

# Market Opportunity in a Changing World

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# Plug Power's Markets – Why We've Chosen Them

## ■ Material Handling

- *Primary opportunity* – replace lead acid batteries with hydrogen fuel cells
- *Economic driver* – measured productivity



## ■ Remote Prime Power

- *Primary opportunity* – replace diesel generators with propane fuel cells
- *Economic driver* – O&M cost reductions



## ■ Residential and Light Commercial $\mu$ CHP

- *Primary opportunity* – replace traditional grid and boiler with natural gas fuel cells
- *Economic driver* – save 30-40% on utility bills



 **plug power**

**POWER** POWER **AHEAD**

# Where are Fuel Cells' Persistent Markets?

## ■ Fuel Cells' Inherent Strengths:

- High electrical efficiency (>30%) – unmatched part load and turndown
- Excellent start-up and load following capability (LT and HT PEM)
- Cogen heat is easily captured with high (>85%) overall efficiencies
- High-quality heat can power absorption cooling (HT PEM and SOFC)
- Weather and environment independent, assured power
- Quiet, ultra-low emission operation

## ■ Fuel Cells' Weaknesses:

- Not a renewable – uses fossil fuels
- Requires precious metals and recycling strategies
- Initial cost
- Lack of market segmentation by technology (LT PEM vs. HT vs. SOFC)



# Where are Fuel Cells' Persistent Markets?

## ■ Persistent Fuel Cell Markets:

- Applications that benefit from high part-load efficiencies and the ability to load follow:
  1. Luxury homes in high energy price ratio areas (California, Luxembourg, Germany/Netherlands, Japan, Korea, New York, Texas)
  2. Convenience stores, laundromats, spas, pools, car washes
- Applications where the heat is valuable
  3. Large homes that require heat in high energy price ratio areas
  4. Laundromats, spas, pools, car washes, military barracks
- Off-grid applications
  5. Cell towers, remote stations, resorts, military deployments, ski resorts, cabins
- Productivity applications
  6. Material handling, auxiliary power systems (marine and land)

**Fuel cell applications must have clear, demonstrable economic benefits in order to carve out persistent markets.**

# Competition vs. Complimentarity

- Because of their nature, fuel cells have no direct competition – its all about application.
  - Nuclear – gas turbine – distributed generation
- Market the technologies where they have persistent economic benefits:
  - Fuel cells vs. solar in Spain vs. Germany
- Fuel cells complimenting other technologies will provide greatest economic and environmental impact

