THE ENERGY SHIFT IS UNDERWAY

SUSTAINABLE ENERGY ECONOMY WORKSHOP

Ryan Sookhoo
rsookhoo@hydrogenics.com

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70+ years of experience in delivering top-tier hydrogen solutions

Leading **PEM stack** and system technology, including unmatched **power density** in a single stack (3MW)

Only global company with leading technology in both **electrolyzers** and **fuel cells**

**Zero-emission** technology

**Ownership**
A Cummins Company

Cummins ~80%
Air Liquide ~20%

Serving customers in **100+ countries** around the world

Over **145 patents**
Hydrogenics designs and builds Fuel Cell Power Modules and Electrolyser systems

Fuel Cells:
- Fuel Cell Bus Integrators, China
- Alstom Coradia iLint, Germany
- UPS Delivery Van, US

Electrolysers:
- Uniper 2MW P2G, Germany
- P2G H₂ Fueling, California
- 2.5MW Power-to-Gas, Ontario
Hydrogenics’ PEM Electrolyser Product Development

R&D

1999

Small Scale PEM Electrolyser

2003

1.5 MW Cell Stack

2012

Test Large Stack

2014

Field Test 1.5 MW Electrolyser

2015

Indoor Architecture

2017

Dual Cell Stack Design

2018

2.5MW Stack

2020

5MW Product Platform

HyLYZER®-1000
Falkenhagen P2G Plant, Germany
Hydrogen Blending and Direct Injection to NG Grid
HyBalance Facility, Denmark
Hydrogen for refueling stations and industrial customers
Markham Energy Storage Facility, Ontario
Regulation Services for IESO
The electrolyser plant responds to the IESO dispatch signal setpoint every 2 seconds.
Markham Energy Storage Facility Highlights

- Plant has been designed for 5MW or 1,000 Nm³/hr or 2,160 kg/day capacity
  - Currently installed 2.5MW or 500 Nm³/hr or 1,080 kg/day capacity
- High purity H₂ is produced by the PEMWE stacks at 30 bar\textsubscript{g}
- Plant provides +/- 1.05 MW of regulation service for the IESO
  - 2 second response time, 2 MW/sec ramp rate
- No operating restrictions—can provide full range of regulation capacity 24/7
  (no state of charge limitations as with Battery Energy Storage Systems)
- Highest power density electrolyser stack in the world
- Meets the highest standards of safety and quality
  - Installed on Enbridge property, residential neighbourhood across the street
- Fully approved for operation by multiple certification bodies having jurisdiction:
  - IESO, Technical Standards and Safety Authority (TSSA) Fuels, TSSA Boiler and Pressure Vessels (BPV),
    Electrical Safety Authority (ESA), Canadian Standards Association (CSA), City of Markham, Ministry of
    Environment and Climate Change (MOECC)
Air Liquide Plant

- New plant at Air Liquide’s Quebec Facility
- 4 HyLYZER-1000s
- Capacity 8000 kg/d of hydrogen a day
- Annual GHG abatement of 27,000 tonnes
- Commercial operation in 2020