

HYDROGENICS
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Panel 3 - ZBus Infrastructure
Renewable Electrolysis Fueling Infrastructure

Zero Emission Bus Technology Workshop

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Our Company

- Global leader in hydrogen fuel cell and on-site hydrogen generation systems
- Incorporated 1995: NASDAQ (HYGS) and TSX (HYG)
- Headquarters in Toronto, Canada
- Offices in United States (California), Germany, Belgium, China, Russia, India
- 150 Employees
- Over 1,800 projects deployed in >100 countries
- Extensive design and system integration experience



Electrolysis Products Portfolio

- HySTAT® Alkaline, modular from 13 over 1000 kgpd
- HyLYZER® PEM, 2 kgpd to MW range

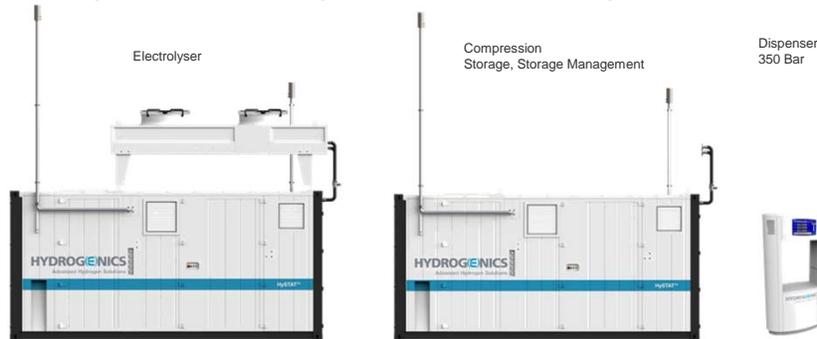


2 MW Alkaline Plant eOn, Falkenhagen
800 kgpd



1 MW PEM Platform Development
HQ, Canada, Up to 400 kgpd

Hydrogenics' Fueling Stations Offering

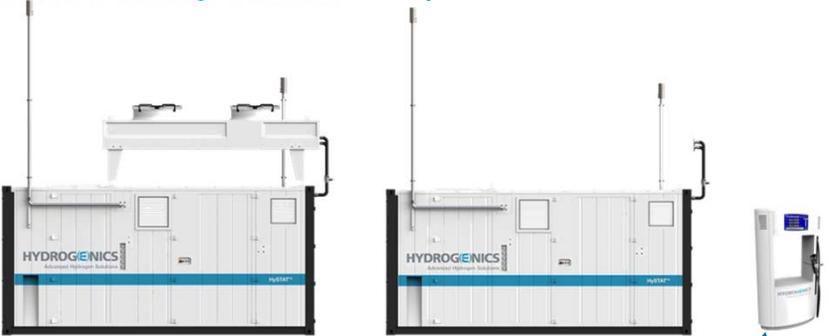


Hydrogenics makes it simple for you:

- Hydrogen production with the HySTAT™ Electrolyser
- Compressor, Storage and dispenser
- Designed, built and started-up by Hydrogenics
- All in turnkey outdoor housings

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350bar Fueling Station Setup





Module 1: Electrolyser
(21,32, 65, 97 or 130kg/day)



Module 2: Compression
(cooling), (storage) and
Storage management system



**350 bar
Dispenser**

- Hydrogen quality: **Fuel Cell Grade (99,998%)**
- Fill type: **According to SAEJ 2601 requirements**
- Consumption: **65 kWh/kg H2 produced**
- **Fully interconnected and centrally controlled**

5

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Hydrogenics and Fueling in Numbers

- Participated in a total of 45 fueling stations projects
- 1750 kgpd of hydrogen fuel installed in the last 5 years
- approximately 4 tons per day of H2 fuel since 1998



Worldwide Fueling Projects - Europe



Sydskraft,
Malmö, Sweden, 2003



CUTE Program,
Amsterdam, Netherlands, 2005



CUTE Program
Stockholm, Sweden, 2005



CUTE Program
Barcelona, Spain, 2005



Vattenfall, Hafen City
Hamburg, Germany (in construction)



Gaz de France
Dunquerque, France, 2008

Worldwide Fueling Projects – North America



DTE, Michigan
2004



Exhibition Place
Toronto, 2004



Toyota HQ
California, 2005



Chevron Tech. Venture
Oakland Station, 2006



Shell,
Santa Monica, CA, 2008



Cal State University,
Los Angeles, CA, (in construction)

Hydrogen Fueling Station – Oslo Norway



**CHIC Project - 2 x HySTAT-60 Electrolysers (260 kgpd)
With Air Liquide**

Shell Fueling Station – West LA – Santa Monica, USA



Shell – 65 kgpd on top of the canopy – 350 bar/5000 psi station

Hydrogen Fueling Station – Vattenfall (Hamburg)



350 bar bus fueling station with Linde for Vattenfall
260 kpgd of H₂ by 2x HySTAT-60 Electrolysers
Total of 780 kpgd by Electrolysis + delivered GH₂

Hydrogen Fueling Station – EnBW (Stuttgart)



EnBW, Stuttgart, Germany - 130 kpgd fueling station for fuel cell cars
HySTAT-60 Electrolyser with station integration by Linde/BOC

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Advantages of Electrolysis

- Requires only:
 - An electrolyzer
 - Water
 - Electricity
- On-site, On-demand H₂ generation
- No hydrogen transport risks
- High purity carbon free hydrogen (up to 99.999%)
- Independence and own control of energy supply
- Compact – small footprint
- Low maintenance
- Proven technology (Mature & Standard Product)
- High availability - unattended operation
- Zero emissions through entire system



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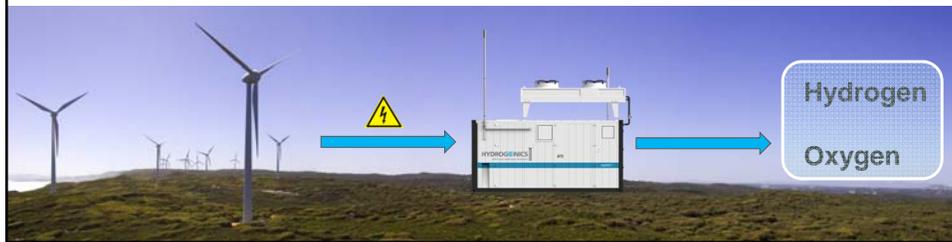
Technology

- 1 MW PEM Single Stack Building Block
- 1st operation – October 2012
- 1st sale – E. ON May 2013
- Breakthrough Performance



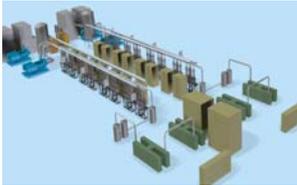
Renewable Electrolysis is...

- A process that uses renewable electricity to produce hydrogen by passing an electrical current through water.
- An Energy Storage solution when using excess renewable electricity



Roadmap **HYDROGENICS**
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Power-to-Fuel plants today will drive commercial scale deployments in the future

Today...	Needs...	Tomorrow...
Among the most proven and utilized technology	Tailored for large scale energy storage	Advanced MW-scale GEN3 technology plant solutions
		
2 MW Alkaline	1 MW PEM	40 MW Plant

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