

simple.fuel.<sup>TM</sup>

Your  
On-site  
Hydrogen  
Refueling Solution





# On-site Hydrogen Refueling Solution

## Generation, Compression, Storage and Dispense in a Single, Compact Appliance

- “Drop-in” installation, small footprint
- Integrated safety system
- Inputs are electricity and water
- Renewable H<sub>2</sub> possible via solar, wind, etc.
- Indoor or outdoor installation

## Optimized Solution for Fleets and Early Markets

- 5-10 kg/day H<sub>2</sub> delivery solution
- 350 & 700 bar refueling options
- Typical fill times of 5-15 minutes for ‘opportunity dispenses’
- One appliance can serve a fleet of 10-20 FCEVs
- Easy to relocate as market grows
- Also applicable to industrial lift truck markets



simple.fuel.™ is a partnership between Ivys Energy Solutions, McPhy Energy NA and PDC Machines Inc. to develop a compact, on-site hydrogen solution

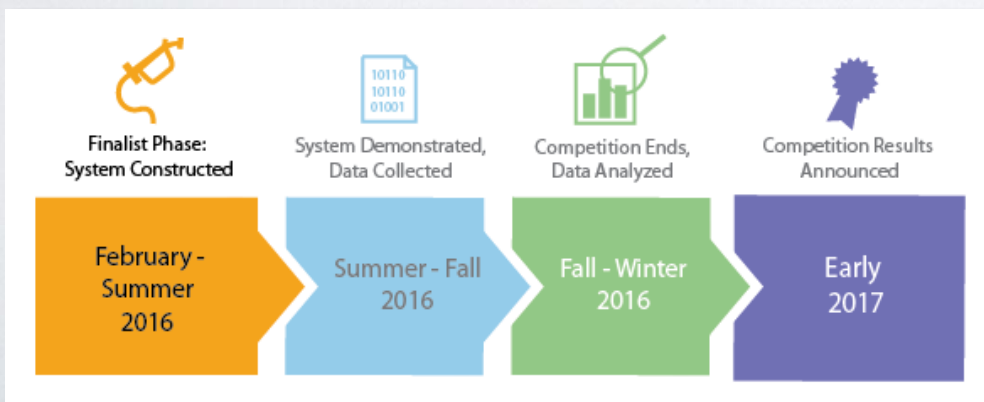


# H-Prize Finalist

## Team Finalist in DOE/HEF H-Prize Competition

- \$1M prize for innovation in H2 infrastructure
- Prototype developed by summer end 2016
- Testing and public events by fall 2016
- Competition results announced by early 2017

SimpleFuel is a partnership between  
Ivys Energy Solutions,  
McPhy Energy NA, and  
PDC Machines Inc.  
to develop a compact, on-site  
hydrogen refueling solution



The 2014-2016 H-Prize Competition





## **Ivys' Role in the Hydrogen Industry**

- Ivys' members led the development of a compact, on-site SMR appliance (Nuvera PowerTap™)
- Responsible for the safe deployment of 8 Nuvera H2 forklift stations (24/7 mission critical operations)
- Helped establish 1<sup>st</sup> H2 FCEV refueling station in Massachusetts (2009)
- Developing state-of-art H70-T40 dispenser systems (DOE Award #DE-EE0007273)

Ivys Energy Solutions, Inc., building on decades of experience in the hydrogen fuel cell industry, is developing innovative technologies and products to make a fundamental impact on automotive hydrogen refueling infrastructure, and enabling the successful near-term rollout of fuel cell vehicles.

## **Team Leader in DOE/HEF H-Prize Competition for Team SimpleFuel**

### **Development Location:**



# PDC's Industry leading H2 experience

- Over 300 compressors in global H2 Energy Applications and growing weekly, representing over 60% of the world Market for all applications
- Unparalleled excellence in Hydrogen Energy!
- Vertically integrated manufacturing- 95% in-sourced.
- Best in customer support servicing a global client base.
- Spare Parts always in stock





## A portfolio of innovative products thanks to 13 years of R&D...

### H<sub>2</sub> production units



A full range:  
Small, medium and  
large-scale hydrogen  
production units  
(electrolyzers)

→ Years of experience in producing hydrogen through water electrolysis, a mature technology

### H<sub>2</sub> solid storage units



A disruptive, green,  
safe and large scale  
solution

→ Exclusive technology for storing hydrogen in solid form



## ... addressing 2 main high-growth markets

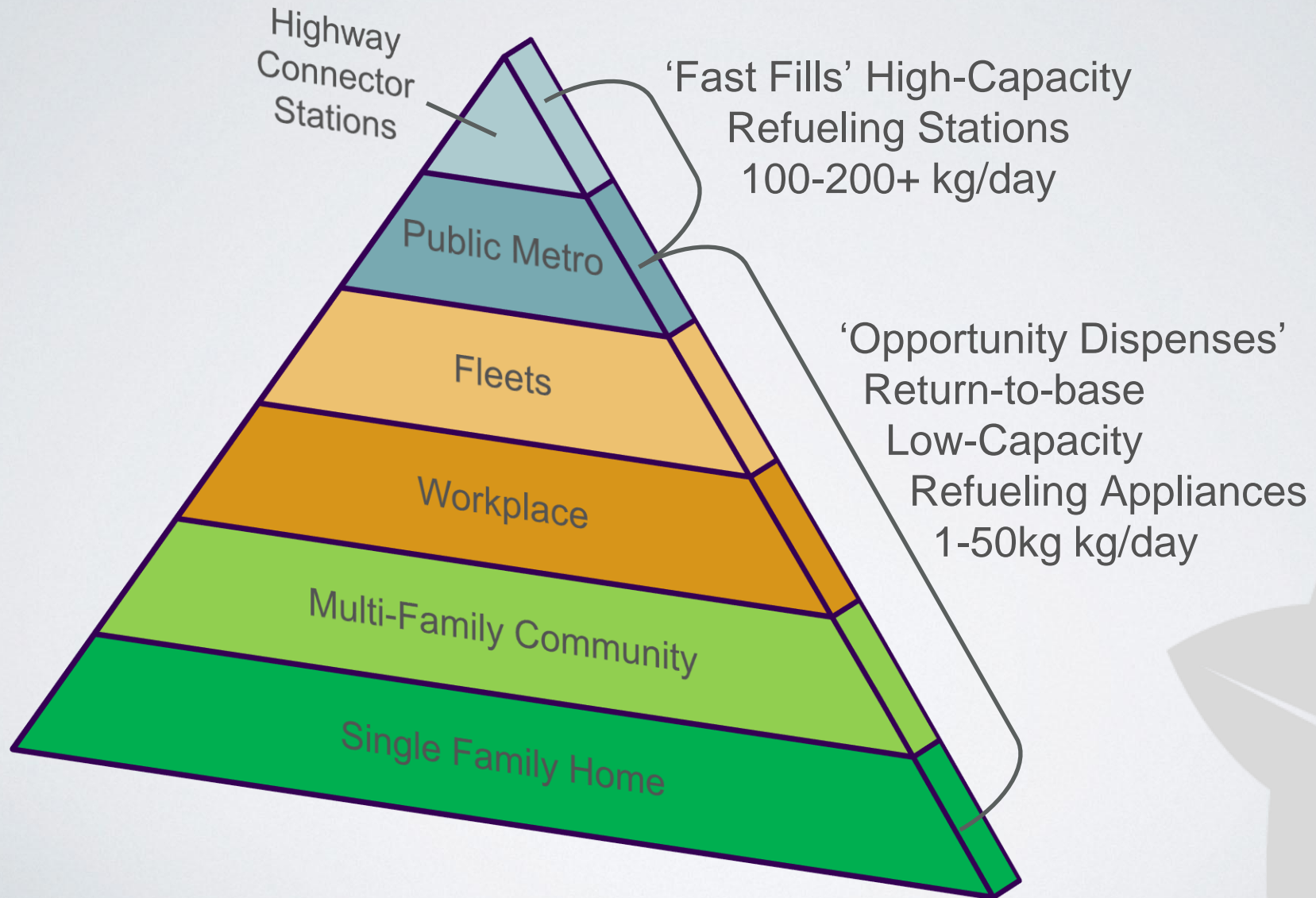


Industry



Energy  
&  
mobility







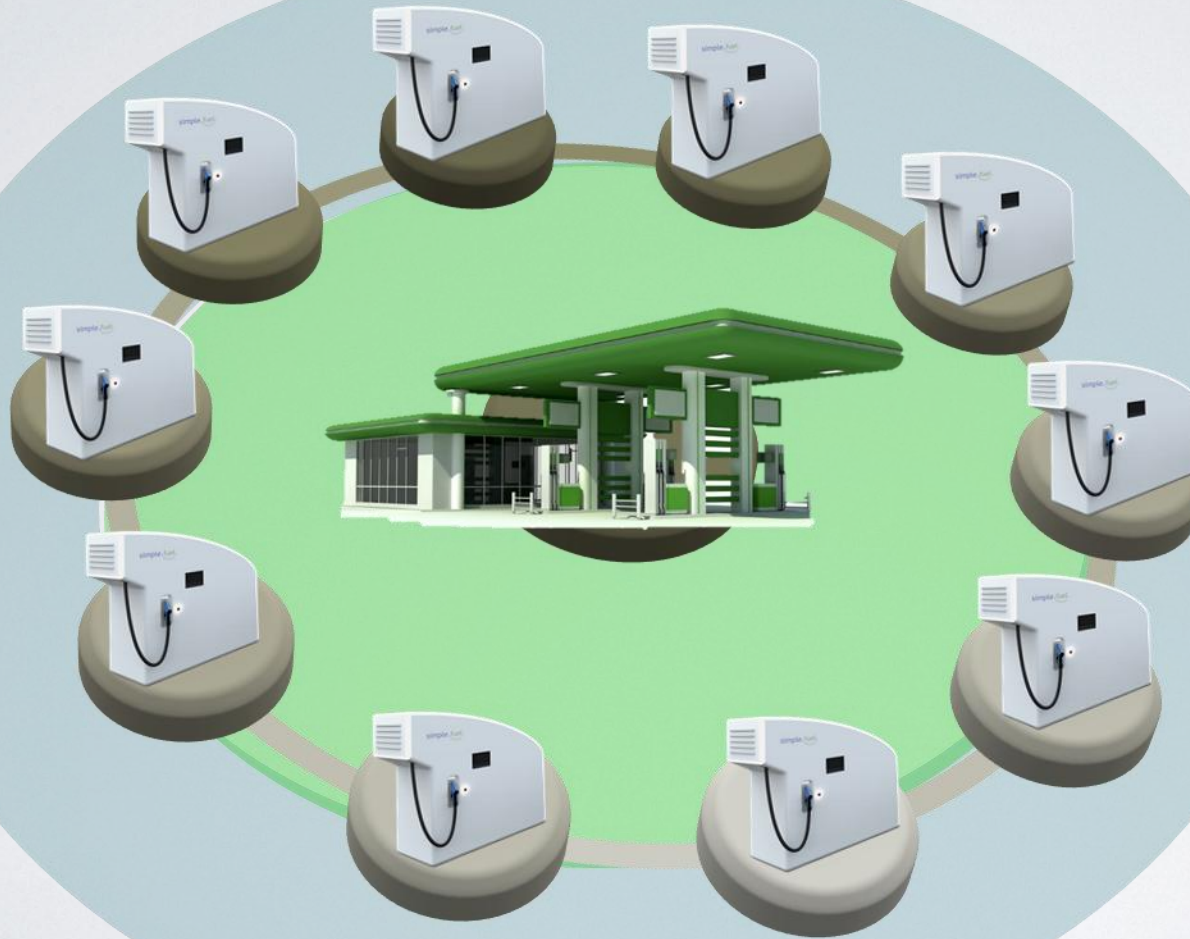
# Distributed Model

Network of 10-20  
SimpleFuel  
Refuelers

AND

'Fast Fill' Central  
Hub Station

= same  
investment





*Enabling Work Place &  
Fleet Charging of  
FCEV's  
GO GREEN!*

simple.fuel.™





*Enabling Your Residential/Community  
Fueling Solution*

*Always depart with a full tank*



simple.fuel.™



*Enabling Fueling at  
Service Centers  
Enhance customer  
experience and  
retention*

simple.fuel.™





*Enabling Distributed Fleet  
Fueling Networks*

*Easily expand your green fleet  
footprint and customer reach*

simple.fuel.™







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*Enabling Your DC/Retail  
Material Handling Fleet  
Easily covert & incrementally  
expand your green fleet*

simple.fuel.™



simple.fuel.™

*Community Outreach  
Warwick-Bucks County First  
Responder Visit (Aug. 23)*





# Installation Requirements

**Installation needs to be provided at Site:**

Very similar to installing a Dispenser:

- ✓ Vents: H2 and O2 per specification
  - ✓ Bollards
- ✓ RO Water Supply – depends on installed capacity; single or multiple systems
  - ✓ Power per specification

**Product will be certified as an appliance and will be listed**



Valued Quality. Delivered.



**Intertek**



# Periodic Inspection & Maintenance

Service Interval / Service Type	6 Mo. Inspection/ Clean/ Replace as Needed	1-Year Inspection/ Clean/ Replace as Needed	1-Year Replacement	5-Year Replacement
<b>Electrolyzer</b>				
Inlet Water Filter	X		X	
Pressure Equalizers	X		X (Internal Seal)	
Electrolyte Solution		X		X
Cell Stack				X
<b>Compressor</b>				
Oil System	X		X (Filter)	X (Oil)
Diaphragms			X (QTY 2)	
<b>Gas Purification &amp; Dispensing</b>				
Dryer Guard Filter		X		
Dispenser Filter		X		
Water Separator Filter	X		X	
Ventilation Air Filter	X			

Service cost typically  $\leq$  2-4% of capital cost per year; year-5 involves stack replacement

# Cost and Value Proposition

Capital Cost of SF-10-700: \$225,000; add \$25,000 for install

- ✓ A SF-10-700 can service 10-15 cars
  - Assumes each car uses 1.0-0.75 kg/day (60-45 miles driven)
- ✓ Lifetime of 10+ years
- ✓ Investment per vehicle: \$2500-\$1500/yr

## Operating Cost of SF-10-700

- ✓ Power Requirement 28.5 kW; @ \$0.10 per kW-Hr the fuel cost: \$7/kg dispensed
- ✓ Service & Maintenance: \$1.25/kg dispensed

If Capex & Service is funded through green initiatives; Fuel cost is \$7.0/kg which is \$3.2 gge (assuming ratio of 2.2 for FCEV/Gasoline)



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