



# BALLARD®

## Utilizing PEM Fuel Cells for Distributed Generation

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**BALLARD POWER SYSTEMS**

**PUTTING FUEL CELLS TO WORK**

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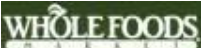



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# Ballard: Putting Fuel Cells to Work

- Ballard leadership in PEM fuel cells is based on -

- Portfolio of proven commercial solutions
    - Fuel cell stacks, power modules and systems
  - Strong delivery capabilities
    - Access to over 2,000 patents and licenses
    - High volume manufacturing facility
    - SI & channel partnerships
    - 100MW+ of fuel cell products shipped

- Developing a global customer base -

	Backup Power	Supplemental Power	mCHP	Distributed Generation	Bus	Material Handling
System Integrators/OEMs						
Downstream Customers	 	 	  	  	   	   

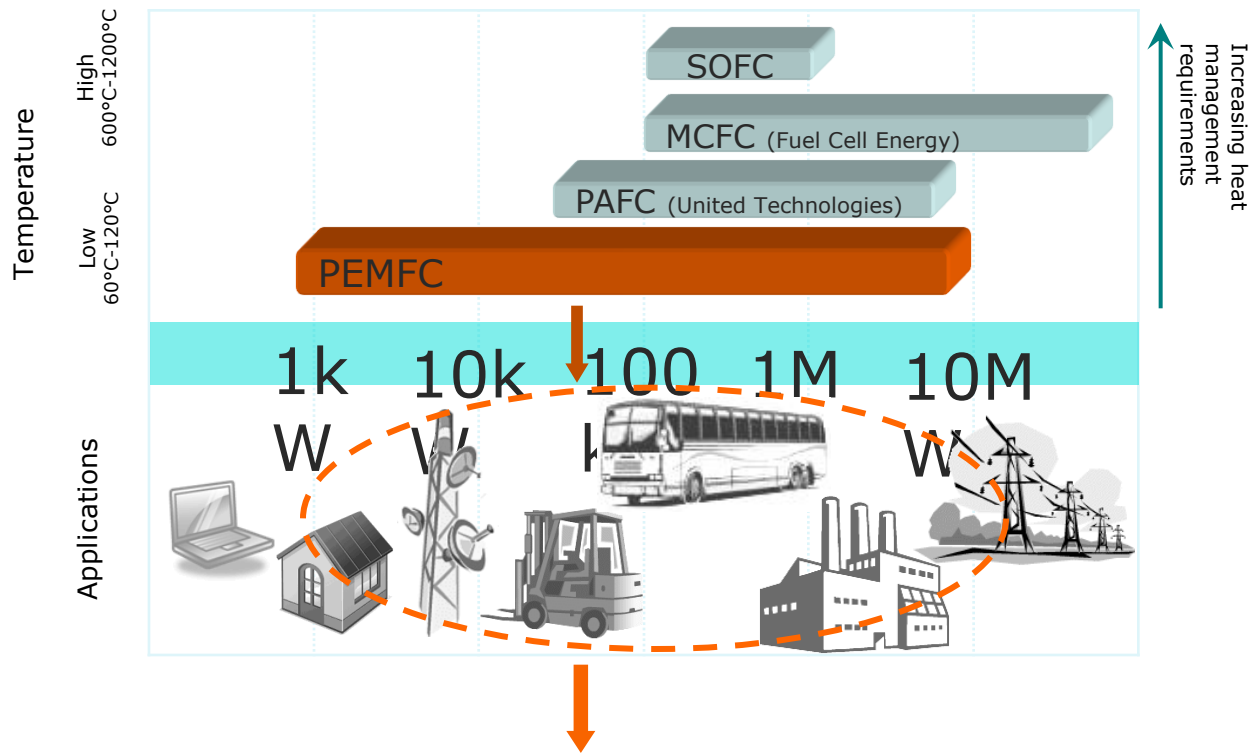
# Global Clean Tech Sector

- **Clean energy growth outpaced traditional sector of the economy:**
  - ▶ Clean Energy secured over US\$150 billion globally in investment in 2008<sup>2</sup>
  - ▶ Global investment in clean energy market expected to reach US\$590 billion by 2030<sup>1</sup>

Largest Green Stimulus Packages

Country	Green Fund USDbn	% Green Fund of total stimulus
<b>Asia Pacific</b>		
China	221.3	37.80%
South Korea	30.7	80.50%
Japan	12.4	2.60%
Australia	2.5	9.30%
<b>Europe</b>		
European Union	22.8	58.70%
Germany	13.8	13.20%
France	7.1	21.20%
<b>Americas</b>		
US ARRA	94.1	12.00%
US EESA	8.2	9.80%
Canada	2.6	8.30%
<b>Total</b>	<b>436</b>	

# PEM Fuel Cells

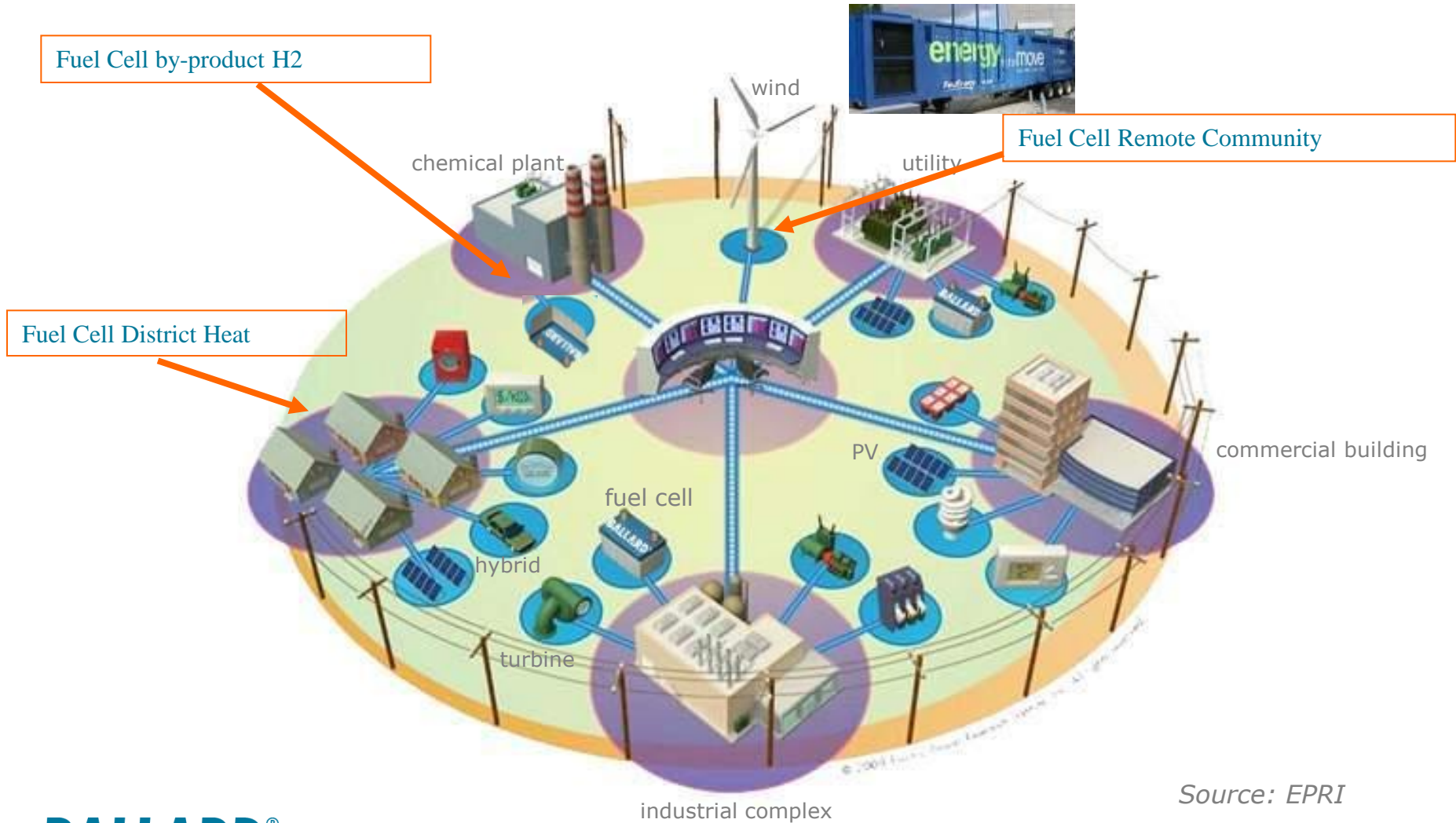


## Ballard leverages leadership in PEM across multiple markets...

- ▶ Compact & scalable
- ▶ Fuel flexibility
- ▶ Efficient, reliable and safe
- ▶ Fast start-up and low temperature
- ▶ Rapid response to changes in power demand
- ▶ Durable across wide variety of duty cycles

# Fuel Cells in Smart Grid

- Fuel cells have unique ability to provide base load power, storage, or load cycle to meet the demands of distributed generation



Source: EPRI



# Example #1: By-Product Hydrogen Generation

- **Fuel cell system to offset power requirements at K2 Pure's bleach plant**
- **Benefits:**
  - Offset power demand on site
  - Sell excess electricity to utility
  - Zero GHG emissions
  - 48% efficiency
  - 15-20% IRR possible
  - Eliminates transmission costs

## Enablers in California:

- **Capital grant (SGIP)**
- **Low cost fuel**
- **Net metering**



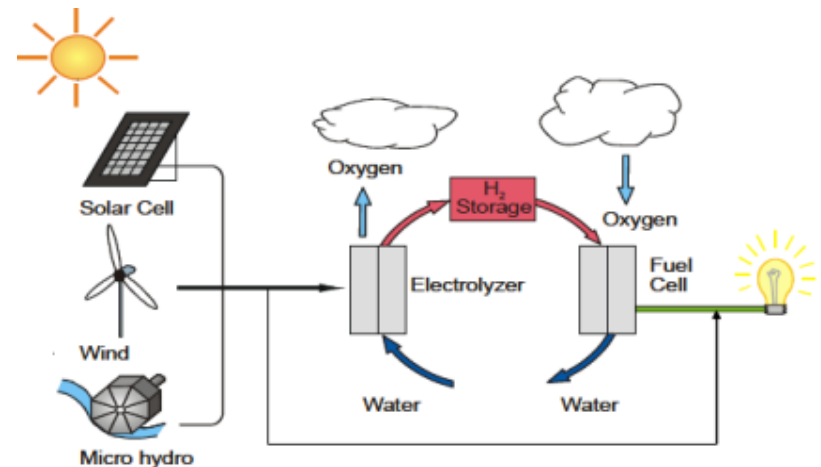
# Example #2: Remote Community Electrification

- **Renewable power for remote, off-grid communities to displace diesel generators**
- **>300 communities across Canada isolated from grid, ~3,000 worldwide**
- **Benefits:**
  - Reduces/eliminates reliance on diesel
  - Low noise
  - Eliminates transmission costs
  - Dispatchable
  - Zero GHG emissions
  - Operated by the community

## Enablers:

- **Capital purchase incentives**
- **Fit or Clean energy mandates**

- BC Hydro's Hydrogen-Assisted Renewable Power (HARP) initiative. Bella Coola



# Example #3: Hydrogen pipeline

- Fuel cell system to offset peak power requirements at facility

- Benefits:

- Offset peak power demand on site
- Reliable power for critical applications
- Capture waste heat for use in facility
- Eliminates transmission costs
- Zero GHG emissions
- 48% efficiency
- 15-20% IRR possible

## Enablers in California:

- Capital grant (SGIP)
- Net metering



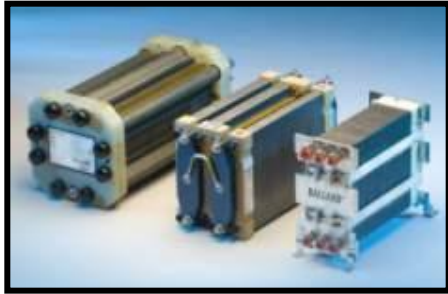
Data Servers



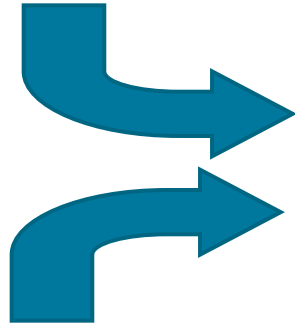
Critical Manufacturing lines



# Product Development – Leveraging Opportunities



Long life



FCgen®-1300



Residential Cogeneration

Leveraged into  
4 markets

Backup and  
Supplemental Power



Distributed Generation

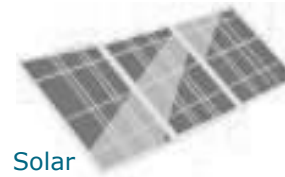
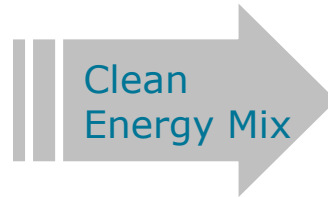
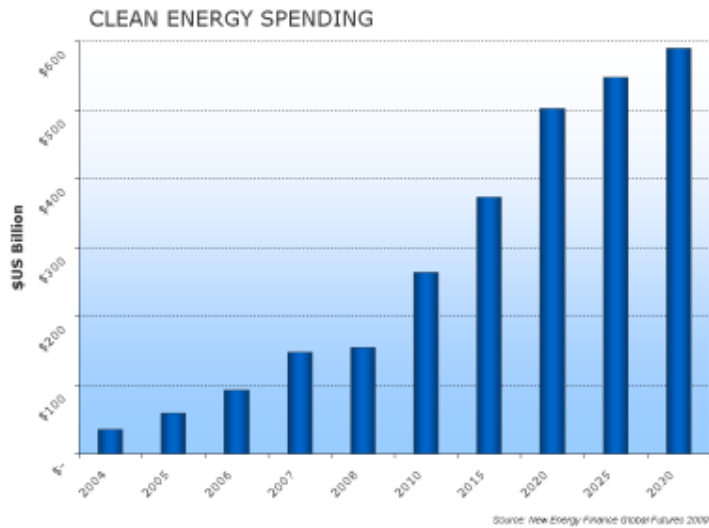


Low cost, automated production

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# Fuel Cells and Clean Power

- Clean energy market growth will reflect a mix of energy technologies



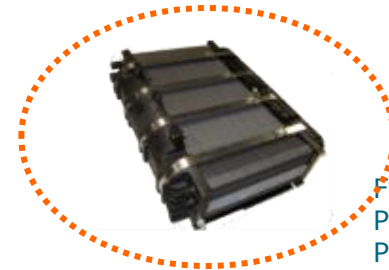
Solar



Wind



Bio-energy



Fuel cells  
PEM, SOFC,  
PAFC...

**As fuel cell product costs continue to decline, fuel cells will play an increasingly prominent role in the clean energy space**

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# Thank you



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