

# International Perspectives for Fuel Cell Vehicles and Insights from the HyLIFT-EUROPE Project

CIN Symposium

Economic and Environmental Benefits with Hydrogen and Fuel Cells in  
Materials Handling and Intralogistics

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# Insights from the HyLIFT-EUROPE project



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The aim of HyLIFT-EUROPE is

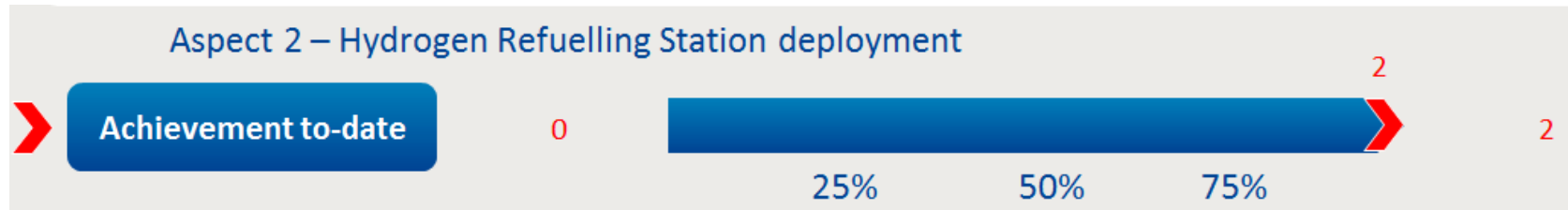
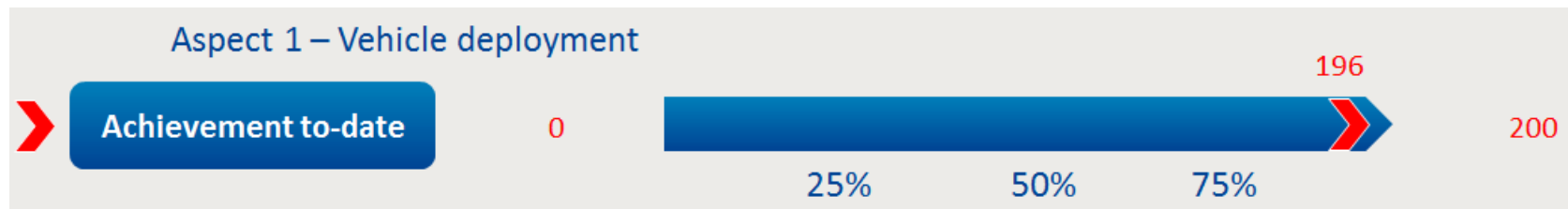
-  to demonstrate more than 200 fuel cell materials handling vehicles and associated refuelling infrastructure at two sites
-  to make it the largest European deployment of hydrogen powered fuel cell materials handling vehicles so far and to reach fleet sizes coming close to the ones in the USA
-  to continue the efforts of previous FCH JU funded projects such as HyLIFT-DEMO & HAWL
-  to demonstrate fuel cell systems in materials handling vehicles from the project partner STILL and from non-participating OEMs
-  to demonstrate hydrogen refuelling equipment for materials handling vehicle operations from the project partner Air Liquide

# Insights from the HyLIFT-EUROPE project



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## Achievements



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## Project progress / actions

### Vehicles at Prelocentre



Source: Air Liquide / H.Lucas S.Guillemain



Source: Air Liquide / H.Lucas S.Guillemain

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## Project progress / actions

### Vehicles for second HyLIFT-EUROPE fuel cell vehicle user



Source: STILL GmbH



Source: STILL GmbH



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## Project progress / actions

### Hydrogen refuelling – fuel supply and outdoor compressor station



Source: Ludwig-Bölkow-Systemtechnik GmbH



Source: Ludwig-Bölkow-Systemtechnik GmbH

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## Project progress / actions

### Hydrogen refuelling – indoor dispenser



Source: Air Liquide / H.Lucas\_S.Guillemain






Source: Ludwig-Bölkow-Systemtechnik GmbH

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## Risks and challenges

-  There is still only one supplier of FC systems for materials handling vehicles who has supplied more than 500 units
  - ➔ STILL deploys FC systems from this supplier; activities with airport tow tractors have been terminated
-  Trials and deployments of FC materials handling vehicles at airports are even more challenging due to their specific regulations and safety landscape
  - ➔ The focus of the project has been directed towards warehouse applications
-  The project faced serious problems to identify sufficient and appropriate customers for the hydrogen powered fuel cell forklifts and warehouse trucks
  - ➔ By trying hard and flexibility from all parties involved the project finally managed to find customers for about 200 vehicles
  - ➔ Recommendation: The customers / vehicle users should be already onboard at the beginning of the project. Therefore, the financial support mechanisms need to be simplified or other instruments need to be found

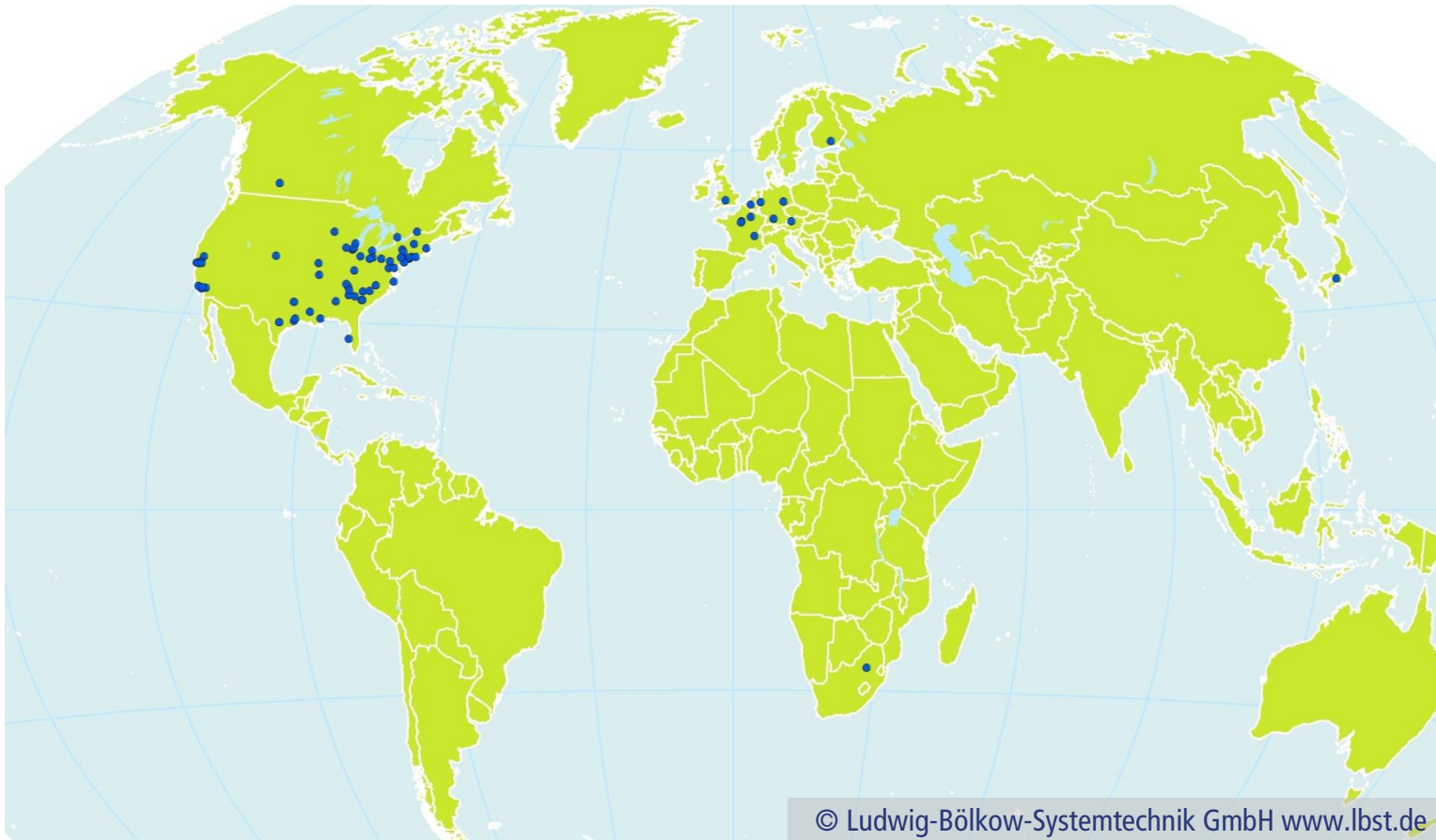


# Operation sites of FC MHVs worldwide



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In total about 21,000 FC MHVs in operation (status NOV 2018)  
First fleets are already on their way in the 2<sup>nd</sup> generation

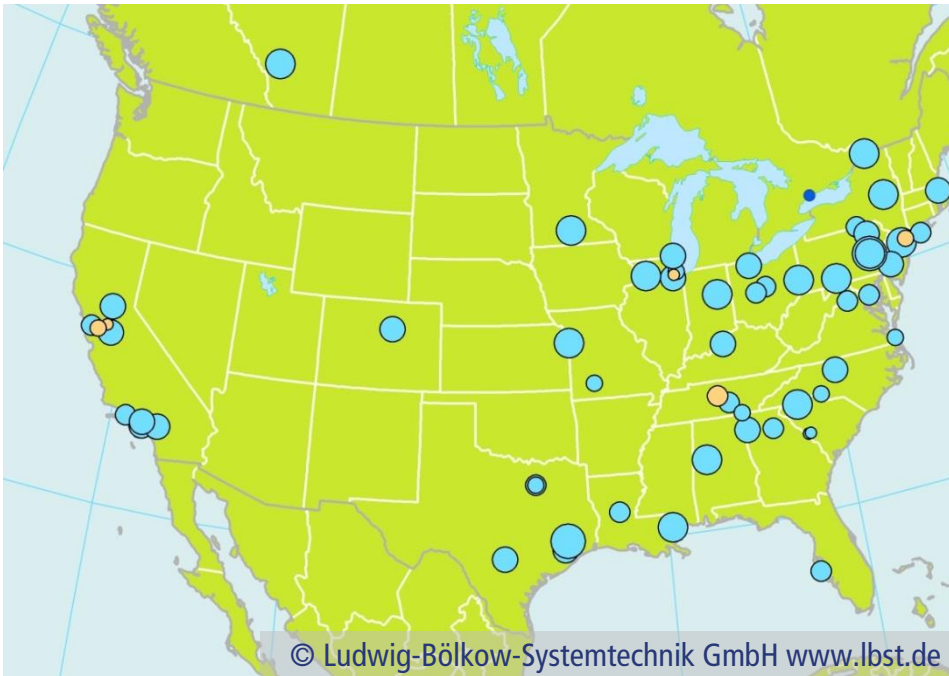


# Operation sites of FC MHVs in North America



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In total about 20,500 FC MHVs in operation (status NOV 2018)  
Average fleet size → ~130 vehicles






# FC MHVs: Perspectives for North America




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## Status Quo

-  ~ 20,500 vehicles in operation
-  In principal only one single supplier (Plug Power) dominating the market
-  Turn-key solution comprising fuel cell system, hydrogen refuelling equipment, hydrogen supply and overall service package already available (Plug Power)

## Current Developments

-  Financial support via tax credits for investments in fuel cell systems reinstated in FEB 2018:  
30%\* through 2019  
26%\* through 2020  
22%\* through 2022  
\* of invest
-  With Hyster-Yale / Nuvera a second supplier has reached the 3 digit figures (~320 units shipped)

## Perspectives

-  Fleet implementations without financial support are already taking place (Canada)
-  Business is focused on large fleets of global players with 24/7 operations & multiple sites
-  Extension of business towards smaller fleets (<50 vehicles not visible yet)

As financial support via tax credits has been reinstated further steady growth expected  
Decrease in tax credit percentage supports preparation of technology for "real" market

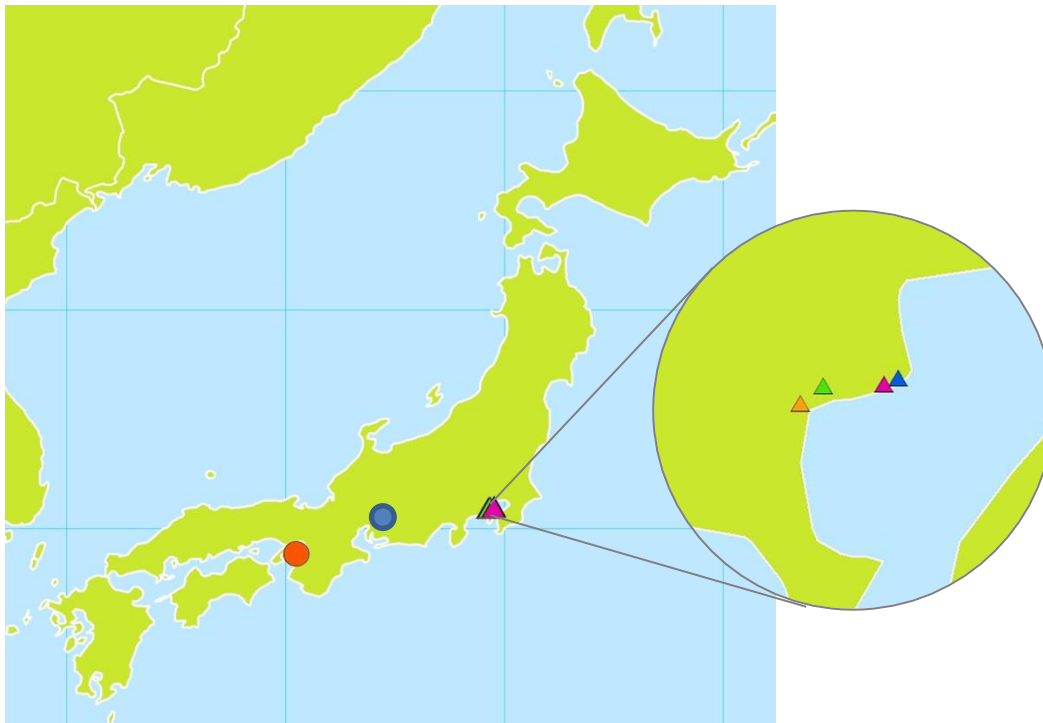
# Operation sites of FC MHVs in Japan



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In total 36 FC MHVs in operation (status NOV 2018):

- Kansai Airport (2 FC MHVs)
- Yokohama / Kawasaki project (4 sites with 3 FC MHVs each)
- Toyota Motomachi plant (22 FC MHVs)



-  Kansai Airport (2)
-  Central Wholesale Market (3)
-  Nakamura Logistics Inc. (3)
-  Kirin Brewery Co. Ltd. (3)
-  Nichirei Logistics Group Inc. (3)
-  Toyota Motomachi Plant (22)

# FC MHVs: Perspectives for Japan



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## Status Quo

-  Field test / demo project with 2 FC forklifts ongoing at Kansai Airport since FEB 2015
-  Yokohama / Kawasaki demo project deploying 12 FC forklifts at 4 sites:
  - 2 since SEP 2016
  - 10 since APR 2017
-  Toyota Motomachi Plant:
  - 2 since JAN 2017
  - 22 since MAR 2018

## Current developments

-  Toyota Industries Corporation (TICO) uses FCs from Toyota Motor Corporation while Toyota Material Handling Europe (TMHE) uses FCs from Plug Power
-  Toyota is already expanding its product portfolio from forklifts to tow tractors

## Perspectives

-  Extension of FC fleet at Kansai Airport by 20-30 vehicles p.a. up to 100 vehicles; further airports might follow; some hundred vehicles are expected for 2020
-  Toyota intends to deploy 170-180 FC forklifts at Motomachi by 2020 and to promote FC forklifts also at other plants

When will Japan catch up ?



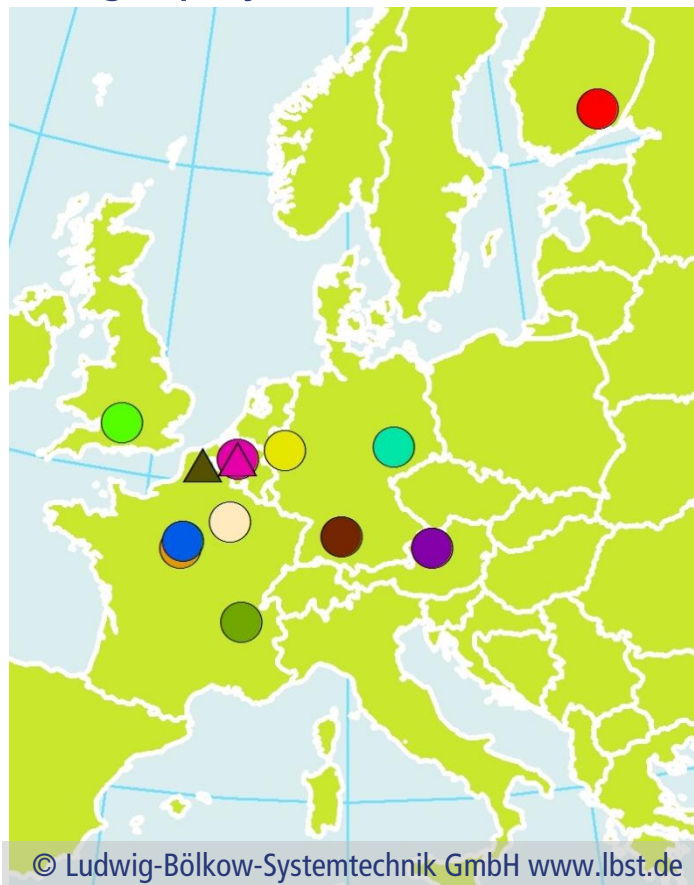
# Operation sites of FC MHVs in Europe



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In total ~ 300 FC MHVs in operation (status NOV 2018):

2 larger projects in the roll-out (Colruyt 75, BMW 70 FC vehicles)






- Colruyt demo fleet (11)
- E-Log-BioFleet (10)
- FM Logistics (46)
- H2IntraDrive / BMW (11 + 70 in the roll-out)
- HONDA (2)
- IKEA France (20)
- Mercedes Benz (2)
- Prelocentre (59)
- Seifert Logistics (1)
- Woikoski (1)
- large retailer in France (137)
- Colruyt (75 in the roll-out)

# FC MHVs: Perspectives for Europe



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## Status Quo





-  ~ 300 FC MHVs in operation
-  Some demo fleets will be extended e.g.
  - Colruyt
  - BMW Leipzig
-  Business case still hardly to achieve:
  - H<sub>2</sub>-costs
  - H<sub>2</sub>-infrastructure costs
  - efforts permission etc.
  - fleet size & op. scheme

→ use cases ?

## Current developments

-  Moderate growth
-  Financial support on European level not before 2020
  - requires engagement
  - focus national / regional programmes
-  Possibilities for networking are used e.g. Clean Intralogistics Net (CIN), Hydrogen Europe
-  Number of FC system suppliers still limited

## Perspectives




-  Stimulus has to come from MHV operators !
-  Not a fast selling-item !
-  Large development efforts & potential in FC trucks → joint infrastructure opens up synergies
-  real GHG-emission reductions to be achieved by replacing ICE-MHVs
  - 80V systems still under development

Successful roll-out also in Europe ?

# Summary and Outlook



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-  From an economic point of view, deployment does not make sense everywhere
  - Large fleets, multi-shift operation, shared use of infrastructure, etc.
-  Commercialization efforts need to be strengthened where they make sense.
  - Full-service packages with attractive TCO (including H<sub>2</sub> supply!) for customers
-  Financial support is still required.
  - Transition from demo projects to marketable products needs to be mastered
-  Appropriate Deployment Support Mechanisms still need to be developed.
  - Difficulty: strong lobby is missing
-  Networking of European actors is necessary and has to proceed.
  - E.g. Hydrogen Europe, Clean Intralogistics Net, ...
-  Focus on battery replacement has to be questioned.
  - Real GHG-emission reductions can only be achieved by replacement of ICEs
-  European supply chain has not yet proceeded as the North American.
  - Speedy and consequent action is urgently required



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