

**fuel cell  
POWER**

**clean  
ENERGY**

**ZERO  
emission**

**HYDRAIL**

**June 9, 2008**

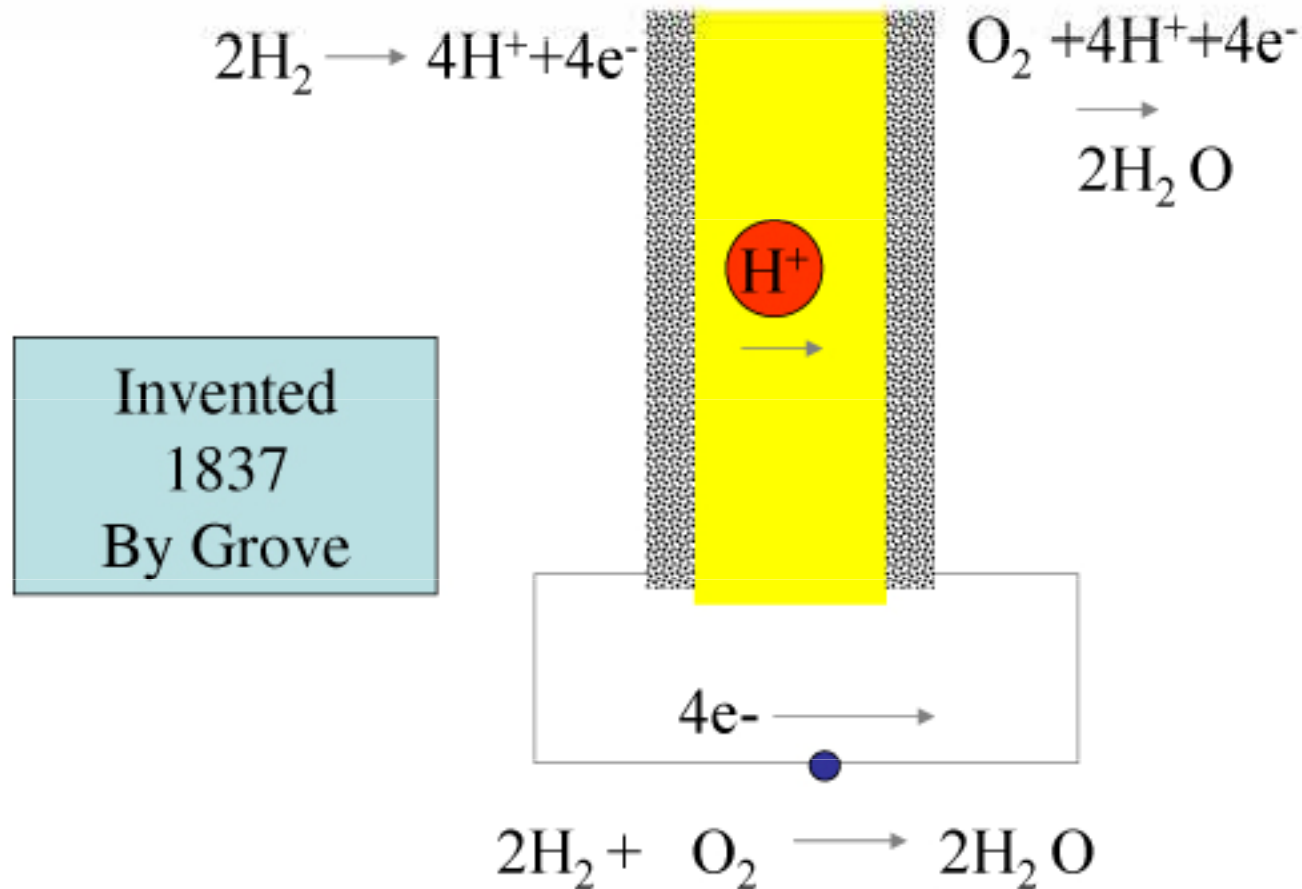
**Rail, a FC opportunity**

***Drs J.P. van der Meer***

**NedStack**



# Basics of the PEM fuel cell technology



# Fuel Cell “plusses”



- High efficiencies
- zero-emission
- High power density
- Recyclable also pt



## History & Status quo



- Continuation of Akzo Nobel started in '89
- From 1999 on as independent
- The largest European Fuel Cell maker
- Well known among the fuel cell industry
- Standardized manual Production
- First 120kW PPP- pilot is running 5385h
- Focus on cost reduction



- NedStack focus on early niche markets
  1. Stacks 2-10 kW
  2. Large stationary:
  3. Heavy duty transport

# 1. NedStack PEM Power Plant stack



- Bipolar plates produced in house, with proprietary developed materials, process and stack design.
- MEA's produced partly in house and partly purchased.
- Cell Voltage Monitoring optional

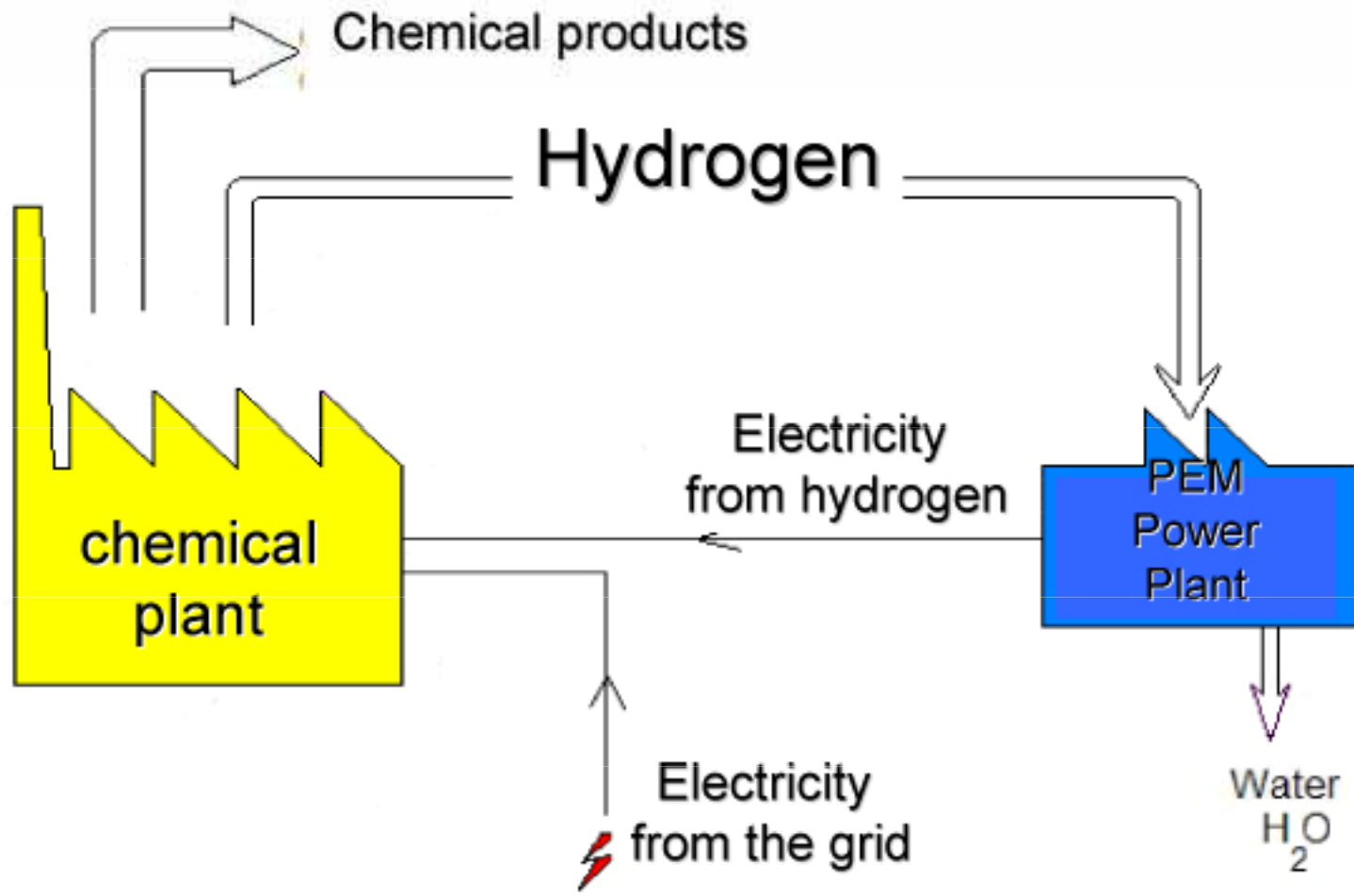


## 2. FC systems (5-10kW)



Most FC systems today are back-up and UPS systems

### 3. Large Stationary



# The pilot 50kW nom PEM FC Power plant >5385 hours running today at Akzo Nobel, Delfzijl



Hydrail June 9, 2008

Drs. J.P. van der Meer



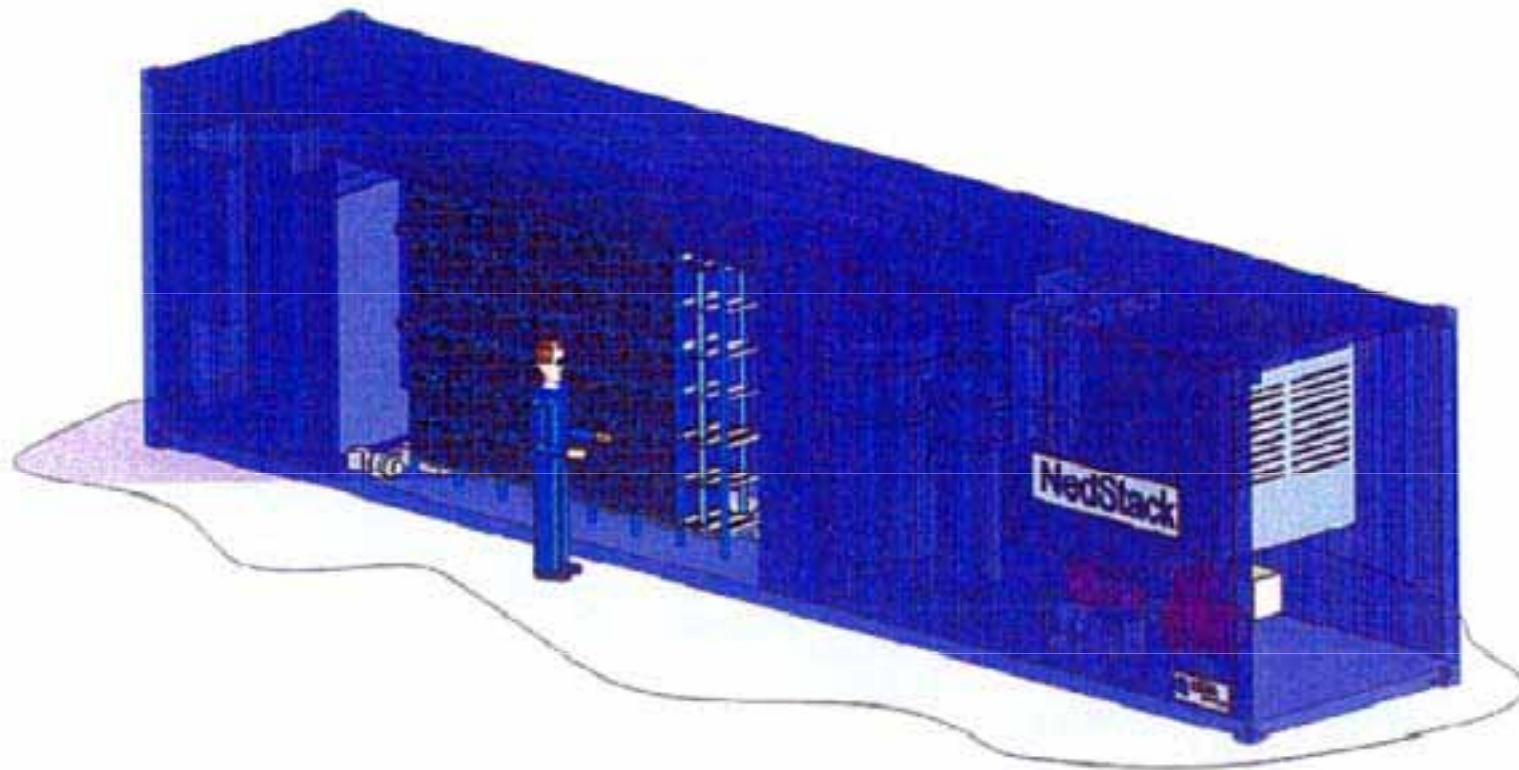


Euro Chlor 16 April 2008

Skid with PEM Power Plant Module

# 1 MW installation fits inside 40 ft. sea container

## Under engineering planned for 2009



# Safety



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# HyTruck Fuel Cell plug-in Hybrid Pilot

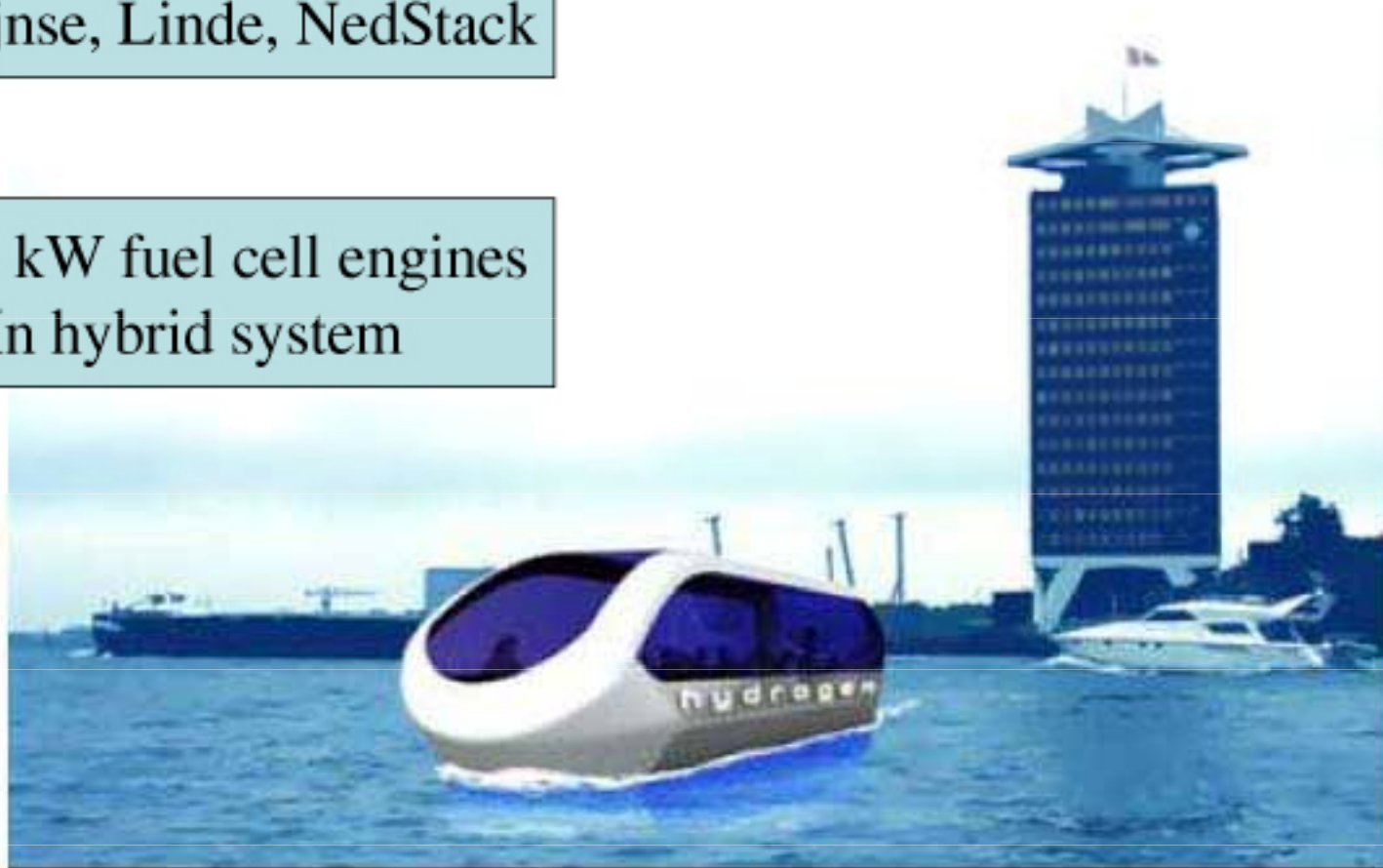


# Rondvaartboot Amsterdam under construction 2008



Partners: Lovers MSN  
Alewijnsse, Linde, NedStack

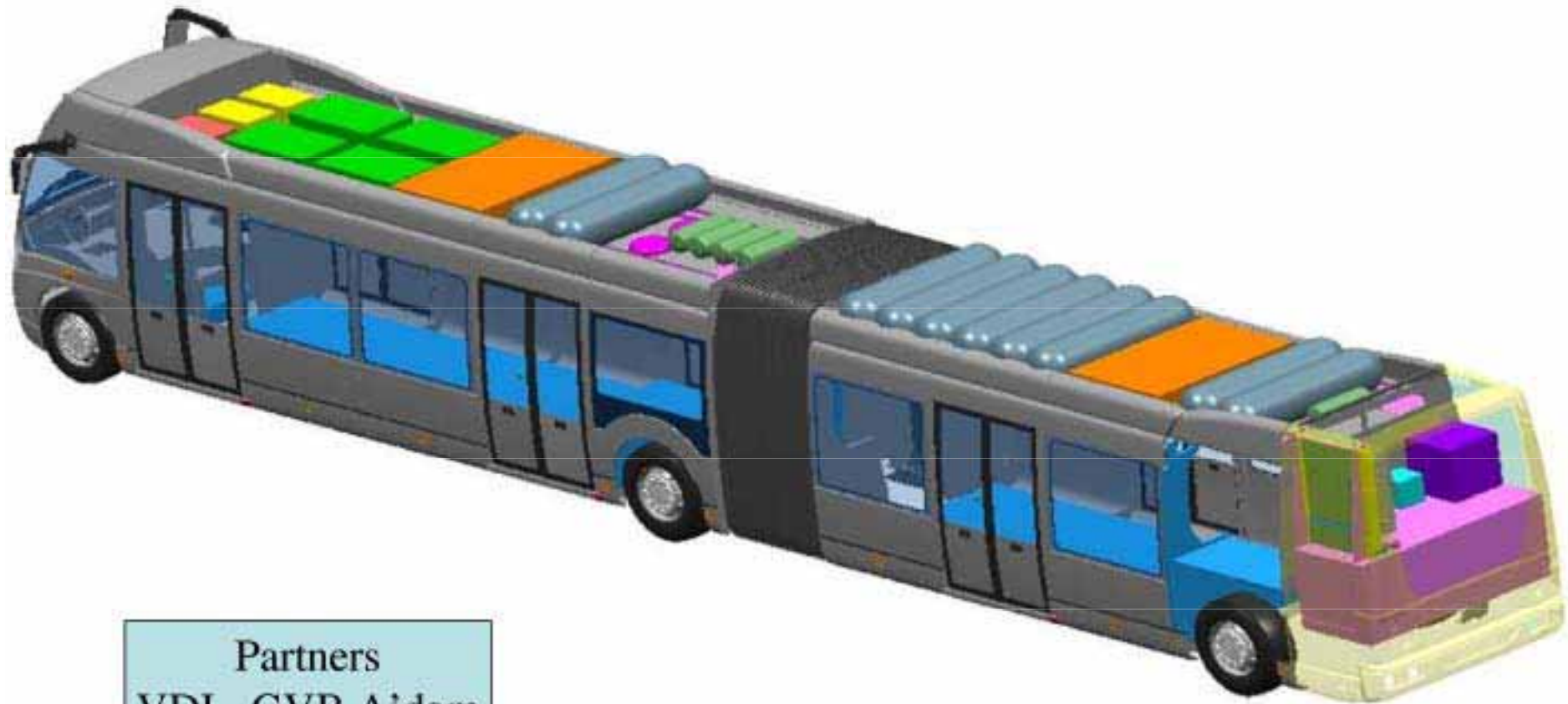
2\* 36 kW fuel cell engines  
In hybrid system



# Lightweight Fuel Cell Bus Project



# City bus project for 2009



Partners  
VDL, GVB A'dam  
NedStack

# Tram train, 500kW



Vossloh

# FC engines for Highly electrified railway grid ? 2 MW



Vossloh

# Shunting engines, mainly operated in city centres



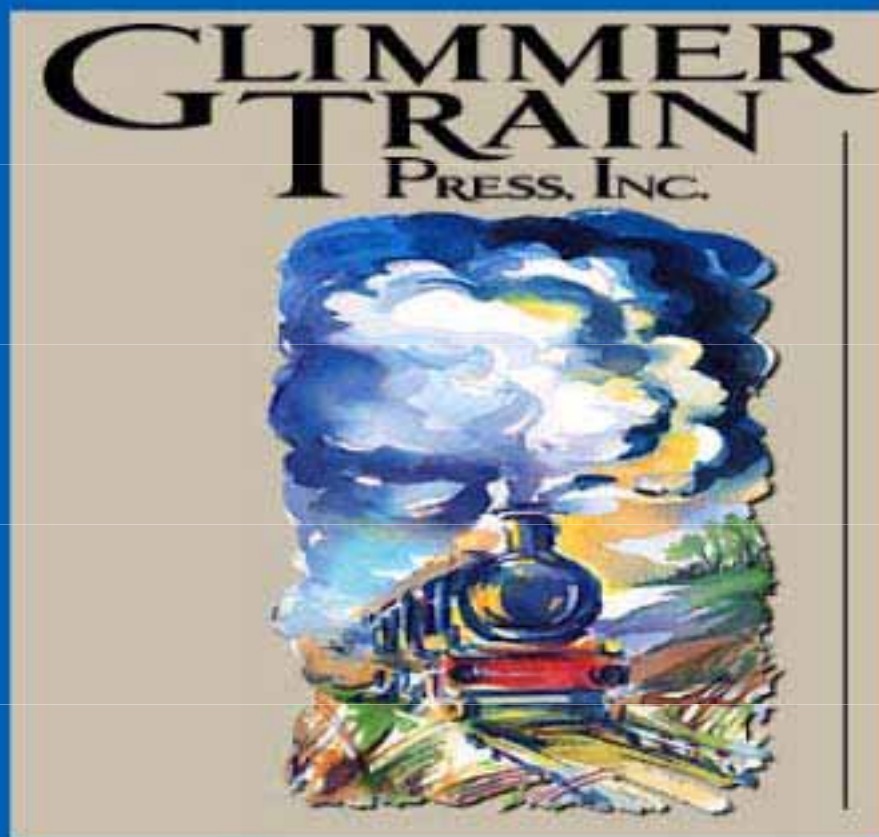
Vossloh

## Conclusions on PEM FC



- Clean
- High efficiency, energy saving!
- New ECO-regulations for harbors and cities will come up soon!
- Cost of ownership

**Innovation is power!**



**fuel cell  
POWER**

**em**

**WWW.  
NED**