



ClearEdge | POWER<sup>®</sup>

Delivering Smart Energy Today<sup>™</sup>

HTAC Meeting

February 2010

# Overview of Topics

**Company Overview**

**History and Fuel Cell Technology**

**Scalable Manufacturing**

**Return on Investment – Understanding  
Financial Analysis**



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# About ClearEdge Power

- Established in 2003
- Headquartered in Portland Oregon, with field offices in California and Korea
- Well capitalized by investors with a long term vision
- Full service provider for customer
  - Design & Manufacture
  - Installation & Permitting
  - Service & Maintenance
- Experienced Mgmt and technical team:
  - Possess extensive background in fuel cell design and scale to volume
  - Rapid job growth
  - Selling in CA and Korea



- Designed to address the urgent concerns:
  - Increased demand on grid infrastructure
  - High energy costs
  - Environmental impact
- Manufactured in our 75,000 sq ft facility
- Certifications:
  - ISO 9001 Quality Management Systems
  - ISO 14001 Environmental Management Systems

# ClearEdge: A New Energy Solution



- **Lower cost than grid:** LCOE as low as \$0.09 per kWh
- **Cleaner than grid:** 37% less CO<sub>2</sub> with untraceable levels of NOx and Sox
- **High Efficiency:** Over 90% CHP energy efficiency requiring 40% lower fuel consumption
- **Scalable with multi-fuel capacity:** Easily installed in multi-unit configuration. Future versions tested to operate on biogas or propane
- **Aesthetic design:** Compact and quiet system operates indoors or outdoors



# Cleaner Energy Than the Grid

## Power from the Grid

**Natural Gas**  
Efficiency: 35%  
4223 therms



**Natural Gas**  
Efficiency: 80%  
2175 therms



**Environmental Impact**  
8.35 lbs CO<sub>2</sub> per hour  
34 Tons per Annum

## Power from ClearEdge

Electrochemical Conversion



**Natural Gas**  
Efficiency:  
up to  
90%

Electricity → 43.8 MWh per year ← Electricity

Heat → 51.0 MWh per year ← Heat

6,398 therms total

3,840 therms total

**Environmental Impact**  
5.3 lbs CO<sub>2</sub> per hour  
22 Tons per Annum

The ClearEdge5 system provides:  
**40%** reduction in fuel and **37%** reduction in CO<sub>2</sub>

# Understanding Fuel Cell Technology

**Innovative Products based on Disruptive Technology**

**Large Market for Distributed Power Solutions**

**Scalable Manufacturing**

**Financial Analysis**

# Unique Platform Design



## LT PEM

- < 100 degrees Celsius
- Requires hydrogen with levels of CO < 20ppm
- Expensive water management and fuel processing systems



Low Cost

## HT PEM

- < 170 degrees Celsius
- Low cost and high volume manufacturing
- Low decay rate: stack design life >40,000 hours
- No flooding or liquid water management issues
- CO sensitivity up to 20K ppm
- Ability to utilize waste heat

Hybrid design captures best elements of both

## PAFC

- > 200 degrees Celsius
- Complicated stack design to accommodate liquid acid
- Stack parts must be fully graphitized to survive
- Operating temperature increases decay rate



High Efficiency



# Extensive Field Trial and Development



Initial Production Shipments

## Power Plant Demo



- First Breadboard

## Alpha Field Trial



- Total 5 units – 4 NG
- Power rating: 3 - 4 kW
- Electrical configuration: GC/GI, 120/240 V
- Total power generated: 18,441 kW-hr
- Electrical efficiency: 28-33% (LHV)
- Overall Efficiency: 70 - 80%

## Pre-production Field Trial



- Total 6 units – all NG
- Power rating: 5 kW
- Electrical Configuration: GC/GI, 120/240 V
- Total power generated: >24,200 kW-hr
- Electrical Efficiency: >40%
- Overall Efficiency: 80 - 92%

## Commercial Production



- Initial Residential units shipped in [Q1 2010]
- Initial Commercial units shipped in [Q2 2010]



### Fuel Cell Stack Durability

- Stack testing up > 22,000 hours



### Fuel Processor Durability

- Test ongoing for > 8,000 hours

# Remote Monitoring And Control

## Commercial Site

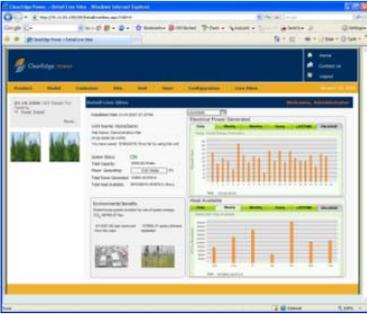


- “Black Box” memory
- 1 GB non-volatile



- Real time remote monitoring
- All CE5 systems monitored 24/7

Real Time Data



# ClearEdge Fault Tolerant System



## Key Customer Benefits

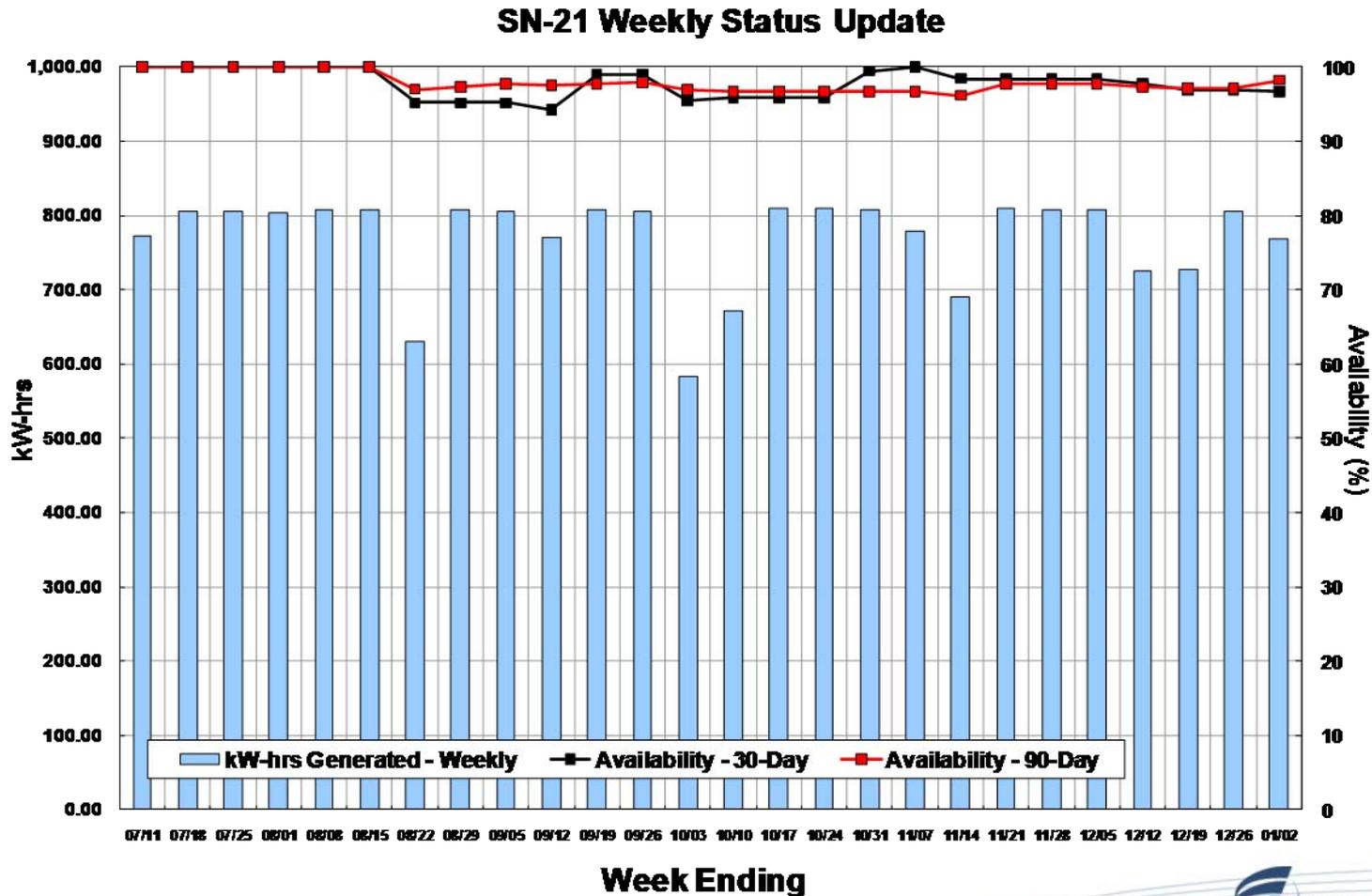
- Triple-redundant, on-site, prime power for small and medium sized data centers and server rooms
- Delivers reliable power with high level of up-time
- Replaces or eliminates the need for PDUs, UPS systems, backup generators and large switching systems
- Reduces upfront capital by over 50% and operating costs by over 65%

# Commercial Performance Summary through 2 January 2011

## Unit Status

Availability:            30 day: 96.7%    90 day: 98.2%    Lifetime: 98.6%

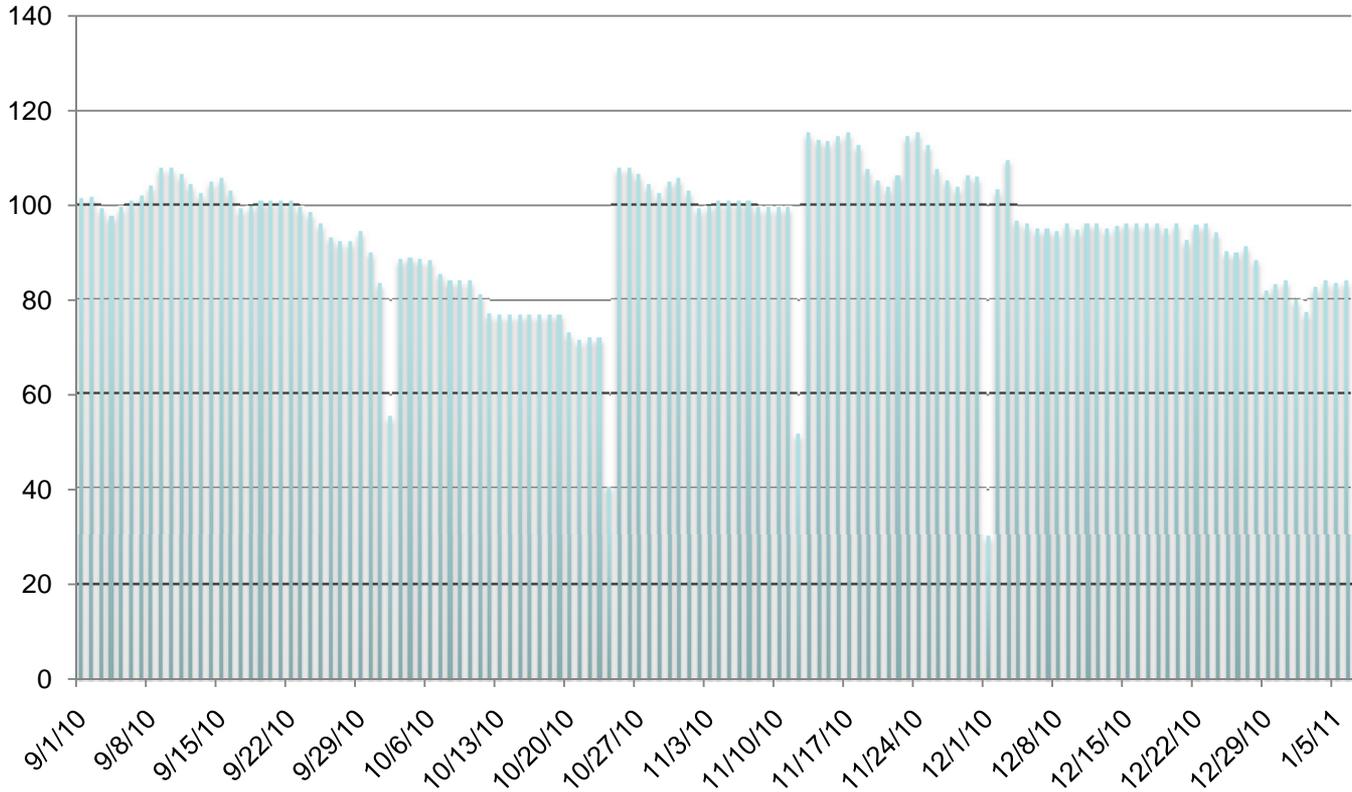
Electrical Power Generated:    Lifetime: 20,030 kW-hrs



# Residential Summary through 6 January 2011

## Unit Status

Availability:            30 day: 99.1%     90 day: 79.7%     Electrical Power Generated: Lifetime: 3,976.8 kW-hrs



# Expanding Markets

**Innovative Products based on Disruptive Technology**

**Large Market for Distributed Power Solutions**

**Scalable Manufacturing**

**Financial Analysis**



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# Target Vertical Markets

## Commercial

Hotels  
Restaurants  
Health & Athletics  
Entertainment  
Agriculture & Greenhouses



## Institutional

Utilities  
Schools  
Government  
Medical  
Military

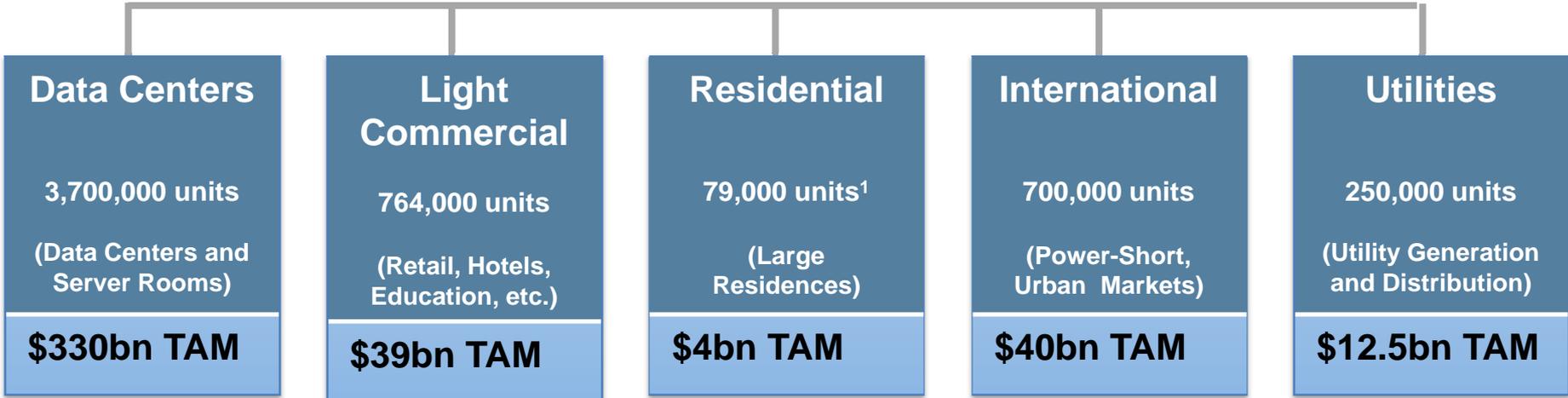


## Residential

Residential Single Family  
Multi-Tenant:  
Planned Communities  
Senior / Affordable Housing  
Condos & Apartments



# Large Addressable Market



**\$425.5 Billion of Diverse Addressable Markets**

Source: Total TAM are based on management estimates.

<sup>1</sup> Residential market size accounts for California homes only.

# Manufacturing is Strategic for Explosive Growth

**Innovative Products based on Disruptive Technology**

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# Scalable, Flexible Manufacturing



- 75,000 sq. ft. facility
- Highly efficient, lean, scalable, and capital-light manufacturing line
- Company performs only final assembly and testing
- Multi-shift capacity of 1,500 units per year
  - Capacity to increase to 10,000 units per year with incremental \$12 million
- Six sigma elements implemented
  - Tier 1, high quality suppliers
  - KANBAN

# Lean/Six Sigma Elements

## Incoming Inspection



- Initial quality gate for the facility
- Top tier suppliers in place
- Source inspect or sample plan
- Initiate supplier development actions

## Sub Assembly



- KANBAN parts presentation
- Sequential single piece flow
- Visual work instructions
- Automated testing & archive

## Final Assembly



- “Supermarket” parts presentation
- Mixed model flow line
- State of the art tooling
- Standardized work implemented
- Line balanced

# Understanding the Numbers

**Innovative Products based on Disruptive Technology**

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# ClearEdge5 – Operating Cost

## ClearEdge5 Fuel Cell microCHP

- Gas consumption at 5 kW rated power
- July '10 Comc'l retail cost of gas (PG&E)
- Cost of gas consumed @ rated power
- Operating cost per kWh
  - **Electric only**
  - **Net of Heat Savings**  
(20,000 BTU vs. 80% eff. heater)

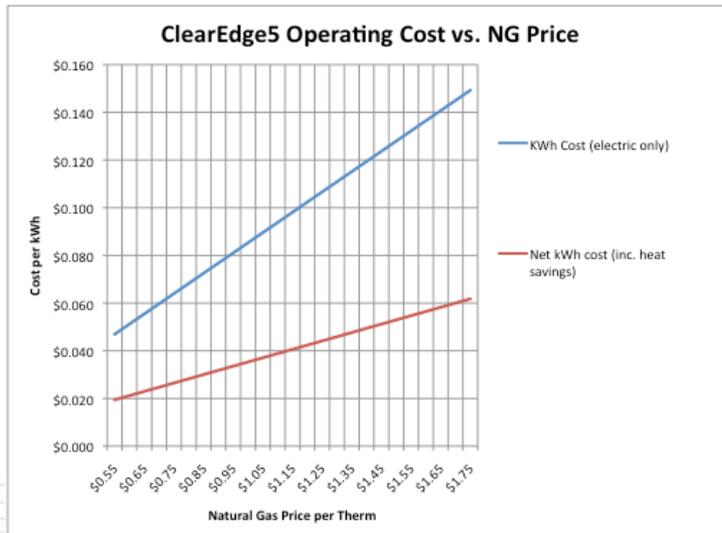
0.426 therms of gas per hour

\$.75 per therm

\$.32 per hour

**\$.064 per kWh**

**\$.026 per kWh**



**Low sensitivity to  
gas price volatility**

# ClearEdge Fuel Cells – Total Cost of Ownership (15 year model)

## ***ClearEdge5 Fuel Cell microCHP***

- Initial Capital Cost w/ install<sup>1</sup> \$ 65,000
- 5 Year Warranty N/C
- Rebates/Tax Credits \$( 27,500)
- Service & Maintenance \$ 20,000
  - Years 6-15
  - ~\$1,000 per year, plus \$5,000 every 6 years
- Depreciation \$(19,500)

## ***Operating Economics***

- Base load power produced 624,150 kWh
  - 15 yrs w/ 95% availability
- Fuel cost electric-only (15 yrs) \$ 39,883
  - Assumes \$.75 per therm NG
- Value of Heat (up to) (\$ 18,725)
  - Assumes \$.75 per therm NG

***Total Operating cost per kWh***      **\$.095 per kWh<sup>1</sup>**

<sup>1</sup> Based on product pricing June 2010

# ClearEdge5 vs. Solar – Investment and Environmental Comparison

**Cleaner Power  
for Your Dollar**



	ClearEdge5	Solar
\$50,000 installed capacity (after government incentives)	5 kW (AC)	5kW PV + 278 sq. ft. Thermal
Annual Production – Electricity	43,000 kWh	8,244 kWh
Annual Production - Heat	51,000 kWh	29,330 kWh
Combined Heat and Power	94,000 kWh	37,574 kWh

**The ClearEdge5 Delivers 2.5 Times More Heat and Power**

CO <sub>2</sub> Reduction from Grid & Heating *		<b>Fuel Cell Advantage</b>
CO <sub>2</sub>	79,200 lbs/yr	34,672 lbs/yr
		<b>2.1x reduction</b>

\* Grid assumes coal-fired power plant and heating with natural gas.

# ClearEdge5 vs. Solar – Payback and Production Comparison (Residential)

## *High Efficiency*

	ClearEdge5	Solar PV (27KW) Thermal 472 Sq. Ft
Electric Production - Annual	43,800 kWh	43,800 kWh
Heat Production	51,000 kWh	51,000 kWh
Space Required	34 sq. ft.	3,182 sq. ft.

## *Superior Financial Payback*

Total Installed & Sales Tax	\$ 82,850	\$ 233,141
Rebate	\$ 12,500	\$ 9,500
Tax Credit	\$ 5,000	\$ 52,700
Net System Cost	\$65,350	\$ 170,941
Utility Savings (Year One)	\$ 14,838	\$ 8,211
Payback	~ 4.4 years	~ 16.6 years

# Commercial Applications



Universal Studios – Los Angeles, CA



McDonalds – Portland, OR

# Commercial Applications



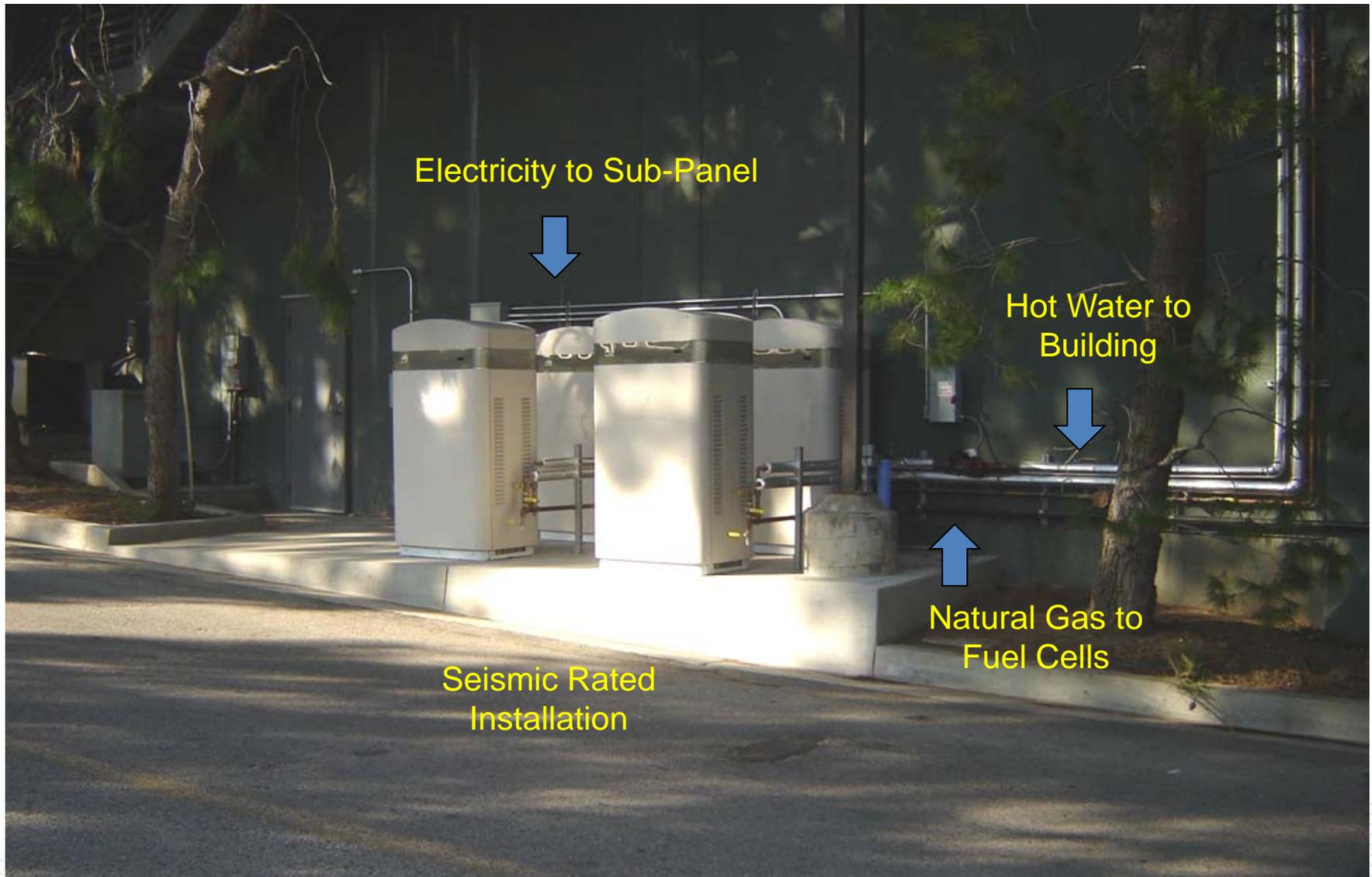
- Installed program to illustrate distributed generation program
- Run consistently- system would offer a saving of \$5,976 per year
- 15 week Environmental Scorecard
  - Delivered 97% uptime
  - Like removing 671 cars and planting 1341 trees
- Proof positive that fuel cells offer a viable, available solution for:
  - Lowering emissions
  - Reducing impact on an aging grid
  - New ways to support growing power requirements

## **\$23M Major Florida Energy Provider- Livermore, CA**

Evaluation Program: 12 week evaluation for run time performance

Current Installation – Q3 2010

# Elements of Fuel Cell microCHP Installation



# Residential Installations



# Commercial Financial Return - Example



## Chipotle Mexican Grill (PGE territory)

Domestic hot water and space heating

215,000 kWh annual electricity usage

1,300 therms annual gas usage (includes kitchen)

\$38,205 annual electric bill (before ClearEdge5)

### Savings with Installation of ClearEdge5

#### ClearEdge5 Annual Net Electric Savings

ClearEdge5 annual net electric savings	\$4,374
ClearEdge5 annual net avoided heat costs	\$1,081
Total savings per year	\$5,455

#### ClearEdge5 System Cost

ClearEdge5 (x1) @ \$9.30 per watt	\$46,500*
Installation and Sales tax	\$19,534
Less Federal tax credit	(\$14,920)
Less SGIP rebate	(\$12,500)
Net System Cost	\$37,614

ClearEdge5 Capital Payback 4.9 years\*\*

### Environmental Impact of the ClearEdge 5

CO <sub>2</sub> Reduction	37%	Offset 13 tons of carbon emissions this year
SO <sub>x</sub> & NO <sub>x</sub>	Undetectable	
Fuel Reduction	37%	



Planting  
2.87 acres of trees



Removing  
4.01 cars from the road today

\*Pricing is based on a multiple unit sale price.

\*\* Including depreciation & 5% escalation

# Commercial Applications



- 8 units total
- Projected Year 1 Savings: \$29K
- Serving as a major component of a complete an energy efficiency program
- All heat transferred to pool
- Eliminated need for solar thermal
- Will obtain the “green” certifications to benchmark its level of sustainability and promote Eco-Tourism
- First Historic Hotel to:
  - Implement fuel cell technology
  - Earn an Energy Star in San Diego
  - Become a “Green Key” Hotel (Hospitality Industry Eco-Rating Program) in SD County

## Lafayette Hotel- San Diego, CA City of San Diego, Historic Landmark On National Register of Historic Places

Retrofit Project: 7 separate buildings, 73 rooms, 85,000 sq ft.  
Anticipated Installation – Q1 2011

# Commercial Applications



- 9 units – 3 units each building
- \$1M savings in construction costs
- Eliminated need for solar thermal
- Reduced amount of solar PV needed
- Allowed for less expensive type of solar PV
- Fuel Cells qualify for City of SD Green Building Program – fast tracked through the permitting process
- LEED Silver Project – Energy & Atmosphere credits in process

## Village Lindo Paseo Dormitories - San Diego, CA

Design/Build, 193 room/386 bed student residence

Fuel Cells chosen and spec'd into design

Anticipated Installation – Q2 2011

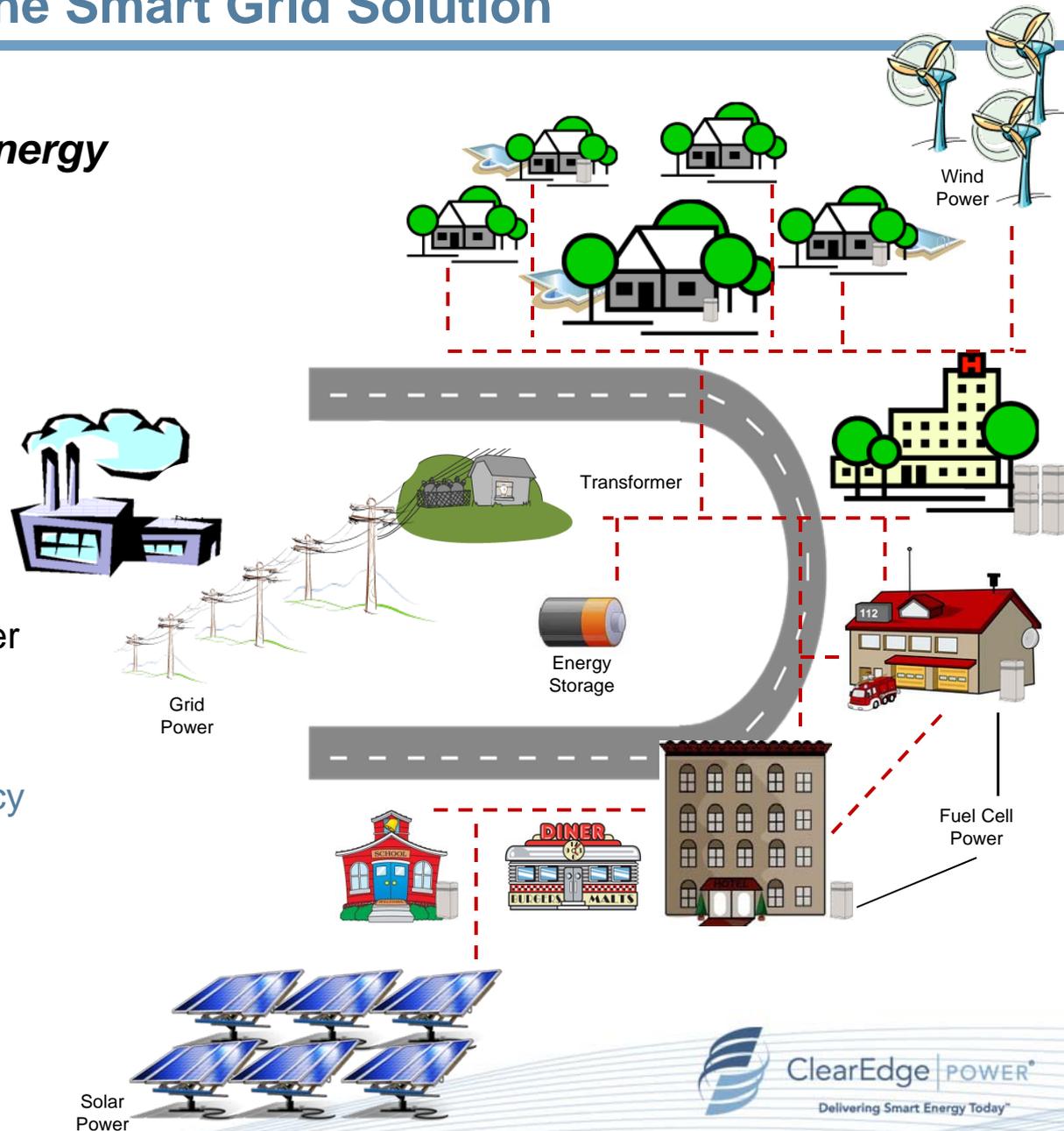
# Fuel Cells – Part of the Smart Grid Solution

## Community Islands for Energy Security and Efficiency

- Distributed Generation
  - Fuel cells, solar, wind
- Energy Storage
  - Off-grid backup
  - Peak shaving

## Fuel Cell CHP

- Continuous base load power
  - Compliments solar/wind
- High efficiency
  - Better electrical efficiency
  - Waste heat utilization
- Demand response
  - Peak shaving on grid
  - Central control



# Questions and Answers

Appendix: DATA Spreadsheet  
IVR Cherry Pick  
Repeatable Process

