

# HAWL

HYDROGEN & WAREHOUSE LOGISTICS

**Grant Agreement N° 325381**

**Air Liquide Advanced Business**

**[hawl-project.eu](http://hawl-project.eu)**

# PROJECT OVERVIEW

- **Objective** : deploy 200 FC powered forklifts in multiple warehouses to demonstrate the productivity given by the technology
- Call topic : SP1-JTI-FCH.2012.4.1
- 01/09/2013 - 31/08/2017\* → 4 years → 50% project duration
- Budget: 8.6 M€ - FCHJU funding : 4.2 M€

**FM** LOGISTIC


**TOYOTA**

MATERIAL HANDLING





\*if ongoing amendment is validated

# PROJECT TARGETS AND ACHIEVEMENTS

	<b>Programme objective</b>	<b>Project objective</b>	<b>Achievements to-date</b>
Total cost of FC system (at early volume production) <b>for FC &gt; 3kW</b>	< 50 units / < 3,500 €/kW	< 3,000 €/kW	
FC System lifetime (with service/stack refurbishment)	Not defined	> 7,500 hours	Not demonstrated in the project yet

# PROJECT TARGETS AND ACHIEVEMENTS

	<b>Programme objective</b>	<b>Project objective</b>	<b>Achievements to-date</b>
FC system efficiency (%)	>40	>45	FC Class 2 (reach trucks) :  FC Class 3 (for Pallet trucks) : <u>40%</u>
Refuelling time	3 min	3 min	

# ACHIEVEMENT - Site identification

A first demonstration took place in Tomaszow, Poland

⇒ Performance analysis performed onsite → Decision from the consortium to **switch to a more relevant site** to demonstrate the interest of the solution

⇒ Another demonstration followed in France, at **Neuville-aux-Bois**



# ACHIEVEMENTS - Site identification

- Decision to start the first deployment at Neuville aux Bois, France
  - Operational area > 80 000 m2
  - Products : Food (chocolate & coffee)
  - Storage in racks
  - Brownfield site
  - Fleet size : 84 Forklifts



# EXPLANATION - Forklifts onsite

2 main categories of forklifts to be converted to the fuel cell solution at Neuville-aux-Bois

- **Stand-on lift pallet trucks**

Voltage : **24 V**

Main usage : Load / unload pallets of goods from trailers



- **Reachtrucks**

Voltage : **48 V**

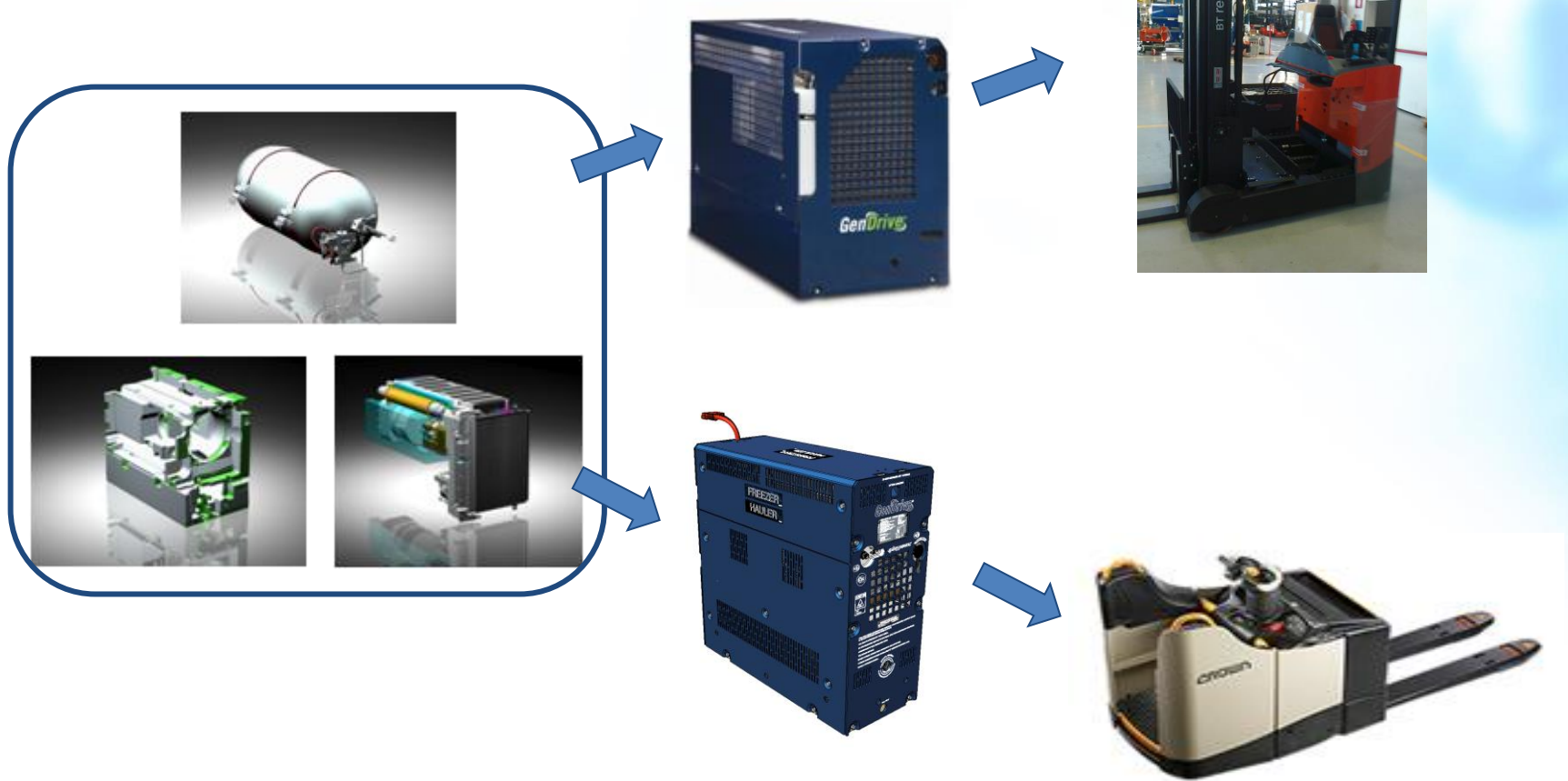
Main usage : Store the pallets on racks (12 meters high)



During the data logging campaign on two existing trucks, the objectives were to assess forklift and battery fleet usage, constraints related to forklift operation and targets for fuel cells powered forklift

# EXPLANATION : Fuel Cell integration

Integration of a fuel cell in the trucks :





# ACHIEVEMENTS - Fuel Cells and forklifts

- **6** types of fuel cells developed by Hypulsion for the European market
  - **4** types of forklifts (from Toyota and Crown) qualified to be used with fuel cells
- ➔ **10** forklifts delivered onsite for the test phase and started up in February 2015



# ACHIEVEMENTS - HRS

- Permitting obtained by FM Logistic at Site 1
- HRS commissioned and installed by Air Liquide (February 2015)



# EXPLANATION - The filling process



# ACHIEVEMENTS - Test phase

## Ongoing Test phase (8 months to date):

- > 3000 fillings
- > 1400 kg H<sub>2</sub> filled
- > 14 000 working hours
- Filling time < 180 s



# MAJOR FINDINGS AND PERSPECTIVES



## Stand-on lift pallet trucks :

The results obtained for this type of FC forklifts should be comparable to the ones with batteries in terms of performances and runtimes with the ongoing upgrades.



## Reachtrucks :

The FC forklifts meet the customer load requirements. Due to heavy load cycles, run time of the fuel cell forklift is not comparable to the one of forklift with new batteries for this specific site. This is offset by lower fueling time compared to battery charging time.

The test phase with 10 forklifts is not fully representative. Further demonstration and product improvements are required.

# MAJOR FINDINGS AND PERSPECTIVES

- **Strong improvement of the working conditions :**
  - Fuel cell solution clearly preferred by the workers  
→ better ergonomics
  - Problem of the risk of accidents due to the battery swap solved
- Valuable **return of experience** helping to identify areas of improvement such as :
  - Fuel Cell efficiency increase (for the autonomy)
  - Reliability for the stand-on Fuel Cell trucks
  - Filling time reduction
- Interest of the solution and cost evaluation to be further assessed for a larger scale deployment and in other environments / industries.



# NEXT STEPS

## Decision milestone :

Additional deployments at site 1 in case of productivity and economic business case demonstration

If the first demonstration is successful :

- Phase Test & deployment at site 2
- Phase Test & deployment at site 3

# SYNERGIES WITH OTHER PROJECTS

- Other project related to H2 fuel cell forklifts :



Ongoing demonstration at Prelocentre, close to Orléans, France

⇒ 35 forklifts running - greenfield site

- Partner in common : Air Liquide
- Common fuel cell provider : HyPulsion
- Return on experience shared between both projects
- Objective to provide a common guideline regarding RCS activities



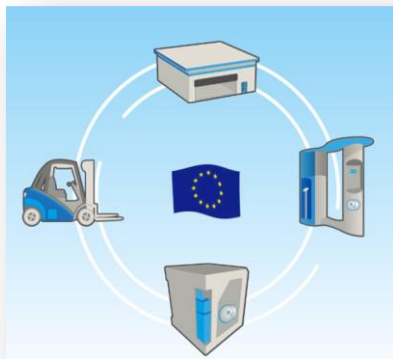
# HORIZONTAL ACTIVITIES

- A Reference Code for Hydrogen Refueling Station in warehouse has been validated by the French CSPRT in October 2015 and should be published in the Official Journal in the coming days/weeks
  - ➔ This will facilitate and accelerate local authorizations for permitting for the future deployments in France
  - ➔ Similar efforts should follow in other European areas
- Training activities have been organised at FM Logistic premises



# DISSEMINATION ACTIVITIES

- Project website
- Video to promote the H2 solution published in the website
- Official opening event in March 2015 at FM Logistic premises
- Press releases both in the Newspapers and in the company websites
- Toyota forklifts have been presented during the Ten-T event, Riga, June 2015
- Conferences/workshops will be organised



# EXPLOITATION PLAN / EXPECTED IMPACT

- The HAWL Project demonstrates the H2 solution at a logistic warehouse. So far, it has demonstrated that the hydrogen / fuel cell solution is technologically ready.
  - ➔ However performance / costs compared to batteries are application / site dependant
- How will the project's results be exploited? When? By whom?
  - ➔ Project results will be exploited directly by consortium member: AL for H2 infrastructure, Hypulsion/Plug for Fuel Cells, Crown and Toyota for vehicles, FM Logistic for further potential deployments

# Thank you !



**TOYOTA**

MATERIAL HANDLING

## *Q&A session*

