FCEVs / 3 stations

HYFIVE

110 FCEVs / 6 stations

CHIC

26 FCBs/ 5 cities

HIGH V.LO-CITY

14 FCBs / 2 cities

HYTRANSIT

6 FCBs / 1 city

3EMOTION*

21 FCBs / 4 cities

* Being signed

2010

2011

2012

2013

2014

2015

2016

>250 cars

67 buses

23 filling points

Urban Buses : alternative powertrains for Europe



Bus manufacturers	Technology providers	Infrastructure providers	Operators	Other organizations
7	14	6 ¹	12	5

A fact-based analysis of the role of diesel hybrid, hydrogen fuel cell, trolley and electric powertrains

Publication: 6 December 2012

Available on <http://fch-iu.eu>

Commercialisation Strategy for Fuel Cell Electric Buses in Europe

Current study



- Local high-level cost analyses
- Mobilisation of interested locations
- Preparation joint procurement



- Engineering of H₂ refueling infrastructure

2014-2015



- Detailed cost analyses



- Grant application for demo project



- EU roadmap/discussion on regulation

2016



- Execution of demo projects

Scale effects
Incentives
Regulation

- Local, national and EU funding schemes for demos



- Regulations framework to support roll-out

2017-2020

VISION –
FC electric buses commercially viable
and rolled-out in Europe



2020 onwards

Background & Project Objectives

Main objective of the study is to identify locations that implement large-scale FC bus demonstration projects and support preparation

Background of the study

- > FCH JU launched a **commercialisation effort** for alternative bus powertrains in Europe in 2012
- > Alternative powertrain solutions have been evaluated – **FC buses with greatest operational flexibility and zero emissions¹⁾**
- > **FC bus TCO** is currently **217%** of diesel buses – Needs to be reduced for commercialisation

Study Goals

- > **Bridging the gap** until full technology maturity and competitiveness within the bus market
- > **Mobilising European bus operators** to reach critical number of buses for unit cost reduction
- > Providing **cost analyses** for European cities and bus operators for future large-scale FC bus deployment
- > **Development of regional clusters** deploying 500 – 1,000 FC buses in total, supported by the FCH JU in
 - 1.) Engineering of large-scale HRS infrastructure
 - 2.) Realising demonstration projects (2017 – 2020)

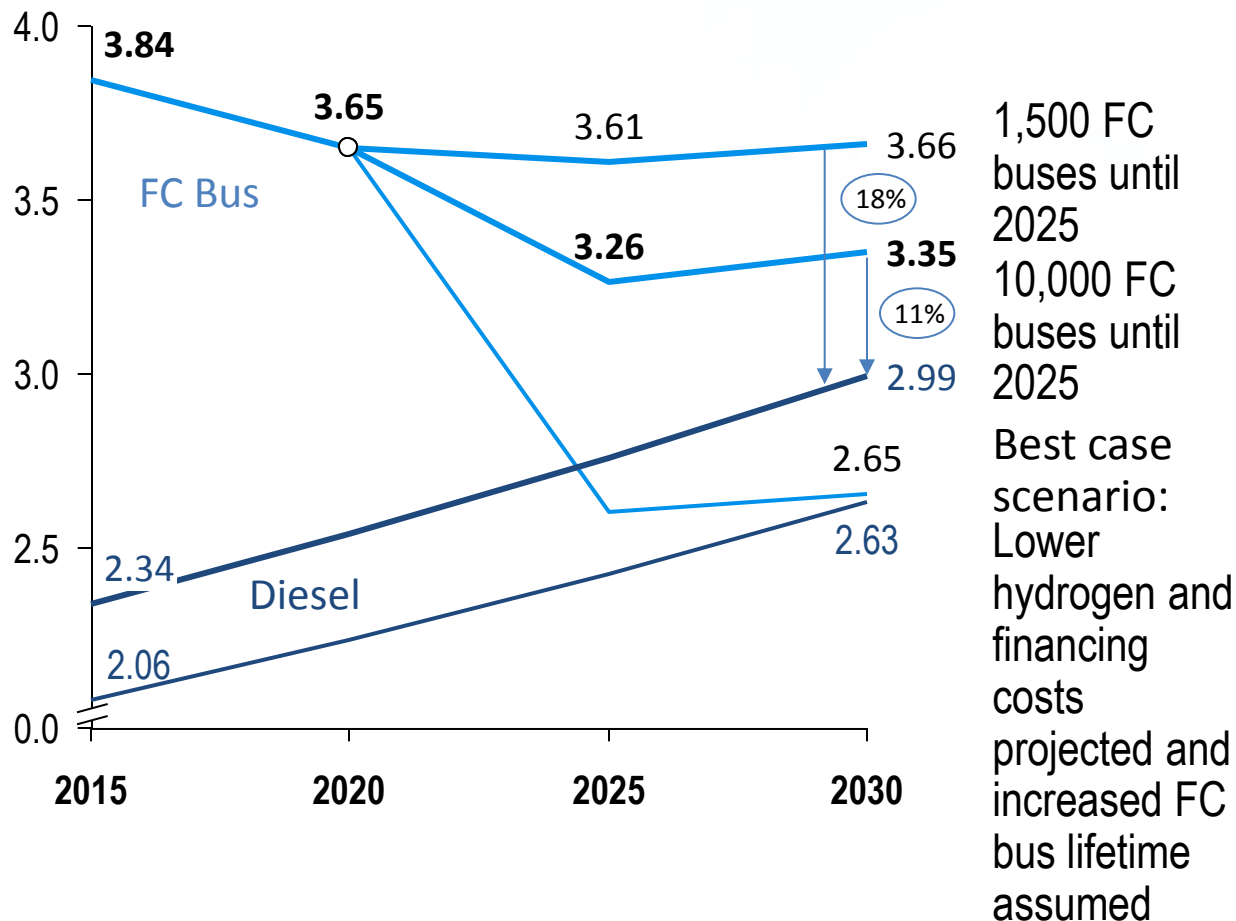
1) FCH JU Study "Urban buses: Alternative powertrains for Europe"



First Results: Cost Analysis

The study assessed FC bus deployment costs to support locations in determining financing gap - Cost premium remains

Total Servicing Cost development scenarios



- > Deploying more buses earlier will support scale effects and cost reduction
- > More locations as first-movers need to be mobilised
- > TSC gap to the diesel bus expected to decrease to 11%, can remain higher, though
- > Synergies with fuel cell passenger car industry offer further significant cost reduction potential (not depicted here)

First Results: Mobilisation

A coalition of industry and public stakeholders has been established - Operators and local governments from 30 locations participating

Participating locations interested in FC Bus roll-out



Industry coalition members

Bus manufacturers



Infrastructure/
H₂ providers



Technology providers



Other organisations



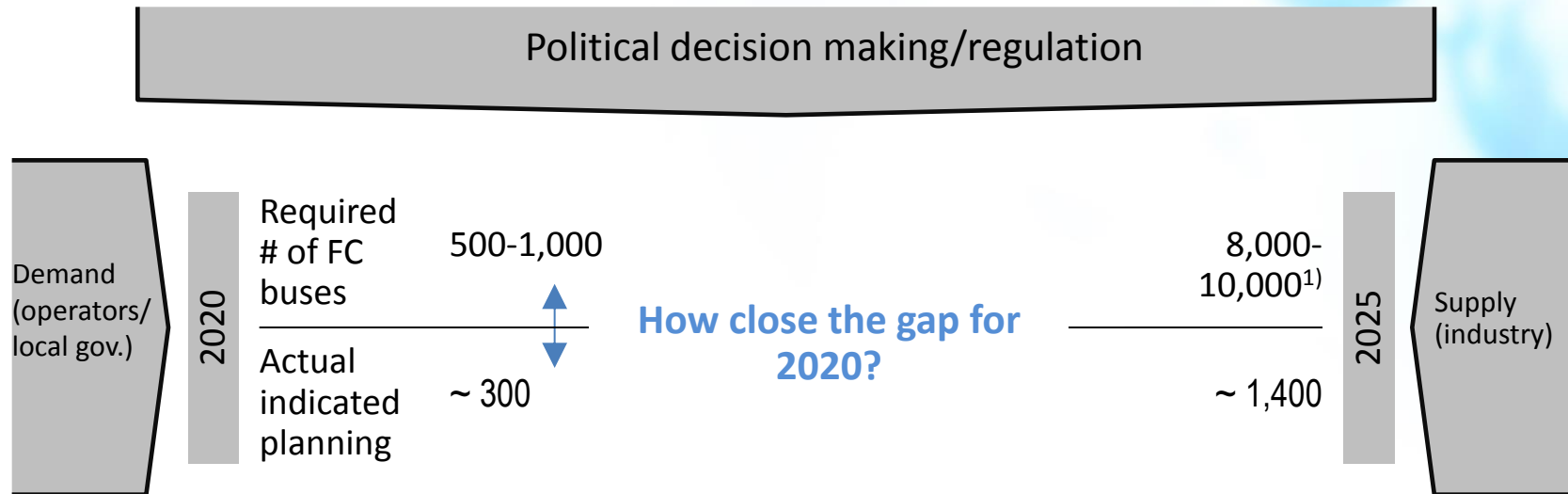
First Results: Communication

To engage local politicians and operators' executive level, line of argumentation to invest in FC Buses has been developed

Storyline high-level presentation for dissemination

- A** What is a FC bus? – It is an electric bus with a fuel cell and battery powertrain, running on hydrogen
- B** What does it cost? – The costs are expected to decrease with a remaining cost premium of 11-18%
- C** How is it beneficial to pay the premium? – Investing in FC Buses pays off in many ways
 - 1** Politically: There is a push for decarbonizing public transport, stricter regulation is expected
 - 2** Environmentally: FC Buses help green cities and reduce noise levels
 - 3** Operationally: FC Buses are the most convenient zero emissions option
 - 4** Economically: FC Buses reduce external costs of public transport and energy production
 - 5** Organizationally: The FC Bus Coalition and FCH JU support operators to introduce FC Buses
- D** Do they work in practice and are they safe? – Yes, numerous European cities are running FC Buses in daily operation and they are convinced
- E** We hope that you will join or support the FC Bus Coalition and explore options for a FC bus roll-out in your city

Taking the first hurdle of a critical number of buses until 2020 will be critical - We need full support of all coalition members



Challenges to be addressed within the study framework and beyond:

- Reach critical mass to establish commercial market, i.e. 500-1,000 FC buses in 2020
- Engage political decision makers to ensure high level support for long term roll-out
- Pursue a cost-benefit storyline that shows FC buses make sense, even if more expensive in next years
- Support operators in preparing for FC bus roll-out
- Set up FCH JU funding scheme to bridge parts of financing gap (incl. conditions on demo size)
- Seizing buses and the demo projects to push fuel cells in transport on a strategic level
- Lobbying for favourable regulatory scheme
- Success beyond 2020 will also depend on "game changing" decisions in 2017/2018

1) Total number of FC Buses required to reach cost down projections as per study results potential passenger car synergy effects not taken into account)

Already happening



To prepare for demonstration projects, the next phase of the study until May 2015 will focus on further supporting operators and cities

Overview next steps

1. Analyse bus purchasing price sensitivities – Analysing which bus target price is required for commercialisation, which funding support can be expected from the FCH JU and whether the number of 500-1,000 FC Buses will be achieved
2. Increase level of commitment – Supporting participants in stakeholder communication and decision making by signing of a Letter of Understanding for bus roll-out (to be signed by operators and local governments)
3. Prepare for joint procurement – Assessing implications of a joint procurement approach and forming regional clusters of interested locations to structure joint procurement
4. Disseminate know-how and lessons learnt – Supporting operators in analysing local costs and benefits of FC bus deployment, disseminating lessons learnt from previous projects

Fuel Cell and Hydrogen 2

Joint Undertaking

Transport

- Road vehicles
- Non-road vehicles and machinery
- Refuelling infrastructure
- Maritime, rail and aviation applications

Energy

- Hydrogen production and distribution
- **Hydrogen storage** for renewable energy integration
- Fuel cells for power and combined heat & power generation

Cross-cutting Issues

(e.g. standards, consumer awareness, manufacturing methods, ...)

- Period 2014-2020
- Approximately 300M€ in funding for transport projects (R&D + Demo)
 - Approximately 200M€ for demo projects
- Increased Cooperation with National and Regional Initiatives

Thank you for your attention!

Further info:

- FCH JU: <http://fch-ju.eu>
- NEW-IG: <http://www.new-ig.eu>
- N.ERGHY: <http://www.nerghy.eu>

Aargau



5 EvoBus buses

Bolzano



5 EvoBus buses



London



8 Wrightbus buses

Milano



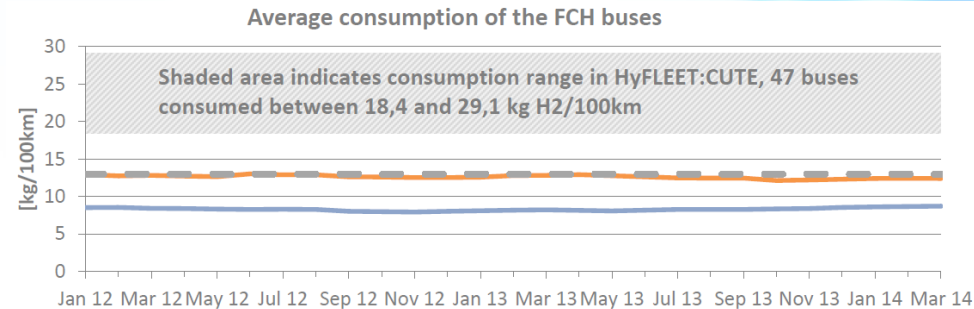
3 EvoBus buses

Oslo



5 Van Hool buses

- Operation of **26 fuel cell buses** in 5 cities in Europe (**Aargau, Bolzano, London, Milano, Oslo**) and the respective infrastructure for a period of 5 years
- Transfer of learning from cities with experience in operating buses and infrastructure (Hamburg, Berlin, Cologne, Whistler; ~ 30 fuel cell buses) to the 5 cities
- Assessment of the technology with focus on environment, economy and society
- Dissemination to the general public and to cities preparing for the technology in the next step
- Demonstration phase 2010-2016
- Cost 82 M€, 26 M€ funding**



City	HRS Availability to date (as of Sept 2013)	Average Refilling time
London	>98%	9 min
Aarau	>98%	6 min
Oslo	>98%	7 min
Cologne	>98%	7 min
Hamburg	83% (Mar-Sept '13: 96%)	7 min
Whistler	>98%	20 min

FCH JU projects: High V.LO City



Aberdeen (UK)

- Implement 14 hybrid fuel cell buses in 3 regions
- Establish 3 hydrogen production and refuelling facilities
- Create a Network of Clean Hydrogen Bus Centres of Excellence (CHBCE)
- Evaluate the total cost of ownership of buses
- Contribute to the Standardisation of Hydrogen refuelling Infrastructure
- Facilitate policies on environmental, health, energy efficiency, social and economic benefits
- Increase awareness, promotion and broader adoption of hydrogen buses
- Budget: 31.6 M€, funding 13.5 M€



Antwerp (Belgium)



San Remo (Italy)

Sites	Flanders	Liguria	Scotland
Buses	5	5	4
FC Module Warranty	>12,000 operating hours = 1,000 hours		
Bus Availability	90% (excl. P.M.)		
H₂Consumption	9-10kg/100km		

HyTransit

- Part of the Aberdeen Hydrogen Bus Project – together with High V.LO-City
- Operation of 6 FCBs (+4 from High V.LO-City)
- Use of hydrogen storage as a means of managing electrical grid constraints
- Budget: 16.3 M4, funding 7M€



Fuel cell bus in Aberdeen (UK)