

Project ID:	633174
Call topic:	SP1-JTI-FCH.2013.1.1 - Large scale demonstration of road vehicles and refuelling infrastructure VI
Project total costs:	€ 39,232,162.60
FCH JU max. Contribution:	€ 14,999,983
Project start - end:	01/01/2015 - 31/12/2022
Coordinator:	VAN HOOL N.V., BE
Website:	www. 3EMotion.eu



BENEFICIARIES: COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, AGENZIA NAZIONALE PER LE NUOVE TECNOLOGIE, L'ENERGIA E LO SVILUPPO ECONOMICO SOSTENIBILE, UNIVERSITÀ DEGLI STUDI DI ROMA LA SAPIENZA, FIT CONSULTING SRL, AALBORG KOMMUNE, Vlaamse Vervoersmaatschappij De Lijn, REGION NORDJYLLAND (NORTH DENMARK REGION), AZIENDA PER LA MOBILITA DEL COMUNE DI ROMA SPA, DANTherm POWER A.S, LONDON BUS SERVICES LIMITED, AIR LIQUIDE ADVANCED BUSINESS, Provincie Zuid-Holland, WaterstofNet vzw, AIR LIQUIDE ADVANCED TECHNOLOGIES SA, REGIONE LAZIO, ROTTERDAMSE ELEKTRISCHE TRAM NV, COMMUNAUTE URBAINE DE CHERBOURG, COMPAGNIA TRASPORTI LAZIALI, ACETILENE & GASTECNICI DI BAGNOLI MARIA & C. SAS, COMMUNE DE CHERBOURG-EN-COTENTIN, CENTRO INTERUNIVERSITARIO DI RICERCA PER LO SVILUPPO SOSTENIBILE, SERVICES AUTOMOBILES DE LA VALLEE DE CHEVREUSE SAS, SYNDICAT MIXTE DES TRANSPORTS URBAINS DE PAU PORTE DES PYRENEES, CONNEXION VLOOT BV, B.E. GREEN

PROJECT AND OBJECTIVES

The 3EMotion project aims at operating 29 FCBs in 5 leading EU cities: London, Pau, Versailles (2x), Rotterdam, Aalborg and developing 3 new HRSs within the project.

Objectives:

- Lower H2 consumption < 9kg/100km
- Integrate latest drive train, FC & Batt technologies < TCO and > actual lifetime
- Ensure Availability >90%
- Increase warranties (>15,000 hours) and improved delivery times of key components
- Reduce bus investment costs to 850K€ for a 13m bus

Status:

12 operational buses, all other FCBs will have hit the road by autumn '19

1 HRS operational, 2 in build-phase.

NON QUANTITATIVE OBJECTIVES

Contribution was made for hydrogen sensors on the hydrogen storage system from the buses. Sensors giving the wrong readings from the factory settings and indicating hydrogen leaks that are not present. This glitch was fixed and future problems are not expected.

PROGRESS & MAIN ACHIEVEMENTS

- 12 Fuel Cell buses already in operation delivering data, 4 will follow soon and the other buses will hit the road before the end of 2019
- To this date all sites have bought their buses, within the set bus-price of the FCH-JU Call and are produced / in production at 3 different EU OEMs
- The buses are meeting to a large extend the h2-consumption (<9kg/100km) with an average of 8kg/100km and availability is steadily progressing to >90%.

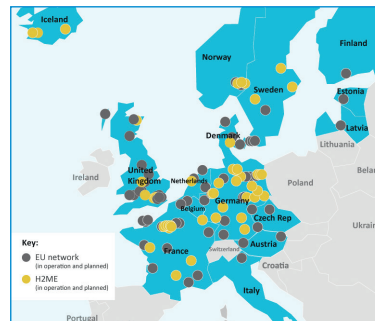
FUTURE STEPS & PLANS

- The start of full operations with the FCBs in the remaining project sites, catching up on the delays encountered
- Start of operations and use of the 2 newly build HRSs or upgrades by the FCBs in the project
- Gathering of operational data and performances of the KPIs for the FCBs and HRSs and provide monitoring reports
- Consolidating and extending the network of H2 Bus Centres of Excellence to the project sites, in collaboration with the H2 Bus Alliance Global H2 Bus.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
Project's own objective/AIP 2013	Lower H2 consumption for FCB's to less than 9kg/100km	kgs/ 100km	9	average of 8 kg/100km	✓	N/A	2019
	Ensure Availability >90%	%	90	< = 80%	✗	N/A	
	Increase warranties (>15,000 hours)	hours	15,000	15,000	✓	N/A	
	Reduce bus investment costs to 850K€ for a 13m bus	Euro	850,000	850,000	✓	625,000	



Project ID: 700350

Call topic:

FCH-03.1-2015 - Large scale demonstration of Hydrogen Refuelling Stations and FCEV road vehicles - including buses and on site electrolysis

Project total costs: € 103,181,910.83

FCH JU max. Contribution: € 34,999,548.5

Project start - end: 01/05/2016 - 30/06/2022

Coordinator: ELEMENT ENERGY LIMITED, UK

Website: www.h2me.eu

BENEFICIARIES: THE UNIVERSITY OF MANCHESTER, DAIMLER AG, OPEN ENERGI LIMITED, AUDI AKTIENGESellschaft, BAYERISCHE MOTORENWERKE AKTIENGESellschaft, RENAULT SAS, STEDIN NETBEHEER BV, EIFER EUROPAISCHES INSTITUT FUR ENERGIEFORSCHUNG EDF KIT EWIV, ICELANDIC NEW ENERGY LTD, NEL HYDROGEN AS, RENAULT TRUCKS SAS, AIR LIQUIDE ADVANCED BUSINESS, Nissan Motor Manufacturing (UK) Limited, NUCELSYS GMBH, MCPHY ENERGY, hySOLUTIONS GmbH, KOBENHAVNS KOMMUNE, CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES, ITM POWER (TRADING) LIMITED, MANUFACTURE FRANCAISE DES PNEUMATIQUES MICHELIN, INTELLIGENT ENERGY LIMITED, MINISTERIE VAN INFRASTRUCTUUR EN WATERSTAAT, SOCIETE D'ECONOMIE MIXTE DES TRANSPORTS EN COMMUN DE L'AGGLOMERATION NANTAISE (SEMITEAN), AREVA H2GEN, AIR LIQUIDE ADVANCED TECHNOLOGIES SA, SYMBIOFCCELL SA, AGA AB, GNVRT SAS, HONDA R&D EUROPE (DEUTSCHLAND) GMBH, HYDROGENE DE FRANCE, COMPAGNIE NATIONALE DU RHONE SA, NEW NEL HYDROGEN AS, BRINTBRANCHEN, HYOP AS, H2 MOBILITY DEUTSCHLAND GMBH & CO KG, SOCIETE DU TAXI ELECTRIQUE PARISIEN, STEDIN DIENSTEN BV, COMMUNAUTE URBAINE DU GRAND NANCY, ISLENSKA VETNISFELAGID EHF, LINDE GAS GMBH, ALPHABET FUHRPARKMANAGEMENT GMBH, TECH TRANSPORTS COMPAGNIE, B. KERKHOF & ZN BV

PROJECT AND OBJECTIVES

H2ME 2 brings together actions in 8 countries in a 6-year collaboration to deploy over 1,100 vehicles and 20 new HRS and builds on activities conducted as part of the H2ME project. The project will perform a large-scale market test of a fleet of fuel cell electric vehicles operated in real-world customer applications across multiple European regions. In parallel, it will demonstrate that the hydrogen mobility sector can support the wider European energy system via electrolytic hydrogen production.

NON QUANTITATIVE OBJECTIVES

- > 1,200 fuel cell vehicles and > 20 HRS foreseen at the end of the project
- H2ME 2 has a dedicated WP to assess the way in which electrolytic hydrogen production in the mobility sector can link to the wider energy system
- Ensure cross-fertilization of knowledge acquired in the project.

PROGRESS & MAIN ACHIEVEMENTS

- Most of the 20 HRS planned for the project expected to be in operation
- > 30% of all vehicles planned for the project expected to be deployed including the first next generation Daimler GLC F-CELL
- Solid and growing basis of operational data from vehicles and station and further fact based analysis on vehicles and HRS performances
- Further exploitation of results.

FUTURE STEPS & PLANS

- All 20 HRS planned for the project expected to have been commissioned and be in operation
- Most of the 1,100 vehicles planned for the project expected to be deployed
- Solid and growing basis of operational data from vehicles and stations and further fact based analysis on vehicles and HRS performances
- Further exploitation of results with key event during the European week of Cities and regions in Brussels.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
HRS							
Project's own objective aligned with AWP 2015/MAWP Addendum (2018-2020)	HRS availability	%	98	95.1	✗	98	2017
	Min HRS operation	months	36	~24	✗	32	
FC Vehicles							
Project's own objective aligned with AWP 2015/MAWP Addendum (2018-2020)	Minimum vehicle operation during project	months	36	25	✗	12	2017
	Vehicle availability	%	98	>99	✓	98	

Project ID: 671438

Call topic: FCH-01.7-2014 - Large scale demonstration of refuelling infrastructure for road vehicles

Project total costs: € 62,840,820.79

FCH JU max. Contribution: € 32,000,000

Project start - end: 01/06/2015 - 31/05/2020

Coordinator: ELEMENT ENERGY LIMITED, UK

Website: www.h2me.eu



BENEFICIARIES: DAIMLER AG, BAYERISCHE MOTOREN WERKE AKTIENGESellschaft, RENAULT SAS, LINDE AG, EIFER EUROPAISCHES INSTITUT FÜR ENERGIEFORSCHUNG EDF KIT EWIV, ICELANDIC NEW ENERGY LTD, TOYOTA MOTOR EUROPE NV, NEL HYDROGEN AS, AIR LIQUIDE ADVANCED BUSINESS, Nissan Motor Manufacturing (UK) Limited, WATERSTOFNET VZW, NUCELLSYS GMBH, MCPHY ENERGY, CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES, ITM POWER (TRADING) LIMITED, INTELLIGENT ENERGY LIMITED, AREVA H2GEN, AIR LIQUIDE ADVANCED TECHNOLOGIES SA, SYMBIOCELL SA, HYUNDAI MOTOR EUROPE GMBH, AGA AB, HONDA R&D EUROPE (DEUTSCHLAND) GMBH, BOC LIMITED, OMV REFINING & MARKETING GMBH, DANISH HYDROGEN FUEL AS, HYOP AS, FALKENBERG ENERGI AB, COMMUNAUTE D'AGGLOMERATION SARREGUEMINES CONFLUENCES, H2 MOBILITY DEUTSCHLAND GMBH & CO KG, LINDE GAS GMBH, ELEMENT ENERGY

PROJECT AND OBJECTIVES

Hydrogen Mobility Europe (H2ME) brings together Europe's four most ambitious national initiatives on hydrogen mobility (in Germany, Scandinavia, France and the UK). The project expand their developing networks of Hydrogen Refuelling Station (HRS) - 29 new stations will be deployed in total - and the fleets of FCEVs operating on Europe's roads - 325 vehicles - creating both a physical and strategic link between these four regions and three 'observer countries' - Austria, Belgium and the Netherlands - who are using the learnings produced by this project to develop their own strategies.

NON QUANTITATIVE OBJECTIVES

- Further activities for deployment of HRS and FCEVs after project
- 294 vehicles and 22 HRS deployed to date - 325 FCEVs and 29 HRS by the end of the project
- HRS to be accessible for private users and preferably integrated in petrol forecourts
- Ensure cross-fertilization of knowledge acquired in the project and a comprehensive dissemination.

PROGRESS & MAIN ACHIEVEMENTS

- Successful continuation of demonstration of 220 vehicles and 6 HRS and additional deployment for 74 vehicles and 12 HRS in 2018
- Launch and beginning of operation for first Daimler GLC in Europe and delivery of all vehicles planned for Toyota and Symbio
- 3/4 of the planned HRSs are now in operation contributing the creating a pan-European network and enabling cross-border driving.

FUTURE STEPS & PLANS

- All 29 HRS planned for the project expected to have been commissioned and be in operation
- All 325 vehicles planned for the project expected to be deployed including the first next generation Daimler GLC F-CELL
- Solid and growing basis of operational data from vehicles and station and further fact based analysis on vehicles and HRS performances
- Further exploitation of results.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
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FC Vehicles

Project's own objective aligned with AWP 2014/MAWP Addendum (2018-2020)	Min vehicle operation during the project	months	12	60	✓	12	2017
	Vehicle availability	%	>95	>99	✓	98	

HRS

Project's own objective aligned with AWP 2014/MAWP Addendum (2018-2020)	HRS availability	%	97	95.1	✗	98	2017
	Min HRS operation	months	24	36	✓	32	2017
	Hydrogen purity	%	99.99	99.99	✓	99.99	2015

Project ID: 278192

Call topic: SP1-JTI-FCH.2010.1.1
- Large scale demonstration of road vehicles and refuelling infrastructure III

Project total costs: € 30,494,110.49

FCH JU max. Contribution: € 13,491,724.00

Project start - end: 01/01/2012 - 31/12/2019

Coordinator: VAN HOOL N.V., BE

Website: highvlocity.eu



BENEFICIARIES: UNIVERSITÀ DEGLI STUDI DI GENOVA, FIT CONSULTING SRL, Vlaamse Vervoersmaatschappij De Lijn, SOLVAY SA, REGIONE LIGURIA, DANTherm POWER A.S, HYDROGEN, FUEL CELLS AND ELECTRO-MOBILITY IN EUROPEAN REGIONS, WaterstofNet vzw, ABERDEEN CITY COUNCIL*, RIVIERA TRASPORTI SPA, BALLAST NEDAM INTERNATIONAL PRODUCT MANAGEMENT B.V., CNG NET BV, QBUZZ B.V., PITPOINT.BE, PITPOINT.PRO BV

PROJECT AND OBJECTIVES

The High V.LO-City project aims at facilitating the deployment of fuel cell buses and hydrogen refuelling stations in four sites across Europe: Antwerp (BE), Aberdeen (UK), Groningen (NL) and San Remo (IT). The key project objectives are to increase the energy efficiency of the buses and reduce the cost of ownership, as well as to demonstrate an operational availability of the buses close to diesel. Another objective of the project is to contribute to the commercialisation of FC buses in Europe. All the 14 buses and refuelling infrastructure in the project are now in operation.

NON QUANTITATIVE OBJECTIVES

- Training of bus drivers and technicians
- A number of bus drivers have received specific training for hydrogen buses. Maintenance technicians have received training from the bus manufacturer as well as from the fuel cell supplier at the beginning of the project
- Refuelling protocols have been improved
- Awareness raising activities around hydrogen and fuel cell buses have taken place in the four regions where the deployment sites are located
- Local supply chains have been improved. There are now also more bus manufacturers producing hydrogen buses on the market.

PROGRESS & MAIN ACHIEVEMENTS

- More than 920,000 km driven by the fleet of buses since the start of the project
- More than 938 tonnes of CO₂ saved
- Buses and refuelling infrastructure successfully demonstrated.

FUTURE STEPS & PLANS

- Technical availability of the buses - expected to improve, especially for the Antwerp and Sanremo sites

- Increased mileage - especially for the Sanremo and Antwerp sites, where buses are expected to drive more
- Relocation of the Antwerp refuelling station at the DeLijn depot - for higher usage of the buses / better efficiency
- Availability of the buses getting closer to diesel equivalent for all sites.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET
HRS			
Groningen site	Distance	km	100,071
Sanremo site			23,833
Aberdeen site			497,994
Antwerp site			213,242
FC Vehicles			
Hydrogen Consumption	Hydrogen dispensed	km	96,426

Project ID:	303451
Call topic:	SP1-JTI-FCH.2011.4.1 - Demonstration of fuel cell-powered Material Handling vehicles including infrastructure
Project total costs:	€ 15,680,960.2
FCH JU max. Contribution:	€ 6,896,871
Project start - end:	01/01/2013 - 31/12/2018
Coordinator:	Ludwig-Boelkow-Systemtechnik GmbH, DE
Website:	www.hylift-europe.eu

BENEFICIARIES: JRC -JOINT RESEARCH CENTRE-EUROPEAN COMMISSION, FAST - FEDERAZIONE DELLE ASSOCIAZIONI SCIENTIFICHE E TECNICHE, H2 Logic A/S, ELEMENT ENERGY LIMITED, DANTHERM POWER A.S, AIR LIQUIDE ADVANCED BUSINESS, HEATHROW AIRPORT LIMITED, COPENHAGEN HYDROGEN NETWORK AS, AIR PRODUCTS GMBH, MULAG FAHRZEUGWERK HEINZ WÖSSNER GMBH U. CO. KG, STILL GMBH, PRELOCENTRE



PROJECT AND OBJECTIVES

The aim of HyLIFT-EUROPE is to demonstrate more than 200 hydrogen powered fuel cell materials handling vehicles and associated hydrogen refuelling infrastructure at ≥ 2 sites across Europe (the initial plan foresaw 5-20 sites), making it the largest European trial of hydrogen powered fuel cell materials handling vehicles so far. This continues efforts of the previous FCH JU supported HyLIFT-DEMO project. In the HyLIFT-EUROPE project the partners demonstrate fuel cell systems in materials handling vehicles from the partner STILL and from non-participating OEMs.

NON QUANTITATIVE OBJECTIVES

- Validation of Total Cost of Ownership & path towards commercial target
- Plan and ensure initiation of supported market deployment beyond 2018
- Best practice guide for hydrogen refuelling station installations

- The European dissemination and supporting of the European industry finished at the end of the project comprising two workshops at vehicle-user sites.

PROGRESS & MAIN ACHIEVEMENTS

- Demonstration of more than 200 hydrogen powered fuel cell materials handling vehicles and the corresponding hydrogen infrastructure at two sites
- Demonstration respectively real-world operation of indoor hydrogen refuelling stations including hydrogen supply at two sites
- Development of a best practice guide for HRS installations and European dissemination and supporting of the European industry in this field.

FUTURE STEPS & PLANS

Project finished.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
FC MHVs							
MAIP 2008-2013	Number of industrial and off-highway vehicles	[-]	200	212	✓	>25,000	2019
AIP 2011	Number of FC systems	[-]	200	212	✓	>25,000	2019
	FC system efficiency	[%]	45-50	>45	✓	53	2015
HRS							
AIP 2011	Refuelling time	[min]	~3	2.5	✓	2.18	2017
	HRS availability	[%]	>98	>98	✓	N/A	N/A

Project ID:	303467
Call topic:	SP1-JTI-FCH.2011.1.1 - Large scale demonstration of road vehicles and refuelling infrastructure IV
Project total costs:	€ 17,850,708.85
FCH JU max. Contribution:	€ 6,999,999
Project start - end:	01/01/2013 - 31/03/2019
Coordinator:	BOC LIMITED, UK
Website:	hytransit.eu



BENEFICIARIES: STAGECOACH BUS HOLDINGS LIMITED, VAN HOOL N.V., ABERDEEN CITY COUNCIL, HYDROGEN, FUEL CELLS AND ELECTRO-MOBILITY IN EUROPEAN REGIONS, DANTHERM POWER A.S, ELEMENT ENERGY LIMITED, PLANET PLANUNGSGRUPPE ENERGIE UND TECHNIK GBR

PROJECT AND OBJECTIVES

HyTransit aimed to trial a fleet of six hybrid fuel cell buses in daily fleet service, together with one state of the art hydrogen refuelling station in Aberdeen, Scotland. By operating the vehicles rigorously on long inter-urban routes, the project aimed to prove that a hybrid fuel cell bus is capable of meeting the operational demands of an equivalent diesel bus, whilst offering significant benefits in terms of environmental performance. The project finished in March 2019. This allowed for four full years of operation of the FCBs and the HRS. HyTransit forms the backbone of the Aberdeen Hydrogen Bus Project, which together with four buses from the High V.LO-City project led to the deployment of Europe's largest fleet of hydrogen buses to date (JIVE and JIVE 2 projects).

NON QUANTITATIVE OBJECTIVES

- Develop six A330 hybrid fuel cell buses specifically modified for long sub-urban routes
- Initiate the first step for a large-scale rollout of hydrogen buses in Scotland. Following the success of HyTransit, Aberdeen City Council have committed to deploy more FCBs through the JIVE project.

Additionally, other Scottish cities have committed to deploy FCBs such as Dundee

- The results from the project can be evidenced to prove the capability of the FCBs.
- Address the main commercial barrier to the technology (namely bus capital cost) by deploying state of the art components. The premium of fuel cell buses has reduced significantly over now equal to c. £70,000/year, down from c.£170,000/year
- Disseminate the results of the project to the public and key stakeholders.

PROGRESS & MAIN ACHIEVEMENTS

- The Kittybrewster HRS has been highly reliable throughout the project, with an average availability of 99.5%. This exceeds industry's expectations
- Nearly 1.4 million kilometres have been driven by the fleet of buses and approximately 1.3 million passengers have used the service
- By using FCBs instead of conventional diesel vehicles, >400,000 litres of diesel has been saved and >1,000 tonnes of direct GHG emissions avoided.

FUTURE STEPS & PLANS

Project finished - the HyTransit buses will continue to operate until the end of 2019. After this, their operation will be reassessed.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)
FC Buses						
AIP 2011 target for fleet	Availability	%	>85	78	✗	85
HRS						
Project's own objective	Availability of the hydrogen refuelling unit	%	>98	99.5	✓	98
	Amount of hydrogen dispensed	kg	>140,000	146,823	✓	N/A
	Operating hours drivetrain	hours	70,000	88,824	✓	N/A
	Number of passengers	Number	>1,000,000	1,302,487	✓	N/A



JIVE 2

JOINT INITIATIVE FOR HYDROGEN VEHICLES ACROSS EUROPE 2



Project ID:	779563
Call topic:	FCH-01-5-2017 - Large scale demonstration in preparation for a wider roll-out of fuel cell bus fleets (FCB) including new cities – Phase two
Project total costs:	€ 107,398,381.75
FCH JU max. Contribution:	€ 25,000,000.00
Project start - end:	01/01/2018 - 31/12/2023
Coordinator:	ELEMENT ENERGY LIMITED, UK
Website:	www.fuelcellbuses.eu/projects/jive-2

BENEFICIARIES: HYDROGEN EUROPE, UNION INTERNATIONALE DES TRANSPORTS PUBLICS, NOORD-BRABANT PROVINCIE, VATGAS SVERIGE IDEELL FORENING, Provincie Zuid-Holland, RUTER AS, BRIGHTON & HOVE BUS AND COACH COMPANY LIMITED, THINKSTEP AG, KOLDING KOMMUNE, RIGAS SATIKSME SIA, WSW MOBIL GMBH, DUNDEE CITY COUNCIL, REGIONALVERKEHR KOLN GMBH, REBELGROUP ADVISORY BV, LANDSTINGET GAVLEBORG, PAU BEARN PYRENEES MOBILITES, OPENBAAR LICHAAM OV-BUREAU GRONINGEN EN DRENTH, STRAETO BS, SOCIETE PUBLIQUE LOCALE D'EXPLOITATION DES TRANSPORTS PUBLICS ET DES SERVICES A LA MOBILITE DE L'AGGLOMERATION PALOISE, RHEINISCHE BAHNGESELLSCHAFT AKTIENGESellschaft, CA DE L'AUXERROIS, ENGIE ENERGIE SERVICES

PROJECT AND OBJECTIVES

The overall objective of JIVE 2 is to advance the commercialisation of hydrogen fuel cell buses through large-scale deployment of vehicles and infrastructure so that by the end of the project (early 2020s) hydrogen buses are commercially viable for bus operators to include in their fleets without subsidy and that local and national Governments feel empowered to regulate for zero emission propulsion for their public transport systems. The key project objective is the order of 152 fuel cell buses for delivery to, and operation in, 14 cities across Europe, securing the lowest possible prices.

NON QUANTITATIVE OBJECTIVES

- Lessons learnt from joint procurement reflected in the Operators' guide to FCB deployment
- Lessons learnt in operator forum, the report is ongoing
- Collation of training materials

- Zero Emission Bus Conference held in Cologne in November 2018; additional dissemination and communication events ongoing.

PROGRESS & MAIN ACHIEVEMENTS

- Most procurement exercises are expected to return bus price offers under the €625k limit
- A number of OEMs have entered the FCB market in response to the demand stimulated by the project
- Ongoing collection of lessons learnt are invaluable for the further roll-out of FCBs beyond the project.

FUTURE STEPS & PLANS

- Despite delays, we expect most buses to be ordered by the end of 2019
- Zero Emission Bus Conference 2020 to be held in Paris
- Ongoing collection of lessons learnt and best practice through project reporting and workshops.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	SOA RESULT ACHIEVED TO DATE (BY OTHERS)
AWP 2017	Vehicle operational lifetime	hours	Operational lifetimes as close to traditional buses as possible (8+ years as a minimum). The target is set in terms of bus lifetime (rather than stack life) as this is more relevant to operators.	Vehicles not yet deployed	Not project specific. Conventional diesel bus should do 32,000 hours; at least one FCB supplier suggests 40,000 hours will be possible for FCBs under JIVE.
	Distance travelled	km	150,000 km per bus / three years of operation.		Route specific. Minimum distance travelled will be 44,000km/year, average of 59,000km and a maximum of 90,000km (in Herning).
	Operating hours per fuel cell system	hours	>20,000 hours by project end.		N/A
	Availability	%	>90% vehicle reliability, but allow for a 6 month teething phase where lower reliability is expected (based on CHIC learning).		85% availability (2012) from High V.LO.City
	Mean time (distance) between failures	km	An MTBF of >3,500 km (after the teething period) will be stipulated in the contracts. The expectation is to be achieved higher		N/A



JIVE

JOINT INITIATIVE FOR HYDROGEN VEHICLES ACROSS EUROPE



Project ID:	735582
Call topic:	FCH-01-9-2016 - Large scale validation of fuel cell bus fleets
Project total costs:	€ 110,375,045.24
FCH JU max. Contribution:	€ 32,000,000
Project start - end:	01/01/2017 - 31/12/2022
Coordinator:	ELEMENT ENERGY LIMITED, UK
Website:	www.fuelcellbuses.eu/projects/jive

BENEFICIARIES: HYDROGEN EUROPE, UNION INTERNATIONALE DES TRANSPORTS PUBLICS, FONDAZIONE BRUNO KESSLER, BIRMINGHAM CITY COUNCIL, PLANET PLANUNGSGRUPPE ENERGIE UND TECHNIK GBR, LONDON BUS SERVICES LIMITED, HyCologne - Wasserstoff Region Rheinland e.V., SÜEDTIROLER TRANSPORTSTRUKTUREN AG, ABERDEEN CITY COUNCIL*, hySOLUTIONS GmbH, THINKSTEP AG, EE ENERGY ENGINEERS GMBH, TRENTINO TRASPORTI SPA, RIGAS SATIKSME SIA, WSW MOBIL GMBH, HERNING KOMMUNE, SASA SPA AG SOCIETÀ AUTOBUS SERVIZID'AREA SPA, WEST MIDLANDS TRAVEL LIMITED, DUNDEE CITY COUNCIL, EUE APS, REGIONALVERKEHR KÖLN GMBH, VERKEHRS-VERBUND MAINZ-WIESBADEN GESELLSCHAFT MIT BESCHRÄNKTER HAFTUNG, MAINZER VERKEHRSGESELLSCHAFT MBH, ESWE VERKEHRSGESELLSCHAFT MBH, IN-DER-CITY-BUS GMBH, REBELGROUP ADVISORY BV

PROJECT AND OBJECTIVES

The overall objective of JIVE is to advance the commercialisation of hydrogen fuel cell buses through large-scale deployment of vehicles and infrastructure so that by the end of the project (early 2020s) hydrogen buses are commercially viable for bus operators to include in their fleets without subsidy and that local and national Governments feel empowered to regulate for zero emission propulsion for their public transport systems. The specific project objectives are discussed below.

NON QUANTITATIVE OBJECTIVES

- Lessons learnt from joint procurement reflected in the Operators' guide to FCB deployment

- Lessons learnt in operator forum, the report is ongoing
- Collation of training materials
- Zero Emission Bus Conference held in Cologne in November 2018; additional dissemination and communication events ongoing.

PROGRESS & MAIN ACHIEVEMENTS

- Offers significantly under the €650k bus capex limit have been received in some procurement processes
- A number of OEMs have entered the FCB market in response to the demand stimulated by the project

- TfL have developed a Procurement Framework that allows cities to order FCBs more quickly than would otherwise be possible.

FUTURE STEPS & PLANS

- Despite delays, we expect most buses to be operating in 2020
- Zero Emission Bus Conference 2020 to be held in Paris
- Ongoing collection of lessons learnt and best practice through project reporting and workshops.

QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	SOA RESULT ACHIEVED TO DATE (BY OTHERS)
AWP 2016	Vehicle operational lifetime	hours	Tender specifications and project require a bus operation of over 8 years.	Vehicles not yet deployed	Conventional diesel bus should do 32,000 hours; at least one FCB supplier suggests 40,000 hours will be possible for FCBs under JIVE.
	Distance travelled	km	Minimum distance travelled will be 44,000km/year, average of 59,000km and a maximum of 90,000km (in Herning).		Route specific. Minimum distance travelled will be 44,000km/year, average of 59,000km and a maximum of 90,000km (in Herning).
	Operating hours per fuel cell system	hours	15,000 hours or 5 years, whichever is lower (at the project start), >20,000 hours by project end – stack replacements built into maintenance costs.		N/A
	Availability	%	Tender specifications and contracts require >90% vehicle reliability, but allow for a 6 month teething phase where lower reliability is expected		85% availability (2012) from High V.L.O.City
	Mean time (distance) between failures	km	An MTBF of >2,500 km (after the teething period)		N/A

Project ID:	779589
Call topic:	FCH-01-7-2017 - Validation of Fuel Cell Trucks for the Collect of Urban Wastes
Project total costs:	€ 8,706,255
FCH JU max. Contribution:	€ 4,993,851
Project start - end:	01/01/2018 - 31/12/2021
Coordinator:	TRACTEBEL ENGINEERING, BE
Website:	h2revive.eu



BENEFICIARIES: COMMISSARIAT A L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES, GEMEENTE AMSTERDAM, ELEMENT ENERGY LIMITED, WATERSTOFNET VZW, STAD ANTWERPEN, SYMBIOFCCELL SA, GEMEENTE BREDA, GEMEENTE GRONINGEN, E-TRUCKS EUROPE, SWISS HYDROGEN SA, SEAB SERVIZI ENERGIA AMBIENTE BOLZANO SPA, AZIENDA SERVIZI MUNICIPALIZZATI DI MERANO SPA, SUEZ NEDERLAND HOLDING BV, SAVER NV, GEMEENTE GRONINGEN

PROJECT AND OBJECTIVES

REVIVE stands for 'Refuse Vehicle Innovation and Validation in Europe'. The project will run from the beginning of 2018 until the end of 2021. REVIVE will significantly advance the state of development of fuel cell refuse trucks, by integrating fuel cell powertrains into 15 vehicles and deploying them across 8 sites in Europe. Currently the first trucks are under construction and the first deployment is expected end of October 2019 for Breda city in the Netherlands.

NON QUANTITATIVE OBJECTIVES

- EU FC suppliers. Today we have Proton Motor selected to provide FC systems for the trucks
- Raise the profile of the technology as a viable option for waste collection through several dissemination activities performed targeting the waste sector.

PROGRESS & MAIN ACHIEVEMENTS

- Final order for the trucks. In total 5 trucks are ordered by the project partners
- First trucks under construction. The first truck will be deployed in Breda in Q4 2019
- New partners identified for truck deployment and for providing FC system to E-trucks.

FUTURE STEPS & PLANS

- Introduce new partners to allocate all 15 trucks
- Introduce new consortium partner and help develop a European Fuel Cell supply chain
- First Truck deployment in Breda (October 2019).



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT
AWP 2017	Number of FC's deployed in the project	#	15	11
	FC Power	kW	>40 kW	45kW
	Tank-to-wheel efficiency	%	50%	N.A.
	Lifetime	hours	25,000	N.A.
	Availability	%	90%	N.A.

Project ID:	303485
Call topic:	SP1-JTI-FCH.2011.1.1 - Large scale demonstration of road vehicles and refuelling infrastructure IV
Project total costs:	€ 15,803,804.24
FCH JU max. Contribution:	€ 6,712,985.6
Project start - end:	01/10/2012 - 31/10/2018
Coordinator:	ELEMENT ENERGY LIMITED, UK
Website:	www.swarm-project.eu



BENEFICIARIES: UNIVERSITAET BREMEN, UNIVERSITE LIBRE DE BRUXELLES, UNIVERSITE DE LIEGE, COVENTRY UNIVERSITY ENTERPRISES LIMITED, THE UNIVERSITY OF BIRMINGHAM, SERVICE PUBLIC DE WALLONIE, BIRMINGHAM CITY COUNCIL, DEUTSCHES FORSCHUNGSZENTRUM FUER KUNSTLICHE INTELLIGENZ GMBH, PLANET PLANUNGSGRUPPE ENERGIE UND TECHNIK GBR, EWE-Forschungszentrum für Energietechnologie e. V., RIVERSIMPLE LLP, AIR LIQUIDE ADVANCED TECHNOLOGIES SA, GESPA GMBH, H2O E-MOBILE GMBH, JADE HOCHSCHULE WILHELMSHAVEN/OLDENBURG/ELSFLETH, TUV SUD PRODUCT SERVICE GMBH, TUV SUD AG, RIVERSIMPLE ENGINEERING LIMITED, RIVERSIMPLE MOVEMENT LIMITED

PROJECT AND OBJECTIVES

The project set out to establish fleets of small passenger vehicles supporting and expanding upon existing hydrogen refuelling infrastructure across three clusters: British Midlands and Wales (UK), Brussels/Wallonia (Belgium) and North Rhine Westphalia (DE). The vehicles demonstration was organised by three SME OEMs, Riversimple (UK), Microcab (UK) and H2O e-mobile (DE). Two Air Liquide 200kg/day stations were built in Frechen and Brussels while smaller stations were built and upgraded in the UK: a 20kg/day station in Abergavenny and two recommissioned stations in Coventry and Birmingham.

NON QUANTITATIVE OBJECTIVES

- Low cost small vehicles - the vehicles produced in this project will have low volume production costs
- The project has enabled the deployment of clusters of hydrogen filling stations in all three European regions and foster further deployment
- The project involves a range of European SMEs facilitating the exchange of IP and the introduction

of dynamic new European companies into Europe's hydrogen economy as well as European Research institutions

- The vehicles deployed are all built in battery dominant hybrid mode. This is a novel approach which optimise the cost, performance and energy efficiency of both battery and fuel cell/hydrogen storage technologies.

PROGRESS & MAIN ACHIEVEMENTS

- Development of 3 generations of powertrains by Microcab and Riversimple with first vehicles in operation since 2015
- Preparation for trial of 20 Riversimple cars in Abergavenny (UK) with HRS in operation and set-up ready
- Air Liquide HRS in Brussels and Frechen in operation since mid-2016 and mid-2018 respectively, supporting further deployment of fleets.

FUTURE STEPS & PLANS

Project finished.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
FC Vehicles							
Project's own objective (aligned with programme's objectives)	Vehicle Efficiency / energy consumptn	kg/km	1kg/100km	<1kg/100km	✓	N/A	N/A
HRS							
Project's own objective (aligned with programme's objectives)	HRS availability	%	>95%	97	✓	98	2016
	H2 price dispensed at pump	EUR/kg	10	9.5-10	✓	10	



ZEFER

ZERO EMISSION FLEET VEHICLES FOR EUROPEAN ROLL-OUT

Project ID:	779538
Call topic:	FCH-01-9-2016 - Large scale validation of fuel cell bus fleets
Project total costs:	€ 25,883,005
FCH JU max. Contribution:	€ 4,998,843
Project start - end:	01/09/2017 - 31/08/2022
Coordinator:	ELEMENT ENERGY LIMITED, UK
Website:	zefer.eu



BENEFICIARIES: MAYOR'S OFFICE FOR POLICING AND CRIME, BAYERISCHE MOTOREN WERKE AKTIENGESellschaft, LINDE AG, VILLE DE PARIS, AIR LIQUIDE ADVANCED BUSINESS, CENEX - CENTRE OF EXCELLENCE FOR LOW CARBON AND FUEL CELL TECHNOLOGIES, ITM POWER (TRADING) LIMITED, AIR LIQUIDE ADVANCED TECHNOLOGIES SA, SOCIETE DU TAXI ELECTRIQUE PARISIEN, BREATH, GREEN TOMATO CARS LIMITED

PROJECT AND OBJECTIVES

ZEFER began in 2017 to demonstrate a viable business case for hydrogen mobility in fleet applications and to highlight a solution to the problem of low FCEV uptake and poor hydrogen refuelling station utilisation. The project will deploy 180 FCEVs into high-mileage fleet services such as taxis, private hire vehicles and emergency services across three major European cities (London, Paris and Brussels). Through intensive use of the vehicles, ZEFER will test the performance of FCEVs, and their supporting HRSs, to ascertain whether FCEVs can provide a direct alternative to diesel counterparts.

NON QUANTITATIVE OBJECTIVES

- Develop comprehensive learnings from the deployment project
- ZEFER will market test 6 HRS in real-world operation. Data collected will feed into a business case analysis on HRS roll-out. Lessons learnt in this exercise will be passed onto HRS investors and policy makers
- Maintain, and if possible, increase SME participation in FCH JU projects, 50% of partners in ZEFER are SMEs.

PROGRESS & MAIN ACHIEVEMENTS

- Of the 180 FCEVs to be deployed, 71 are currently in everyday operation - 36 in Paris and 35 in London - in high-demand fleet applications
- The FCEVs are being used rigorously in everyday service amassing more than 1 million km driven with no reports of reliability problems
- Project HRSs are being highly utilised and are performing well, even prior to the completion of HRS upgrades.

FUTURE STEPS & PLANS

- Confirm approach for vehicles deployment and associated HRS upgrade for remaining trials
- All HRS upgrades are expected to be completed
- Collection of operational data from the HRS and FCEV will continue. Further fact based analysis will be conducted
- Greater dissemination efforts are expected to publicise project milestones such as 'last vehicle delivered'.



QUANTITATIVE TARGETS AND STATUS

TARGET SOURCE	PARAMETER	UNIT	TARGET	ACHIEVED TO DATE BY THE PROJECT	TARGET ACHIEVED?	SOA RESULT ACHIEVED TO DATE (BY OTHERS)	YEAR FOR SOA TARGET
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FC Vehicles

Project's own objective	Min. distance for vehicles	km /vehicle	90,000	average of ~ 42,000km per year. Will achieve targets after ~ 2+ years	✗	10,000	2016
	Vehicle Operation lifetime	hours	>6,000	average of ~ 2,800hrs per year. Will achieve targets after ~ 2+ years	✗	>2,000	
	Vehicle availability	%	> 98%	>98	✓	98%	

HRS

Project's own objective	HRS availability	%	>98	96	✗	98%	2016
	Hydrogen purity	%	99.99	99.99	✓	99.99	2018