

Status of H2 Technologies for Material Handling and Industrial Application @ Fronius

Eco-Mobility 2014, Vienna, 20th and 21st October

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**WE HAVE THREE DIVISIONS
AND ONE PASSION:
SHIFTING THE LIMITS.**

Content

- / The Fronius Company
- / Fronius Hydrogen Technologies
- / Projects & Results
- / Summary

FRONIUS - WHAT WE DO

/ We create new technologies and solutions for monitoring and controlling energy by shifting the limits of what is possible.



BATTERY CHARGING SYSTEMS

.....
Economical, flexible, unique



SOLAR ELEKTRONIKS

.....
We must revolutionise the energy supply
of our planet



WELDING TECHNOLOGY

.....
We master the arc like no other

Fronius H2 Technologies



Energycell 10.0E HPEM Electrolyser

8kW/400VAC, 1,2Nm³/h
163bar, 80°C

L/W/H 1000/380/990 mm
ISO 22734-1:2008, EMC

Pilot production /
demonstration

HyLOG Fleet 26F PEM FC – Battery Hybrid

2.6kW/11kWp, 24VDC
H2 tank: 23L, 200bar / 6kWh(el)
350bar / 9,6kWh(el)

Temp. range (target): -10 to +60°C
L/W/H 786/310/630 mm
EN62282-5-1:2007, PED, EMC

Pilot production /
demonstration

HyLOG Fleet 100F PEM FC – Battery Hybrid

10kW/30kWp, 80VDC
H2 tank: 85L, 350bar / 35kWh(el)

Temp. range: -20 to +50°C
L/W/H 1028/855/771 mm
EN62282-4-101:2014, PED, EMC

Product development

Fronius H2 Technologies



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Status E-LOG-Biofleet @ DB Schenker

Duration: 06/2010 – 05/2014

/ Application characteristics

/ Location: DB Schenker cross-docking terminal Hörsching (AT)

/ Truck fleet: 10 (+2) Linde T20-24 AP/SP stand-on pallet trucks

/ Hours of operation: 24/5

/ Ambient temperature: 0 to +25°C

/ Indoor H₂ refuelling and on-site generation
from biogas: 0.45 kgH₂/h @ 200bar



/ FC fleet statistics (Sept. 2014)

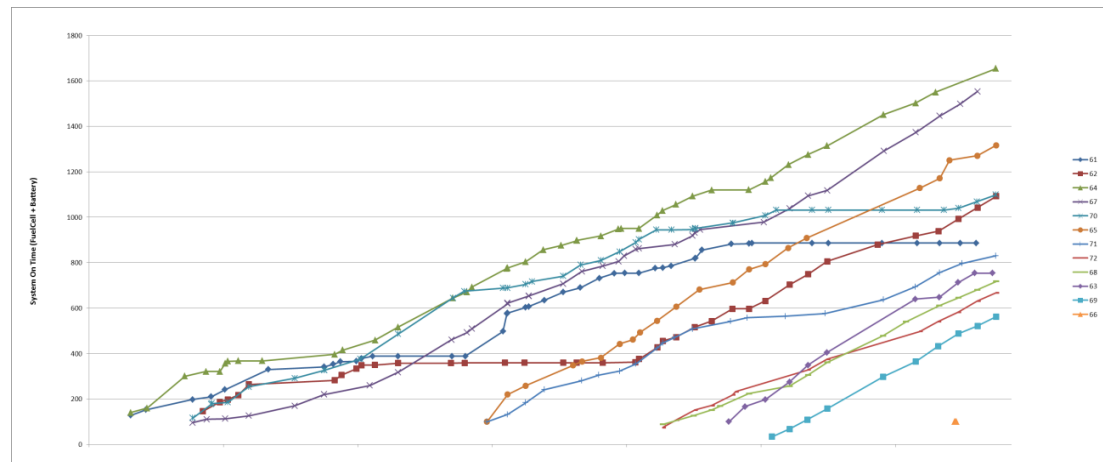
/ Truck on-time: 11.235h

/ FC on-time: 6.021h

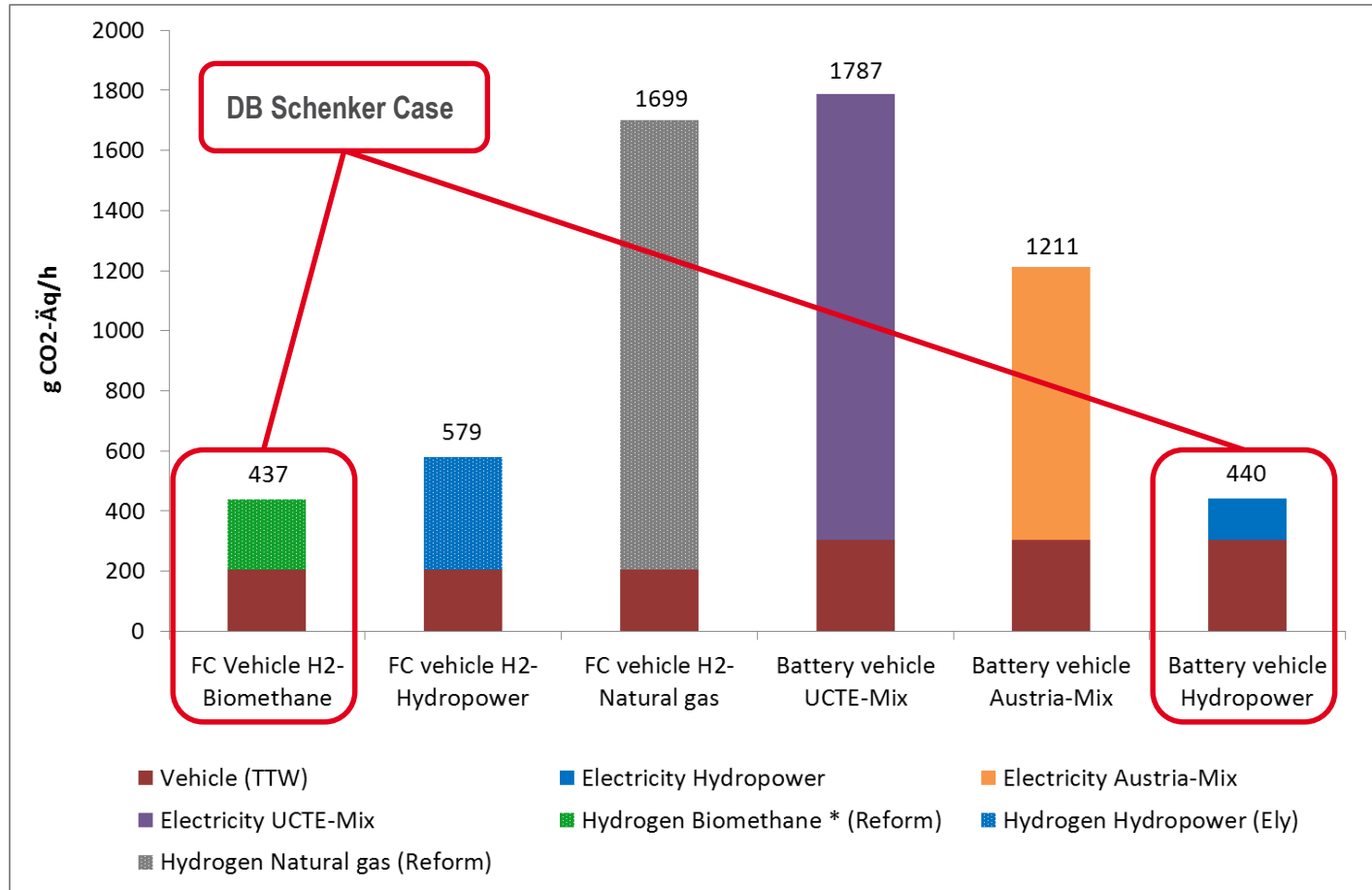
/ FC power demand: <750W

/ FC system drive cycle efficiency: 53%

/ Number of refuellings: ~1.600



E-LOG-Biofleet WTW-GREENHOUSE GAS EMISSIONS

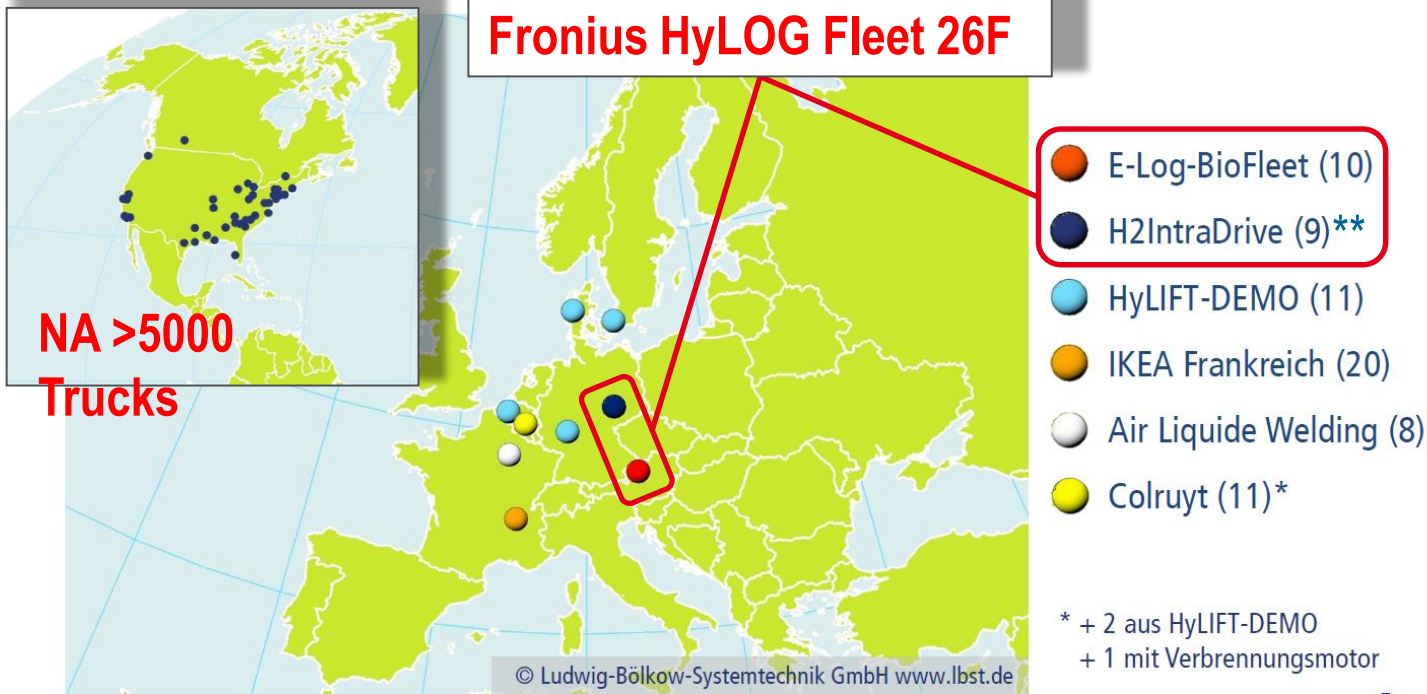


Einsatzorte der BZ-Flurförderzeuge in Europa



ludwig bolkow
systemtechnik

Insgesamt ca. 70 im Flotteneinsatz (Stand 2014):



Apr-14

© Ludwig-Bolkow-Systemtechnik GmbH

LBST.de

E-LOG-Biofleet Benefits & Lessons Learned

/ Competitive advantage & primary customer experience

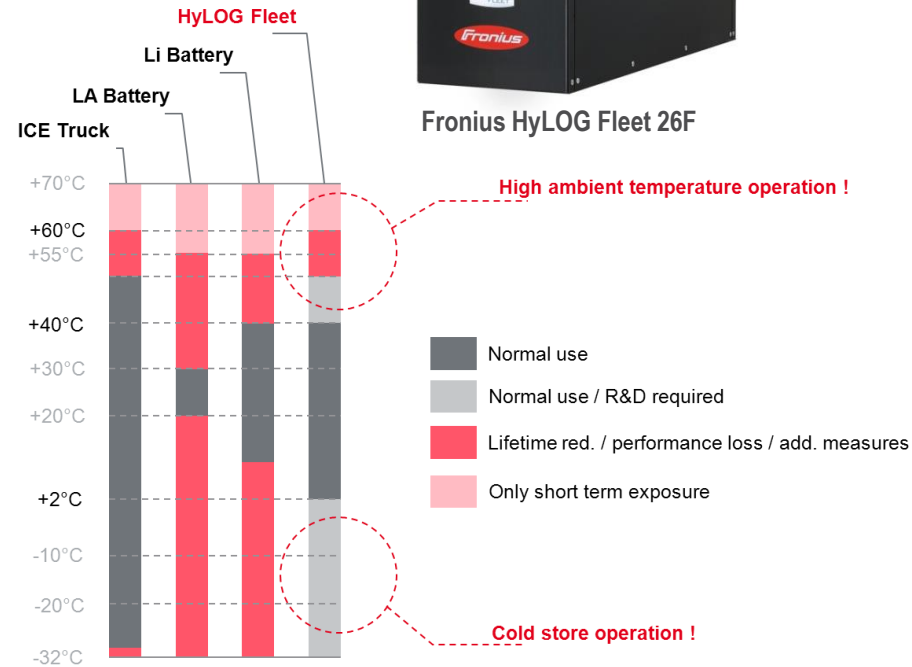
- / No battery swap
- / Fast H2 refuelling increases flexibility
- / Regular and reliable 24/5 operation of FC trucks and H2 filling station confirm maturity
- / High employee acceptance & confidence

/ Lessons learned

- / Modularity, scalability and reliability are key for both FC systems & refuelling infrastructure
- / Driving range improvements support economics most effective
- / High performance & zero emission requirements, high/low ambient temp., etc. are early market entry scenarios
- / **Customer needs a solution!**



Fronius HyLOG Fleet 26F



STable and low cost Manufactured bipolar plates for PEM Fuel Cells

STAMPPEM

/ Objectives

/ Develop durable coatings materials for metal based bipolar plates

/ mass producible for less than 2.5 €/kW

/ Lifetime target >10 000 hours

/ contact resistance (< 25 mOhm cm²) and corrosion resistance (< 10 μA/cm²)

/ Project duration: 07/2012 – 06/2015

/ Funding program: FCH-JU



ELAAN* PROJECT

Duration: 10/2013 – 09/2016



Municipal Vehicles

80V, 2 x 10kW / 30kWp

Environment: Outdoor /
public roads



Class 1 Forklift Trucks

80V, 1 x 10kW / 30kWp

Environment: Indoor / outdoor
plant grounds, public roads

Objectives:

/ 80V 10kW/30kWp FC-battery-hybrid system for industrial application

/ FC stack with low-cost metal BPP

/ 350bar H2 tank system

/ Modular Li ion battery system

/ Heavy duty environment: freezing / high temp. environm., road salt, jet-wash, etc.

/ Certification targets: road traffic admission, EU directives

*Elektrischer Antriebsstrang für Arbeits- und Nutzfahrzeuge (ELAAN)

World Implement & Tractor Market

Material Handling



By Courtesy of Linde MH GmbH

Municipal Services



By Courtesy of LADOG-Fahrzeugbau u. Vertriebs-GmbH

Construction



By Courtesy of Construction Machine Blog

**Global Market
~ 260 Billion €**

Agricultural

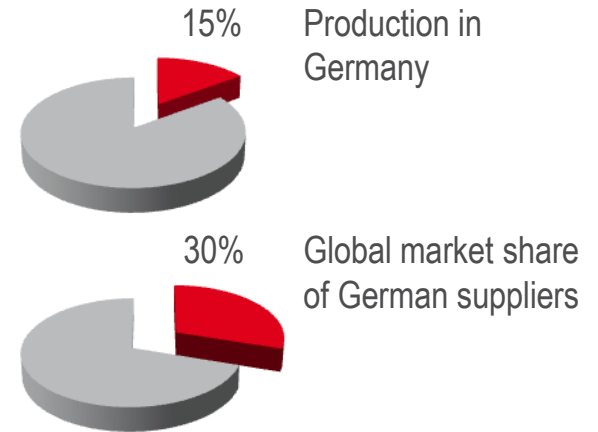


By Courtesy of Manitoba Association of Agricultural Societies

Forestry



By Courtesy of LBX Company LLC



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Wind2Hydrogen Research Project

Duration: 01/2014 – 12/2016

Hydrogen generation from renewables for storage and transport via natural gas grid

- ▶ Modular high-pressure PEM electrolyser system development
- ▶ 100kW Power-to-Gas pilot plant engineering, commissioning & operation
 - ▶ Identify technical and legal barriers for application
 - ▶ Live operation data collection and analysis
- ▶ Business model development
 - ▶ Wind-capacity dependant hydrogen generation & storage
 - ▶ Electricity grid balancing services (load dispatch, residual load & price based operation, etc.)
 - ▶ Compressed hydrogen taped in bottles or fed into the grid
 - ▶ Renewable hydrogen fuel generation for H2 mobility



→ This project is funded by the Climate & Energy Fund Austria within the „ENERGY MISSION AUSTRIA“ program

Summary & Outlook



/ **H2 & FC technology** have the potential not only to **green mobility** and transport but also to **improve performance and economics** of industrial applications

/ Large scale **field evaluation** of H2 & FC technologies is required to **confirm customer benefits** and **identify barriers**

/ **Customers require solutions** and request for improvements of **existing technology limitations** at a reasonable price

/ Battery Charging Systems / Welding Technology / Solar Electronics



SHIFTING THE LIMITS