



**HYDROGENICS**  
SHIFT POWER | ENERGIZE YOUR WORLD



POWER  
TO FUEL TO GAS





POWER  
TO MOVE TO PROTECT

**Hydrogen Fuel Cells for Electric Bus Fleets – Status and Future**

**Zero Emission Bus Technology Workshop**  
SCAQMD, Diamond Bar, California, Sept 17, 2013

Rob Del Core  
Hydrogenics USA  
Director, Business Development  
San Diego, California  
rdelcore@hydrogenics.com



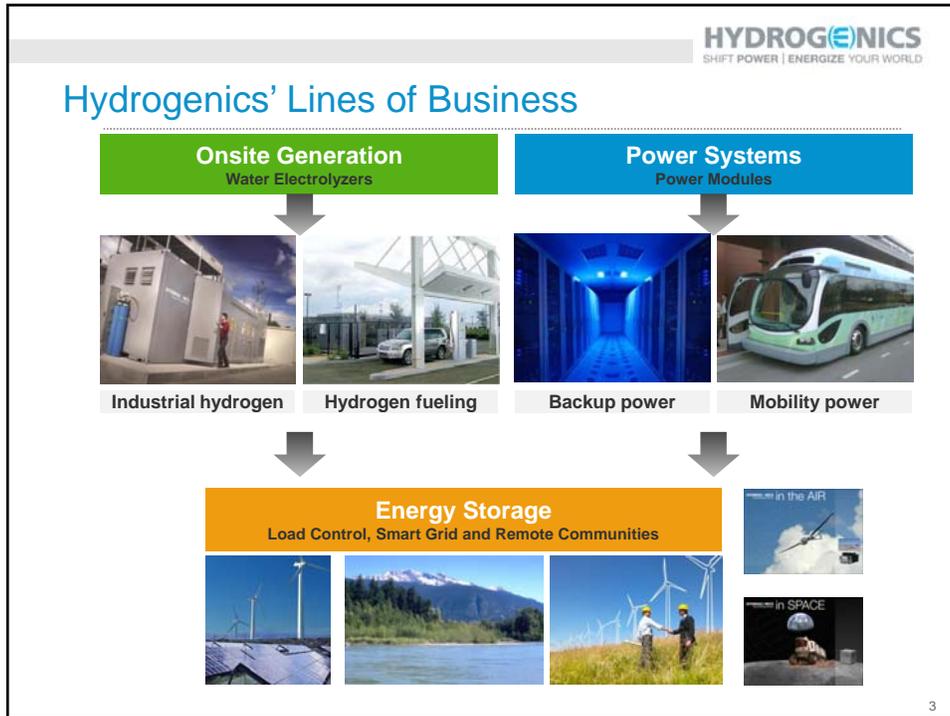
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## Our Company



*Hydrogenics HyPM Fuel Cell Power System Production*

- 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
- Our HyPM are currently in over 20 buses in North America and Europe



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## HyPM for Prime Power or Range Extension



**HD30**



**HD90**

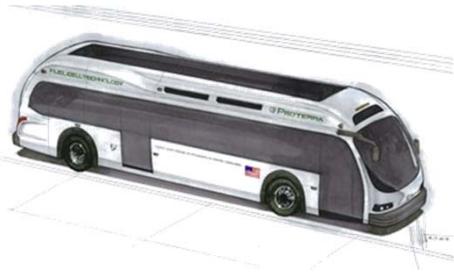


### HyPM Product Portfolio – From Low to High Power

					
HyPM™		HD 16	HD 30	HD90	HD120
Continuous Power	[kW]	16.5	33	90	120

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## HyPM™ in Proterra 2013 Fuel Cell Hybrid Bus



- Bus Chassis: Proterra lightweight composite body
- L/W/H: 35' 102" 134"
- Curb/GVW: 27,600 / 38,000
- Passenger Capacity: 64- 37 seated/27 standing
- Two HyPM HD30 – double the power in same volume as first generation bus
- Roof mounted HyPM and fuel system
- Proterra battery dominant plug in hybrid system
- Energy Storage: LTO up to 88 kWh
- Traction Motor: 220 kWp PM UQM, w/ Proterra 2 speed transmission
- Electrically driven accessories

- Capital Metro Authority, Austin Texas
- District Department of Transportation , Washington DC
- Deployments data for NREL 's evaluation
- funded by FTA, project by CTE




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## HyPM™ Fuel Cell Power Module is Perfectly Engineered for Transit Agencies' Operating Requirements

- *Unlimited start-stop cycling – good for range extension*
- *Pioneered stack technology requiring no humidification – Dry anode and cathode*
- *>13,000 hours proven durability*
- *Ease of maintenance*
- *Reduced mass, volume, piping, wire harnesses, parts*
- *-40°C freeze tolerance with -10°C unassisted stack start temperature*
- *Low pressure operation – high efficiency, low noise*
- *Cathode air delivery system and control included*
- *Rapid start-up*
- *Excellent high duty cycle performance*
- *No degradation due to shelf life or storage*
- *12 – 14 weeks lead time*



**HyPM HD30: 30 kW, 66 L, 75 kg**  
265 x 410 x 605 mm  
500 A, 60 – 120 V

## Hydrogenics HyPM

- Developed specifically designed for heavy duty commercial vehicle market
- Over 10 years of development and deployment experience
  - 5 Generations & \$100,000,000 invested
  - Lessons from broad range of applications and conditions worldwide fed back into development improvements
- Numerous technical competitive advantages

### Simple

- Fully integrated architecture
- Integration made simple and straightforward

### Standard

- Flexibility on size - 15 variants in portfolio

### Proven

- > 13,000 hours and increasing
- Competitive warranty and service support

WE'RE  
**READY**

**Hydrogenics USA**

**Rob Del Core**

[rdelcore@hydrogenics.com](mailto:rdelcore@hydrogenics.com)