

# **SHEL**

(Contract number: 256837)



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### General Overview

- Sustainable Hydrogen Evaluation in Logistics
- Duration: 42 months
- Project total costs: 4,669,938.20 €. Project funding: 2,443,095.00 €.

### Partnership description

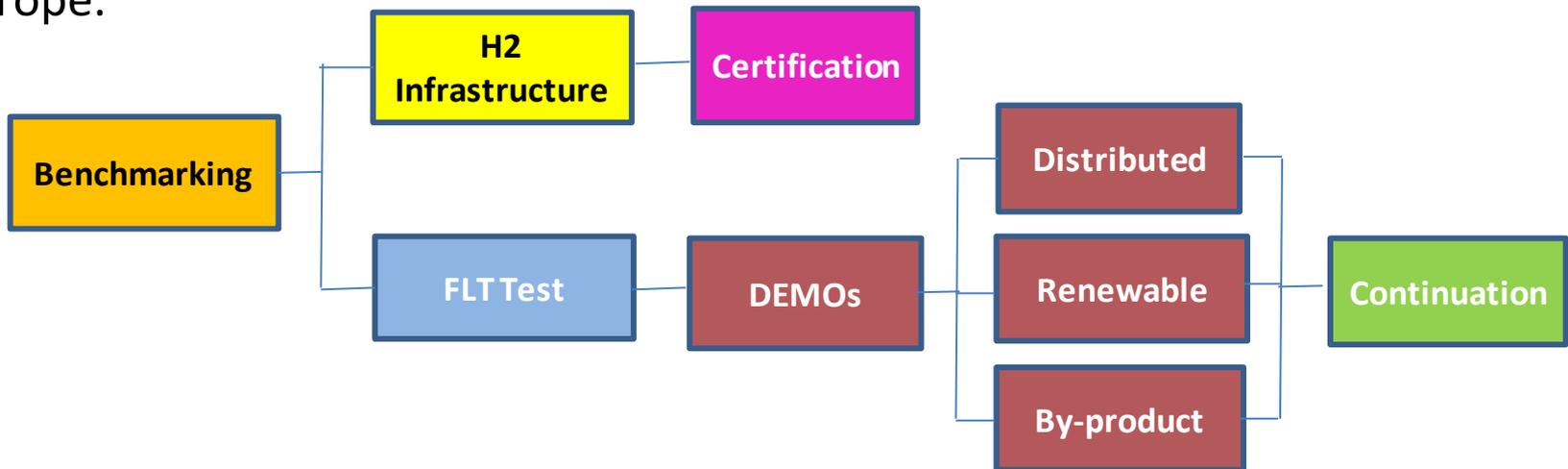
- 13 partners
- 7 EU countries
- research + industry

Short name	Country	Partner type
CIDETEC-IK4 (coord.)	Spain	research
UNIDO-ICHET	Austria - Turkey	research
AP	UK	industry
CRES	Greece	research
JRC	Netherlands	research
AIJU	Spain	research
INTA	Spain	research
FHA	Spain	research
UH	UK	research
FAST / EHA	Italy	association
HYGEAR	Netherlands	SME
CEGA Logistics	Spain	industry
CUMITAS	Turkey	industry



## Project description

The overall objective of SHEL project is to demonstrate the market readiness of Fuel Cell Hydrogen powered (FCH) materials handling vehicles, hydrogen refuelling infrastructure, demonstrate end user acceptance, and accelerate early market take-up of Fuel Cell Hydrogen Fork Lift Trucks (FCH FLT) in Europe.





### Project goals and targets

- SHEL will demonstrate 10 FC FLT's and associated hydrogen refuelling infrastructure across 4 sites in Europe (Turkey, UK, Greece & Spain).
- Each site represents a likely early market segment (Industrial, Port, Distribution Centre, and Light Logistics) for future commercialisation.
- SHEL will develop simplified procedures to reduce the time required for product certification and infrastructural build approval

### Approach in performing the activities

- WP2: Benchmarking

Objective: identification of key performance and economic parameters that will underpin real time data gathering from the project

1. Analysis of the current State of Art (SoA) across various international demonstration to date has been done.
2. An Operation Cost Model (OCM) has been developed to be used as a high level early stage economic indicator for future commercialisation of FC FLT.

- WP3: Hydrogen Infrastructure

Objective: identification and development of HRS design improvements, based on simulation tool.

1. A site simulation model for most common hydrogen pathways for FC FLT refilling has been developed.
2. HRS design improvements are proposed.
3. Hydrogen infrastructure plan for each demonstration site has been developed.
4. An electrolyser for the Spanish demonstration has been developed.



### Approach in performing the activities

- WP4: Certification and Planning

Objective: investigate current Hydrogen Certification process in four Member States, built upon the other EU studies linked to Hydrogen Installation in particular Handbook for Hydrogen Refuelling Study from the FP6 HyApproval Project.

1. A detailed report covering the certification process for four member states is under development.
2. A Qualitative Risk Assessment for each of the planned sites is under development.



## Approach in performing the activities

- WP5: FLT Preparation

Objective: delivery of 10 FC FLTs for the demonstration (one basic prototype, 7 counterbalanced type and 2 reach trucks).

1. An on-board monitoring software that registers the operation and performance of FC FLTs has been developed.
2. 4 of the 10 FLT are under preparation.

- WP6: Demonstration

Objective: demonstration of 10 FLTs at four individual sites.

1. Each demo site hydrogen infrastructure is under development



## Approach in performing the activities

- WP7: Continuation Plan and Dissemination

A public website has been designed and is available for consultation at the following address: [www.shel.eu](http://www.shel.eu)

A screenshot of the SHEL.EU website homepage. The page has a dark header with navigation links: HOME, OBJECTIVES, EVENTS, PARTNERS, CONTACT, LOGIN. Below the header is the SHEL logo and the tagline "SUSTAINABLE HYDROGEN EVALUATION IN LOGISTICS". A search bar is located in the top right. Below the header are links for Slideshow, News, and Extranet, along with an RSS icon. The main content area features a featured story titled "Fuel Cell Mounted on FLT" with a photograph of a fuel cell unit. To the right of the featured story is a "Welcome to SHEL.EU!" section with a paragraph of text, and a "Recent Posts" section with two bullet points.

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**shel**

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**Fuel Cell Mounted on FLT**

**Welcome to SHEL.EU!**

The aim of the SHEL project is to demonstrate the market readiness of fuel cell materials handling vehicles and associated refuelling infrastructure, demonstrate end user acceptance of the concept, and accelerate early market take-up.

**Recent Posts**

- Expansion of US Tax Break to Benefit Sales of Fuel Cell Forklifts
- Ballard Announces Commitment From Plug Power to Purchase 3,250 Fuel Cell Stacks Thru 2012

FEATURED STORIES



## Technical Accomplishments and Progress towards overall project and state of the art (SoA)

- Current SoA across FC FLT deployments has been analyzed
- Stake Holder Group has been established
- Operation Cost Model has been developed.
- A simulation model for current sites has been developed.

# 1. Project achievements



## Overall bottlenecks in the project

**Fuel Cells**      2011 Year: the real cost of FC systems exceeded original previsions  
Extra costs of 4 FCs was covered by partner internal resources

2012 Year: the real cost of FC systems exceeds original previsions  
Cost of the rest 5 FCs under negotiation with suppliers.

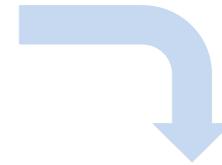
**Demonstration Sites**      Change in the UK demo site

- Limited availability from Newcastle Airport to host a suitable demonstration for the project.
- Felixstowe Port as new demo UK

New additional demo in Greece

- A new demo has been arranged at the facilities of AB Vassilopoulos supermarket, at no extra cost for the project.

**ForkLift Trucks**      Counterbalance FLT's are not substantially used in CEGA, being reach trucks the main type of FLT.



A request for Amendment was submitted on 21.06.2012:

1. Modification of DoW
2. New Duration: 42 months



The Amendment was officially accepted by the FCH JU on 28.09.2012



## Correlation of the project with the corresponding Application Area (as mentioned in MAIP/AIP documents)

Overall project objectives / Scope of Work	SHEL approach
Demonstrate the advantages of using fuel cells with hydrogen refuelling	Overall project target
Development of certification procedure	WP4 Certification and Planning
Identification of potential RCS needs.	WP4 Certification and Planning
Dissemination of results to wider audience, preferably to potential customers	WP2. Task 2.2: To establish Stake Holder Group
Envisaging a continuation of efforts / a following market introduction	WP7 Continuation Plan and Dissemination



# Detailed project activities & results/achievements versus MAIP/AIP document targets

Expected output AIP Topic: 4.1 Call: FCH-JU-2009-1		Objectives Project	Status at 50% of the project	Expected revised objectives
<i>Number of forklifts</i>	10	10	4 under development	10
<i>FC system costs ( €/kW)</i>	< 4,000	< 4,000	6,500	N/A
<i>FC system life time (h)</i>	>5,000	>5,000	N/A	2,000
<i>FC system efficiency (%)</i>	>40	>40	N/A	>40
<i>H2 price at pump (€/kg)</i>	<13	<13	10 (simulated value)	<13
<i>Refuelling time (min)</i>	< 5	< 5	3	< 5



### Gaps/bottlenecks in RTD&D proposed by MAIP/AIP documents

- FC systems cost issue:
  1. MAIP target for FLTs is  $< 4,000$  €/kW. Real system cost is approx  $\geq 6,500$  €/kW
  2. MAIP target for system lifetime (with service/stack refurbishment)  $> 5,000$  hrs; currently suppliers provide a 18 months guarantee or up to 2,000 hours
- HRS cost issue

H2 refuelling infrastructure cost to be included within the overall financial analysis
- Certification:

No uniform approach at EU level for overall infrastructure and FLT certification. Need for converging to a common EU RCS to facilitate on-site applications in different countries.

## How project addresses and contributes to :

- Training and Education

The new 9 FLT's will be formally handed over for demonstration at the end of this period.

- Safety, Regulations, Codes and Standards

1. A review of existing regulations, codes, standards and relevant technical references guidelines that make use of recognized best practice industry experiences to set safety standards to design and construct the demonstrations.
2. Certification process report for four member state will be established.
3. HAZOP study and FMEA analysis to build a Qualitative Risk Assessment of the 4EU sites. The followed methodology will be in line with the recommendations identified in FP6 HyApproval project



## How project addresses and contributes to :

- Dissemination & public awareness
  1. Identification of key stakeholders within Europe for a future EU FC FLT industry.
  2. Website, Newsletter, Conferences etc.

### Some attended Conferences:



### SHEL project Workshops planned for:

- Month 25 (January 2013)
- Month 31 (July 2013)
- Month 35-36 (December 2013).



## Technology Transfer / Collaborations

- Originated in a national project: ECOLIFT / UNIDO-ICHET
- Linked with other FCH JU projects, i.e.:
  - JRC, UNIDO-ICHET as liaison to standardization bodies (IEC TC 105)
  - HyLIFT-DEMO : The European Hydrogen Association leverages dissemination between SHEL and the HyLIFT-DEMO Project
- Coordination with various material handling companies
- A National project in Greece has brought the opportunity to increase the number of demonstration sites.



## Project Future Perspectives

- Cooperation across FCH JU is envisaged to ensure consistent Fuel Cells and Hydrogen deployment strategy at European level.
- The project should enable the key partners to establish contacts to potential end-users.
- Lessons learnt to be shared with other demo projects such as HyLIFT



This project is co-financed by European funds from the Fuel Cells and Hydrogen Joint Undertaking under ***FCH-JU-2009-1 Grant Agreement Number 256837.***



***The project partners would like to thank the EU for establishing the fuel cells and hydrogen framework and for supporting this activity.***