European demonstration of hydrogen powered fuel cell materials handling vehicles – HyLIFT-DEMO (Grant agreement number 256862)

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Project and partnership description

HyLIFT
Clean Efficient Power For Materials Handling
www.hylift.eu

European demonstration of hydrogen powered fuel cell materials handling vehicles

01/2011 – 12/2013 (36 months) ➔ 95% of project duration passed

➔6 month extension under preparation

Total budget € 7.3 Mio.

FCH JU contrib. € 2.9 Mio.

Main objectives

- Demonstration of > 30 hydrogen powered fuel cell material handling vehicles
- Ensuring commercial market deployment from 2013 on

HyLIFT-DEMO partners

H2 Logic – Hydrogen Fuel Cell Motive Power Solutions
THE LINDE GROUP – Linde
SINTEF
TÜV SÜD Industrie Service – Choose certainty. Add value.
DTU
ludwig bölkow systemtechnik
European Commission
FAST – Federazione delle associazioni scientifiche e tecniche – fondata nel 1897
EHA – European Hydrogen Association

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Project achievements in relation to the AIP/MAIP (1)

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Project objective 1:

Ensure commercial market deployment no later than 2013

- AIP: “A strong effort […] is needed to accelerate commercialisation, …”
- Achievements:
  - First ‘real-world’ sales of fuel cell powered materials handling vehicles (end-users not project partners; financial support for FC system supplier)
  - Report on deployment support mechanisms published
- Remarks:
  - Commercial market deployment not to be achieved in project
  - Technology is far from being fully commercial
  - Deployment support mechanisms required beyond HyLIFT-DEMO (and HyLIFT-EUROPE) ➔ to be reflected in FCH JU 2.0 / Horizon 2020

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Project achievements in relation to the AIP/MAIP (2)

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Project objective 2:

Secure RCS for enabling commercialisation

- AIP: “The projects also need to cover the development of certification procedures in conjunction with relevant agencies; Identification of potential RCS needs.”
- Achievements:
  - For all demo sites required permissions for vehicles and HRSs achieved
  - Gaps analysis on RCS for materials handling vehicles and HRSs published
- Remarks:
  - In principle, sufficient RCS in place for FC systems, vehicles and HRSs
  - Standardisation required to reduce efforts for certification procedures

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Project achievements in relation to the AIP/MAIP (3)

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Project objective 3:

Plan and secure initiation of R&D of 4th generation commercial products

- AIP: “Projects […] shall be based on sufficient maturity levels of fuel cell systems.”
- Achievements:
  Based on experiences from demos childhood diseases could be eliminated
  ➔ improvements to be integrated in next generation FC systems
- Remarks:
  - Remaining components still failing are mainly high pressure hydrogen components like tank valves, regulators and pressure sensors
  - For the tow tractor additional power and driving range needed. A specific task needed to increase both the hydrogen storage capacity in the tow tractor and the average power output of the fuel cell system

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Project achievements in relation to the AIP/MAIP (4)

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Project objective 4:

Conduct accelerated laboratory durability tests

- AIP: “Prove durability of the fuel cell system, …”
- Achievements:
  Vibration testing at JRC resulted in very valuable insights with regard to vulnerable components and installations and required improvements
- Remarks:
  - Shock and climate testing cancelled
  - Accelerated laboratory tests are somewhat delayed
    ➔ project extension enables to achieve 4,000 h of durability testing

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Project achievements in relation to the AIP/MAIP (5)

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Project objective 5:

Demonstration of hydrogen refuelling infrastructure at end-user sites

- AIP: “Prove […] functionality of hydrogen refuelling infrastructure …”
- Achievements:
  - Hydrogen refuelling infrastructure demonstrated according to specific requirements at each demo site
  - >2,000 refuelling procedures at single hydrogen refuelling station
- Remarks:
  Demonstration will proceed as long as it is required by the vehicle demonstrations

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Project achievements in relation to the AIP/MAIP (6)

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Project objective 6:

Demonstration of at least 30 materials handling vehicles

- AIP: “Demonstration shall comprise at least 10 vehicles at a single end-user site.”
- Achievements: 13 vehicles built; 11 in trial / demo operation
  - 2 DanTruck trial forklifts — start APR 2011 (finished)
  - 1 STILL trial forklift — start FEB 2012
  - 1 MULAG trial tow tractor — start MAY 2012
  - 2 STILL forklifts at Colruyt / BE — start AUG 2012
  - 4 STILL forklifts at STARK / DK — start OCT 2012
  - 1 STILL forklift at STILL Frankfurt / D — start NOV 2012
  - 2 STILL forklifts at egetæpper / DK — start JUN 2013

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Project achievements in relation to the AIP/MAIP (7)

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Project objective 7:

Validate value proposition & reaching of commercial and environmental targets

- AIP: “The projects should be conceived envisaging a continuation of efforts in high volume deployment projects and following market introduction”
- Achievements:
  - In order to validate value proposition a Monitoring and Assessment Framework (MAF) is applied to the vehicles and HRSs in the demo
  - Data acquisition is ongoing and first MAF results are available
- Remarks:
  The validation regarding reaching of performance targets on durability, efficiency and costs to be performed at the end of the project

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Lessons learned

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- Required supply chains able to provide significant numbers at competitive prices are far from being fully established
- Customers of materials handling vehicles are operating in a fully commercial and industrial area where Total Cost of Ownership (TCO) is main criteria for purchase decision
- Test trials for potential customers are inevitable and therefore easy approaches need to be developed to enable these test trials at potential customer sites
- The hydrogen price delivered to the demo sites is of high relevance as this is one of only a few variables to enable cost reductions for the overall package
- Deployment support mechanisms are required beyond HyLIFT-DEMO and the upcoming large scale demos and have to be reflected in the FCH JU 2.0 in the context of Horizon 2020

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Status of FC materials handling vehicles in Europe

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- HyLIFT-DEMO is one of the leading projects in Europe
- 11 vehicles in demonstration (10 forklifts, 1 airport tow tractor)
- Tests, trials and demo operations helped to overcome childhood diseases
- Equal TCO difficult to achieve (better performance of conventional vehicles compared to NA, cheap hydrogen sources rare)
- Batch production of fuel cell systems in place
- Small batch sizes disable significant cost reductions in supply chain
- Several vehicles clocked >1,500h of operation at real end-user sites
- >2,000 refuelling procedures at corresponding hydrogen refuelling station
- Further large scale demos already started or under preparation

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Self assessment summary

- Project is not a big success, but a success!
- It is the largest known project on FC materials handling vehicles in Europe
- Project extension is required to perform all tasks and to collect sufficient demo operation experience
- It provides a very good basis for the follow-up project HyLIFT-EUROPE
- Technology is far from being fully commercial
- Deployment support mechanisms are required beyond ongoing demos and have to be reflected in the FCH JU 2.0
- In order to catch up with North America tremendous efforts are required

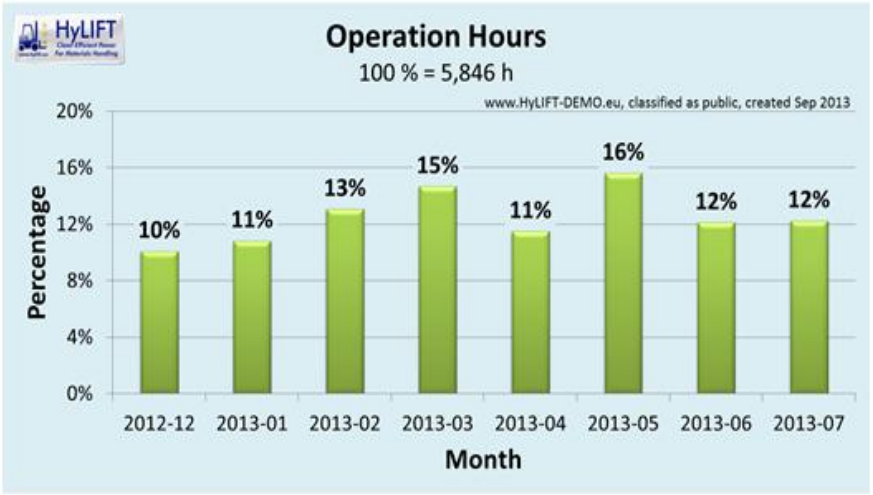
Source: H2 Logic A/S

Source: STILL GmbH

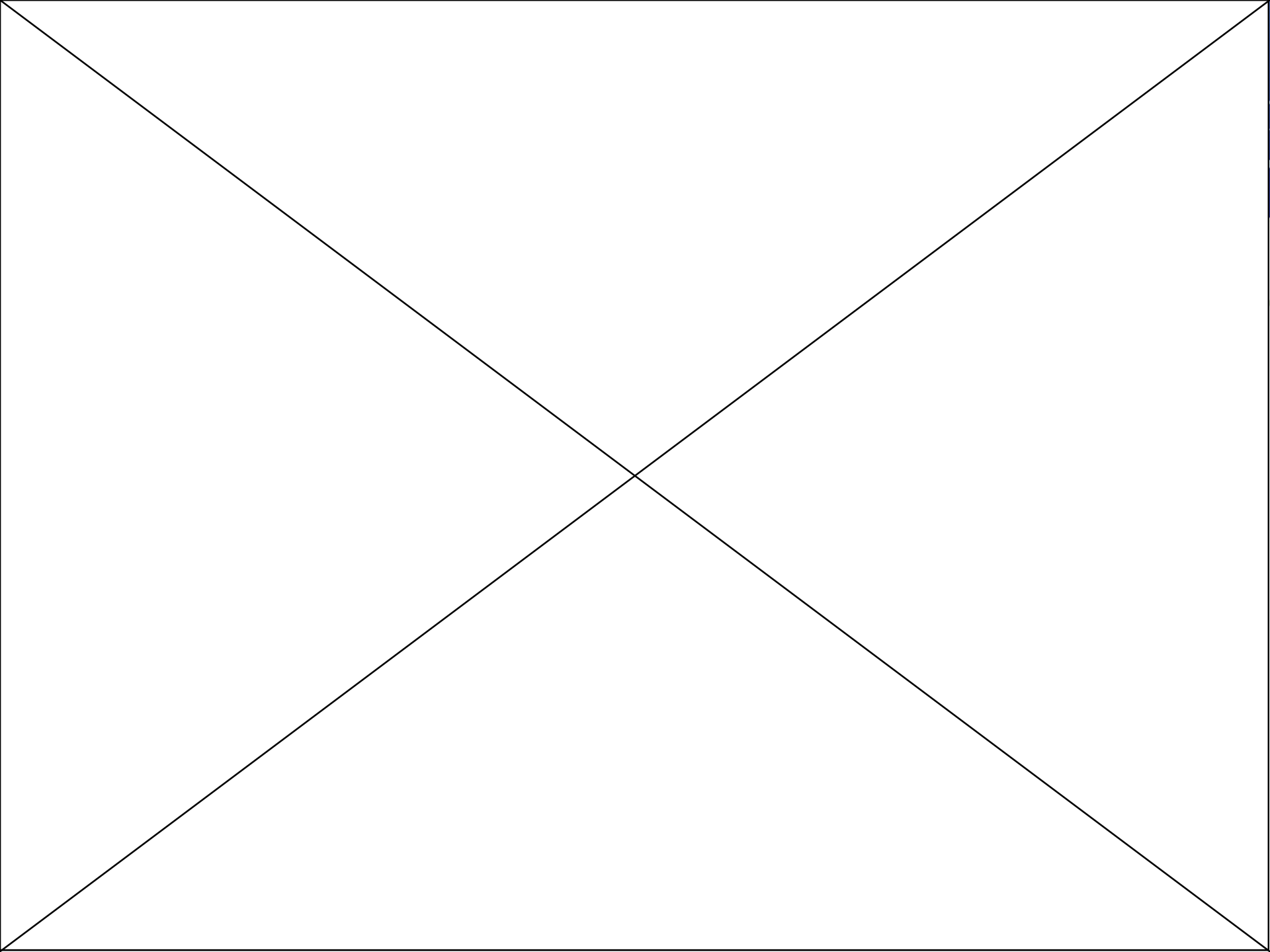
Source: MULAG GmbH

Source: H2 Logic A/S

Usage of FCEVs



Within the first 8 months, the FLTs were operated for 5,846 hours in total. This amounts to more than 1,000 workshifts.



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New Energy World JU
fuel cells & hydrogen for sustainability

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