

RESILIENT



POWER

A Project of **Clean Energy Group**

Fuel Cells for Educational Facilities

October 8, 2015

Todd Olinsky-Paul
Project Director
Clean Energy Group



Housekeeping



All participants are in “Listen-Only” mode. Select “Use Mic & Speakers” to avoid toll charges and use your computer’s VOIP capabilities. Or select “Use Telephone” and enter your PIN onto your phone key pad.

Submit your questions at any time by typing in the Question Box and hitting Send.

This webinar is being recorded.

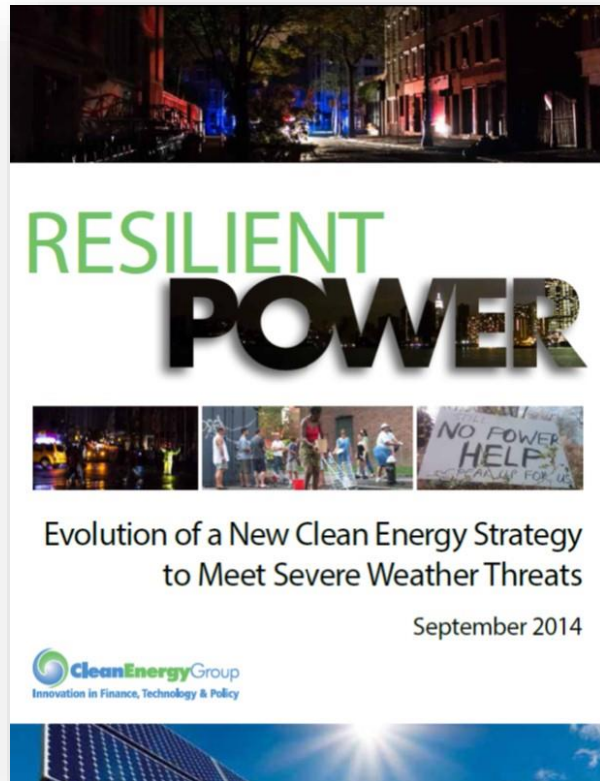
You will find a recording of this webinar, as well as previous Resilient Power Project webinars, online at:

www.cleangroup.org/ceg-projects/resilient-power-project/webinars/

and at

vimeo.com/channels/resilientpower

Who We Are



www.cleangroup.org



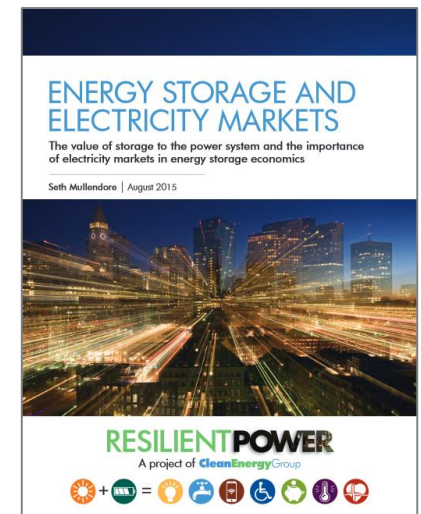
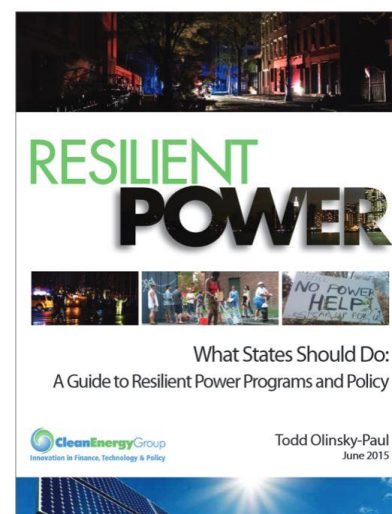
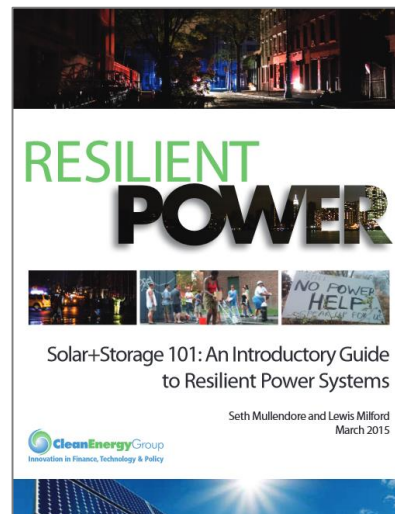
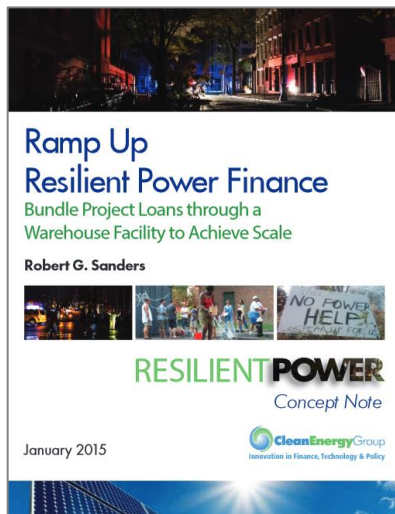
SURDNA FOUNDATION
Fostering sustainable communities in the United States

RESILIENT POWER

www.resilient-power.org

Resilient Power Project

- Increase public/private investment in clean, resilient power systems
- Engage city officials to develop resilient power policies/programs
- Protect low-income and vulnerable communities
- Focus on affordable housing and critical public facilities
- Advocate for state and federal supportive policies and programs
- Technical assistance for pre-development costs to help agencies/project developers get deals done
- See www.resilient-power.org for reports, newsletters, webinar recordings



Northeast Electrochemical Energy Storage Cluster (NEESC)

NEESC is a network of industry, academic, government and non-governmental leaders working together to help businesses provide energy storage solutions.



www.neesc.org

Today's Guest Speakers

- **Kent McCord**, Director of Marketing Strategy, Doosan Fuel Cell America, Inc.
- **Kenneth Frisbie**, Managing Director, Biofuels Energy, LLC
- **Erik Robie**, Commercial & Industrial Sales Manager SCG & CNG, The United Illuminating Company



RESILIENT POWER

A Project of Clean Energy Group

Sign up for the RPP e-Distribution List to get notices of future webinars and the monthly *Resilient Power Project Newsletter*: <http://bit.ly/RPPNews-Sign-UP>

More information about the Resilient Power Project, its reports, webinar recordings, and other resources can be found at www.resilient-power.org.

Upcoming Webinars

- **Severe Weather and the Reliability of the US Electric Power Grid**, Wednesday, October 14, 2-3pm ET

More resilient power webinars soon to be announced! Visit www.resilient-power.org for details.

Contact Info

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www.cleanegroup.org
www.cesa.org
www.resilient-power.org



www.neesc.org

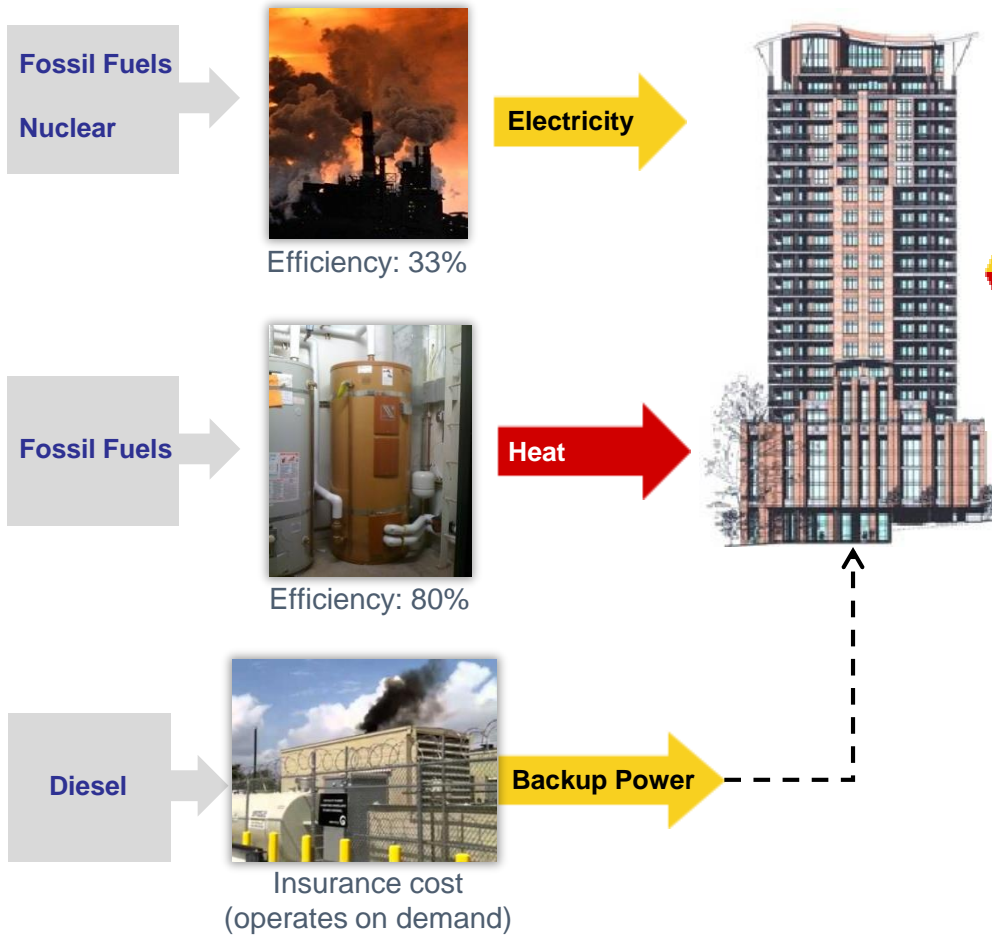
DOOSAN

Fuel Cells: The Clean Energy You Count On

Fuel Cells for Educational Facilities

A NEW ENERGY MODEL

Old Utility Model

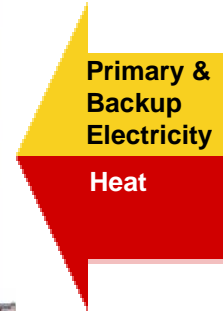


New Fuel Cell Model

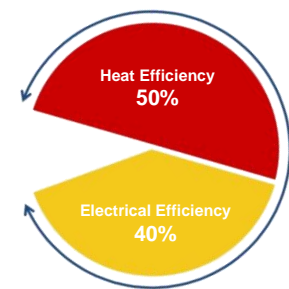
PureCell® Model 400 System



Efficiency: 90%



Up to 90% total CHP energy efficiency



Fuel Cells provide a 41% reduction in CO₂



DOOSAN PURECELL® SYSTEM

Fuel Cell Combined Heat & Power (CHP) Systems



**440 kW fuel cell
combined heat and power
fueled by natural gas**



CLEAN

- 90% system efficiency
- Ultra-low CO₂ and air emissions
- Water savings



SECURE

- Continuous, onsite power
- World-class uptime / availability
- Grid-independent critical power

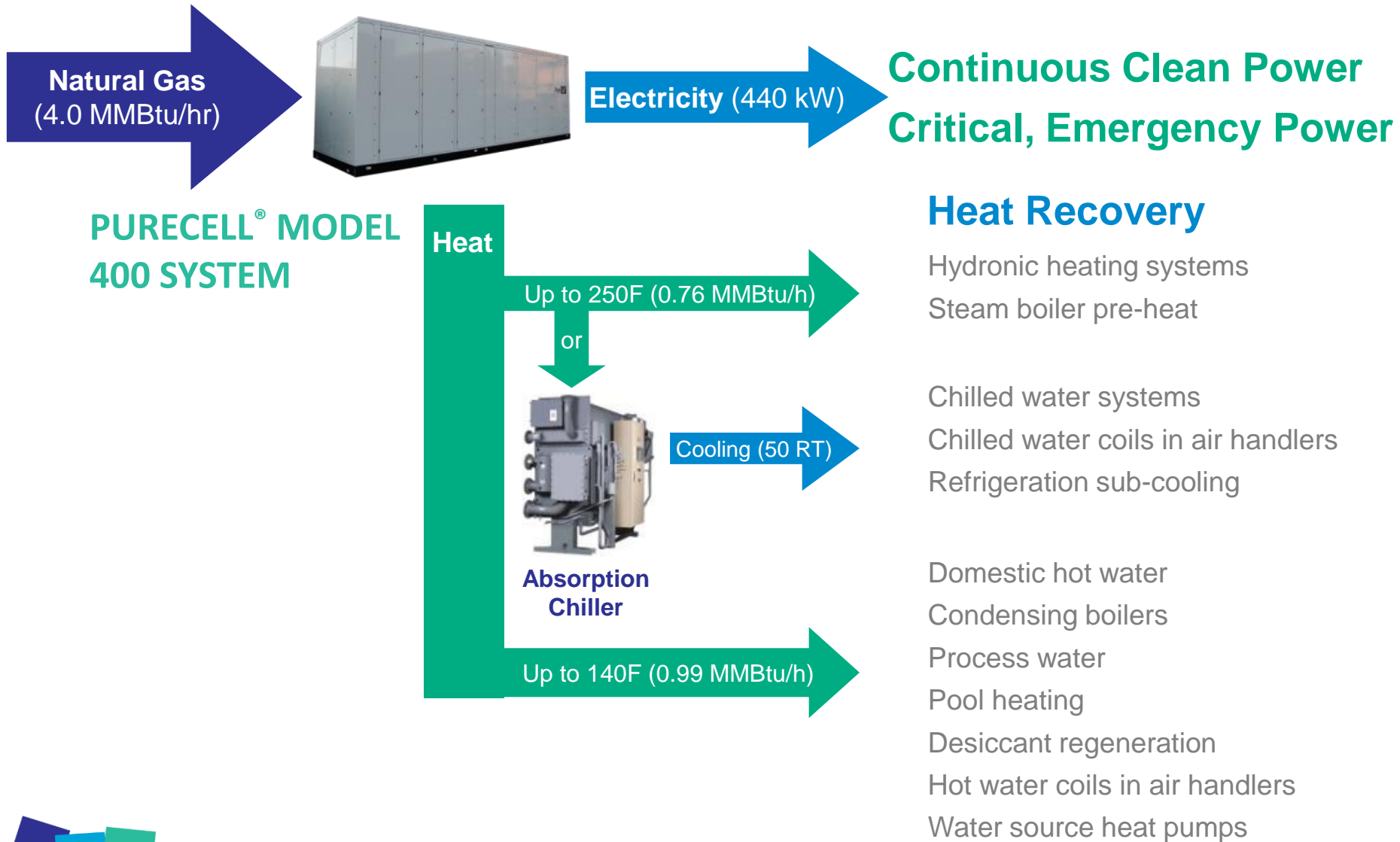


COST-EFFECTIVE

- 10 year stack life
- Low cost natural gas
- Competitive cost of energy



ENERGY APPLICATIONS



ENVIRONMENTAL BENEFITS

CO₂



1.1 million lbs
saved**

(116 acres of trees)

NO_x



3,300 lbs
saved**

(87cars)

H₂O



1.4 million gal
saved**

(2.2 Olympic pools)

NOISE



65 dBa @ 10 m

(no louder than
piano music)



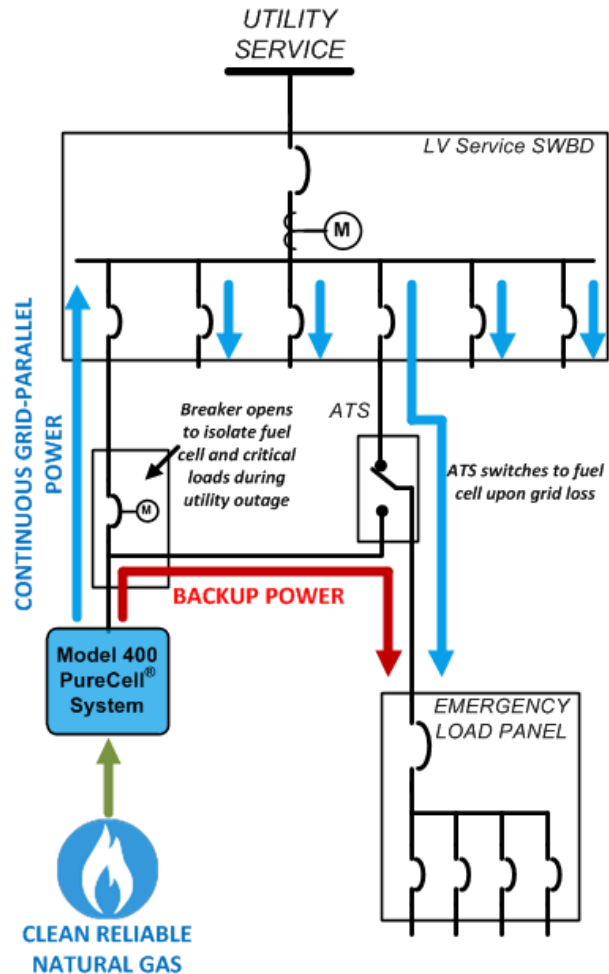
**Fuel cell installation can
provide 4-6 LEED points**



** Annual savings from one PureCell Model 400 compared to traditional energy sources.
CA Example.

FUEL CELL BACKUP POWER

PURECELL MODEL 400



- Continuous operation – system running when backup power needed
- Critical asset used continuously for energy savings
- No requirement for periodic testing
- Greatly reduced noise and emissions
- Highly reliable natural gas - no diesel tanks or refueling
- Heat available during grid outage
- Low greenhouse gas footprint

COUNT ON OUR RELIABILITY

CRITICAL POWER CAPABILITY



October 2012 Hurricane Sandy

- All 23 PureCell System Model 400 fuel cells in the impacted areas were operational during the storm
- Stop and Shop (Torrington, CT) automatically transitioned to grid-independent mode providing power throughout the storm



CT October 2011 Winter Storm

- South Windsor High School serves as community shelter
- Whole Foods Market prevents costly food spoilage
- CT Juvenile Training Facility operates continuously through prolonged power outage



San Diego September 2011 Blackout

- Albertsons supermarket remains open for business
- Perishable inventory protected
- One of the few retail stores operating

EXAMPLE ECONOMICS

Connecticut Example

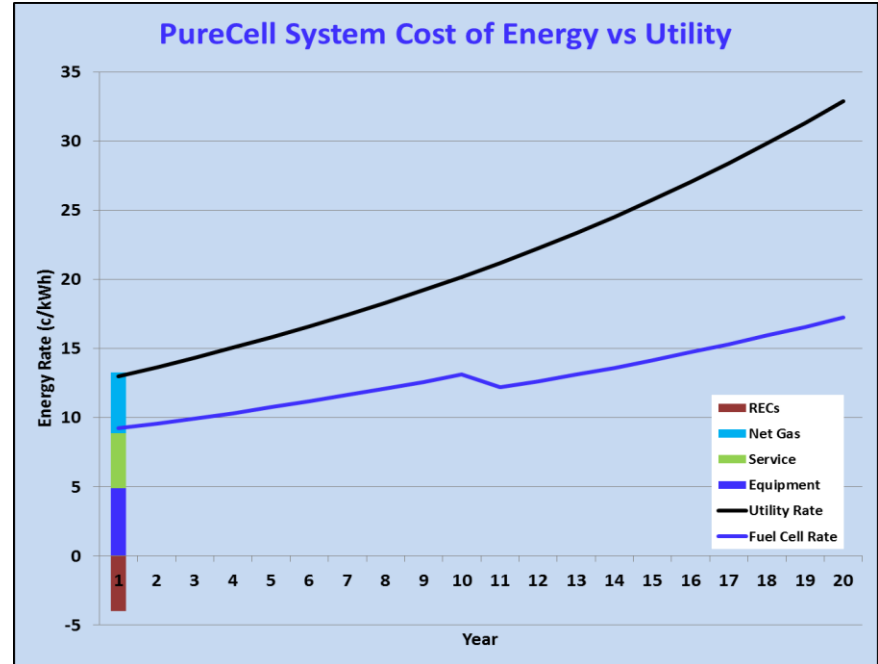
**COST OF PURECELL SYSTEM ENERGY
= 9.2 c/kWh**

Capital Costs

- Total installed cost
- Includes 30% Federal tax credit
- Financed over 20 years

Operating Costs

- Natural gas @ \$7 /MMBtu
- Includes benefit of reduced facility heating fuel through heat recovery
- 20 year comprehensive plan
 - Includes overhaul after year 10
- Renewable Energy Credits (RECs) @ 4 c/kWh



	C/KWH	20 YEAR COST
Utility	13.0	\$15.5 M
PureCell System	9.2	\$9.2 M



EDUCATION CUSTOMERS

9 UNITS
3.7 MW
8 CUSTOMER SITES

University of Connecticut



Rochester Institute of Technology



California State University



Norco College



Hamden High School



Eastern CT State University



Western CT State University



New Haven Schools



CUSTOMER PROFILE



PROJECT DETAILS

- 400 kW fuel cell installed 2012
- Continuous-duty baseload operation
- Heat recovery for space heating, space cooling, domestic hot water

2013 CT DEEP MICROGRID AWARD RECIPIENT

- Electrical gear upgrade to enable isolation of entire campus
- Fuel cell will work with solar PV and back-up gensets to power critical loads across multiple buildings

CUSTOMER PROFILE

R·I·T

Rochester Institute of Technology



PROJECT DETAILS

- 400 kW fuel cell installed 2013
- New construction project
- Continuous-duty baseload operation
- Grid-independent backup power for critical circuits
- Heat recovery for space heating and domestic hot water
- NYSERDA grant to support installation (PON 2157)

“Every visitor will recognize that this is more than an impressive structure. A new generation of engineers, architects, scientists and policy makers will work and study here. This facility represents the next step in RIT’s development as a leading innovator in sustainable development.”

Nabil Nasr

Director of the Golisano Institute for Sustainability



CUSTOMER PROFILE

NORCO COLLEGE

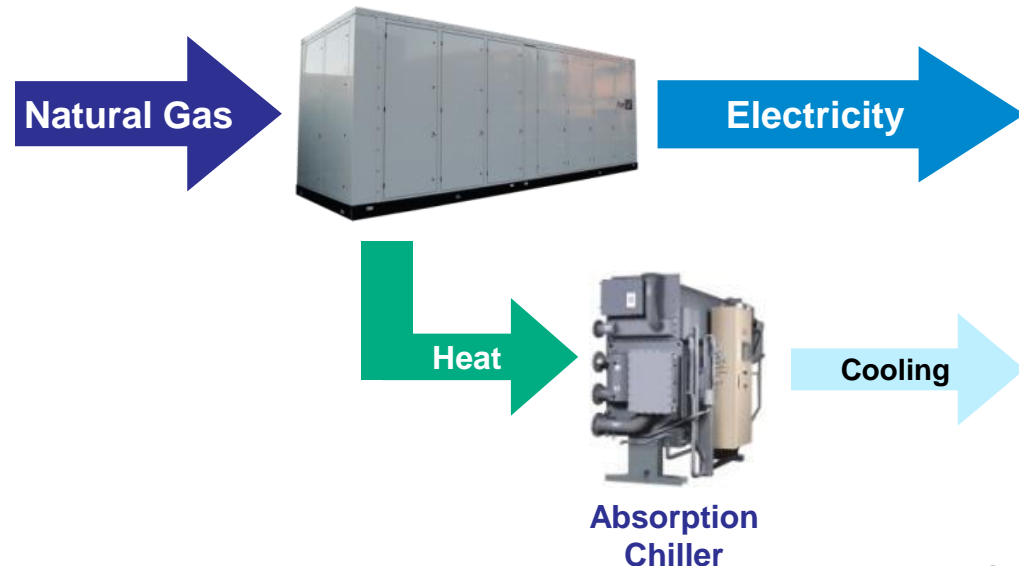


“We are devoted to fostering environmental responsibility and sustainability among our student body, while controlling energy costs”

Laurens Thurman
Facilities Planning and Development

PROJECT DETAILS

- Riverside Community College District, Norco, CA
- 400 kW fuel cell installed 2014
- Continuous-duty baseload operation
- Heat recovery for space cooling through absorption chiller



KEY MARKETS

DATA CENTERS/ TELCOM



UNIVERSITIES



HOSPITALS



INDUSTRIAL



KEY MARKETS

UTILITIES



RETAIL



COMMERCIAL



GOVERNMENT



DOOSAN GROUP

GLOBAL

- \$22 billion revenue
- 42,000 employees

U.S.

- \$3 billion revenue
- 3,000 employees
- Major brand: Bobcat



Power Generation



Water Desalination



Construction Equipment



Electro-Materials



A group of four children are running happily across a vast, green grassy field under a bright blue sky with scattered white clouds. In the foreground, a young girl with blonde hair, wearing a pink and white plaid shirt and white shorts, is running towards the camera while holding a blue butterfly net. To her right, another girl in a bright green t-shirt and denim shorts is running. In the background, a boy in a brown and white plaid shirt and khaki pants is also running, and another child in a yellow shirt is partially visible behind him.

Kent McCord
Doosan Fuel Cell
kent.mccord@doosan.com

DOOSAN

The Clean Energy You Count On

Fuel Cell Generation System for Universities



Presentation By:

BioFuels Energy, LLC.
2211 Encinitas Blvd.
Encinitas, CA 92024

BioFuels
energy, LLC.

About BioFuels Energy



- BioFuels Energy is a company with significant hands-on experience in the purchase, installation, interconnection, permitting, contracting and operations of 5.5 MW's of fuel cell power.
- BioFuels has fuel cells operating at the University of California, San Diego, City of San Diego and soon California State University, San Marcos.
- BioFuels has experience with various fuel cell and cogen technologies.
- BioFuels also has experience in securing biogas from wastewater treatment plants and landfills. BioFuels currently operates the only plant in California that injects cleaned biogas to the utility pipeline.

CSU San Marcos



- The California State University San Marcos (CSSM) is located in northern San Diego County. CSSM is part of the California State University System. The CSSM campus was founded in 1989 and currently has over 10,000 students enrolled.
- CSSM is fully accredited by the Western Association of Schools and Colleges and is the 20th campus established in the 23-campus CSU System.
- The campus has more than one million square feet of facilities, all of which has been constructed since 1990.
- CSSM's annual spending approximated \$189 million in 2013 supporting over 5, 000 employees.

Cal State University San Marcos



Project Incentives (cont.)



- **FEDERAL INCENTIVES** – This Project is eligible to receive incentives through the Federal Investment Tax Credit (ITC). This program allows developers of fuel cell projects a 30% tax credit based on the project costs. Additionally, this Project is entitled to MACRS accelerated depreciation benefits.
- BioFuels will be monetizing the ITC and MACRS providing incentives of \$2.9 million to reduce the Project capital costs.

Project Incentives



- **This project is entitled to receive the following incentives to assist in paying down the cost of the fuel cells:**
- STATE INCENTIVES – This Project is eligible to receive incentives through the California State PUC’s Self Generation Incentive Program (SGIP). The California Public Utility Commission’s SGIP provides incentives for the installation of new qualifying distributed energy resources, including fuel cells. SGIP funding is NOT revenue of the State of California or any jurisdiction of the State. Funding is supplied through a Public Goods Charge to utility customers.
- This Project qualifies for \$1.98 million of SGIP incentives.

Stationary Fuel Cell System Comparison



Best-in-Class Stationary Fuel Cell

Company Product	Bloom Energy ES5700	Fuel Cell Energy DFC1500	CEP PureCell Model 400	<i>PureCell System Advantage</i>
Fuel cell technology	Solid Oxide	Molten Carbonate	Phosphoric Acid	<i>Most proven technology</i>
Operating temperature (F)	1300	1300	375	<i>Lowest operating temperature</i>
Cell stack life (yr)	3	5	10	<i>Most durable cell stack</i>
Power – rated / avg lifetime (kW)	210 / 200	1400 / 1345	400 / 400	<i>Steady power output</i>
Heat output (MMBtu/MWh)	N/A	1.59	3.88	<i>Most available heat</i>
Efficiency – overall / electrical (% LHV)	50% / 50%	69% / 47%	90% / 42%	<i>Highest overall efficiency</i>
Electric Load Following (Y/N)	N	N	Y	<i>Electric load following</i>
Weight (lb/kW)	194	162	158	<i>Lowest weight</i>
Installation footprint (ft ² /kW)	2.5	2.9	2.2	<i>Smallest footprint</i>
Indoor and rooftop installation (Y/N)	N	N	Y	<i>Most flexible siting</i>
Water consumption / discharge (gal/MWh)	0 / 0	200 / 100	0 / 0	<i>Responsible water use</i>

Fuel Cell Information



- The following slides will reflect the specific aspects of BioFuels proposed fuel cell application for the PureCell 400 model.
- BioFuels configures 2 of these fuel cells and is able to generate 880kW in electricity along providing waste heat for hot water loop. An additional option is to run a 90Ton chiller with waste heat.

Fuel Cell Permitting/Emissions/Exempt from Standby Charges



- The PureCell fuel cells are California Air Resource Board compliant.
- The PureCell fuel cells are exempt from AB 32 GHG emission requirements.
- The PureCell fuel cells, less than 1MW, are eligible for the CPUC Fuel Cell Net Energy Metering Tariff which features and exemption from utility stand-by charges.
- The fuel cells can add a feature for island mode and act as a back-up generator.

Key Elements of the PureCell Fuel Cell



- The PureCell fuel cells require no water consumption or water discharge. With the current drought state of emergency declared by Governor Brown, implementing any new project must minimize the use of water.
- The PureCell fuel cells have a 10 year stack life since they run at 375 degrees versus 1300 degrees for other stationary fuel cells with shorter stack life's.
- The PureCell unit has 97% system reliability resulting in minimal demand charges.

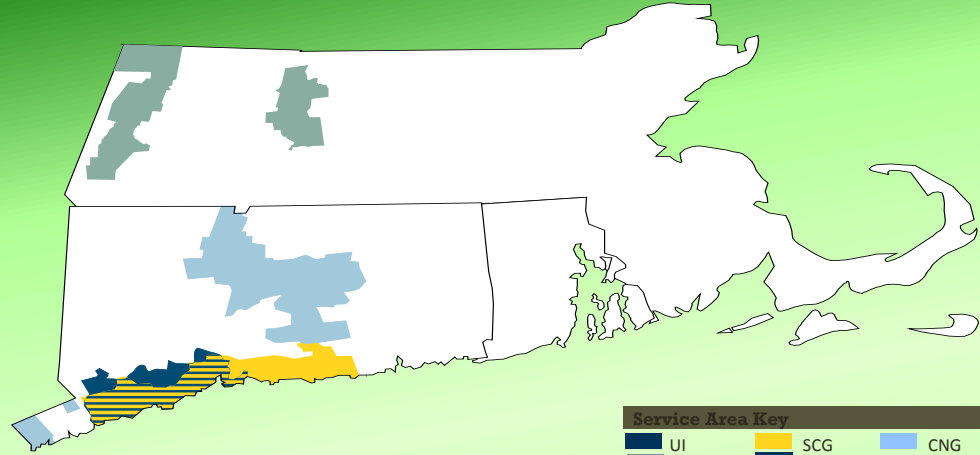
Heat Smart.

Natural Gas Fuel Cells for
Educational Facilities

A UIL Holdings Company




a diversified energy delivery company




The United Illuminating Company (UI)

- Service territory: 335 sq miles
- ~321,000 customers
- 17 communities
- 50% interest in GenConn Energy LLC




Southern Connecticut Gas (SCG)

- Service territory: 512 sq miles from Westport, CT to Old Saybrook, CT
- ~183,000 customers
- 2,281 miles of mains with ~133,000 services
- 24 communities




Connecticut Natural Gas (CNG)

- Service territory: 716 sq miles - Greater Hartford-New Britain & Greenwich
- ~165,000 customers
- 2,022 miles of mains with ~126,000 services
- 22 communities



Berkshire Gas Company (Berkshire)

- Service territory: 738 sq miles in Western MA including Pittsfield and North Adams
- ~37,000 customers
- 744 miles of mains with ~31,000 services



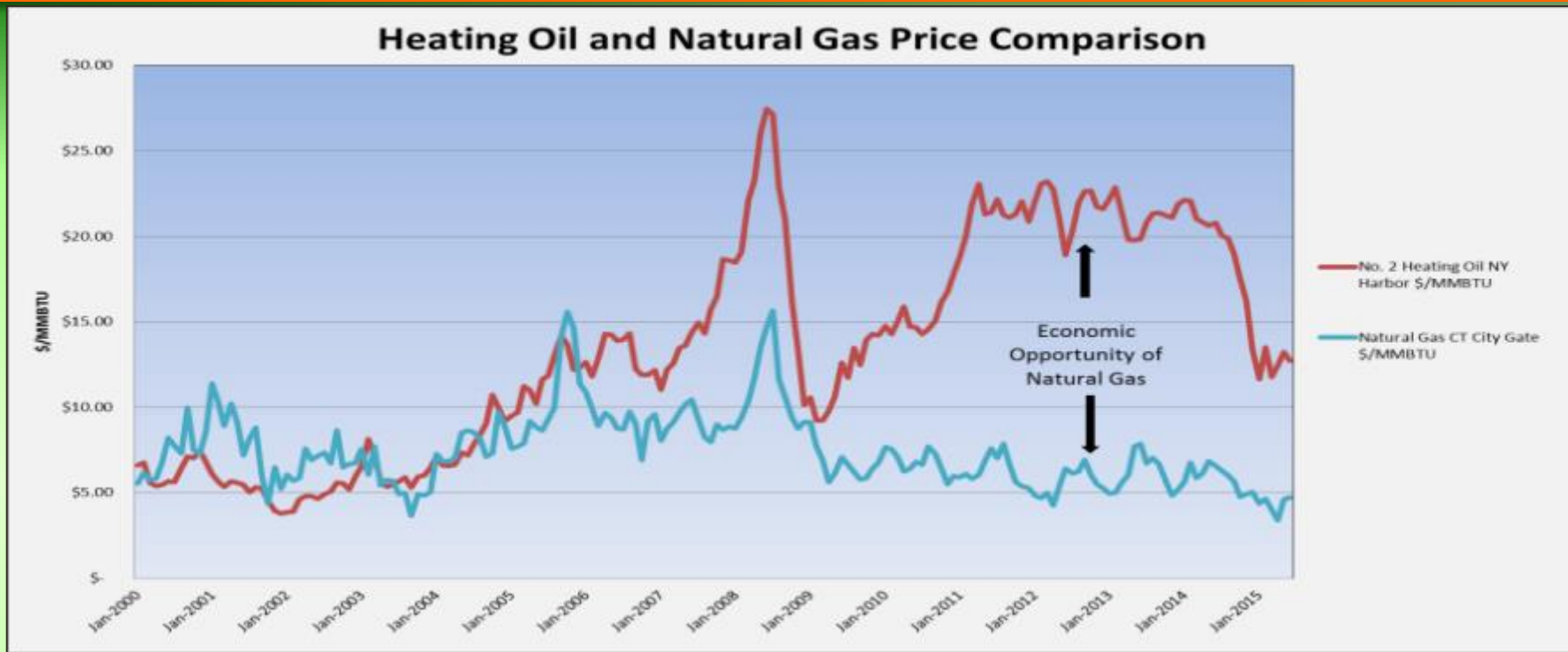
The Regulated Utility Model

What's in it for me?

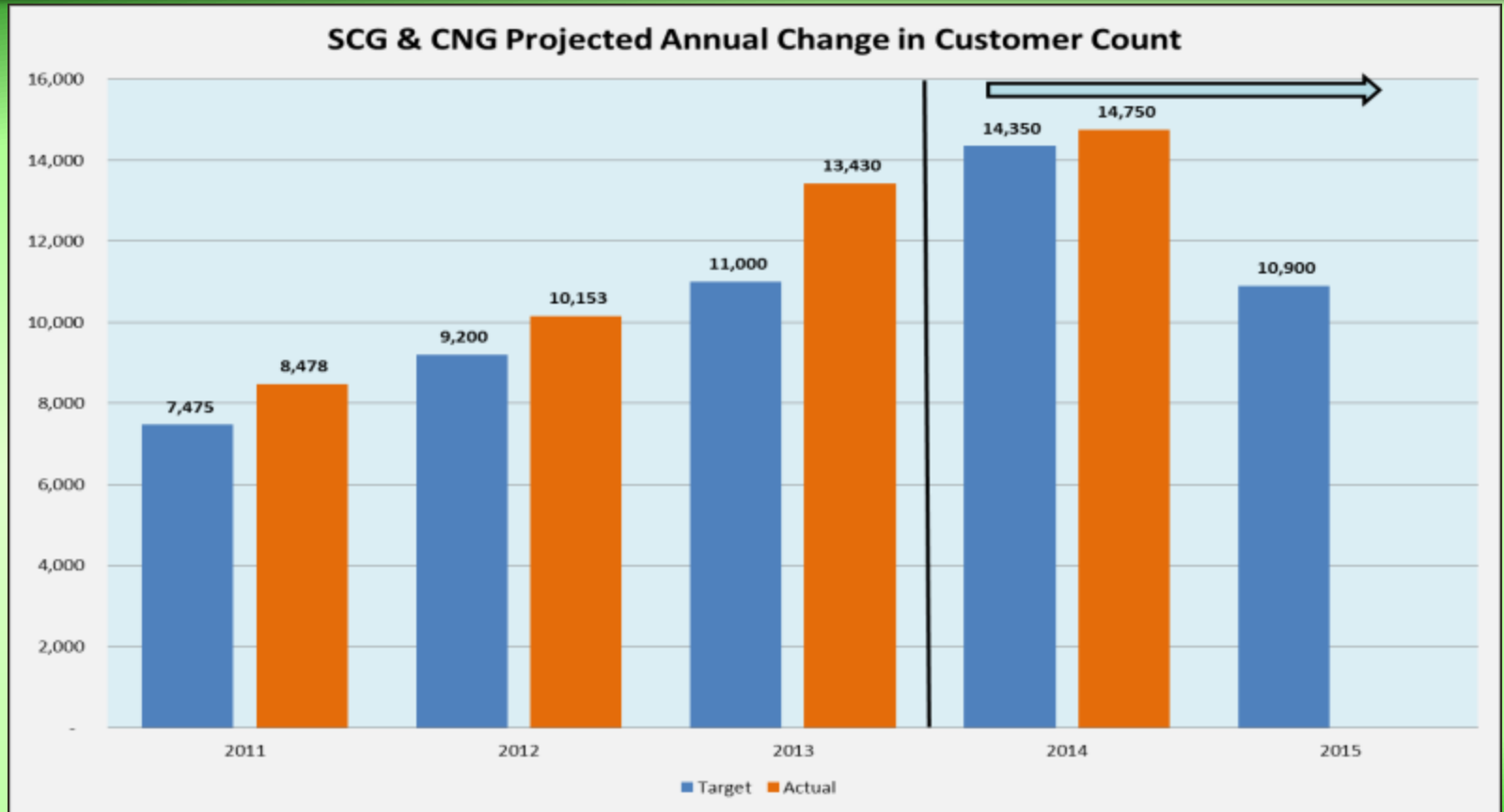
- Natural gas customer acquisition
- Infrastructure/franchise expansion
- Increased revenue
- Base load consumption
- Long term customers
- Base load generation helps reduce grid congestion
- Revenue decoupling



The Economic Advantage of Natural Gas



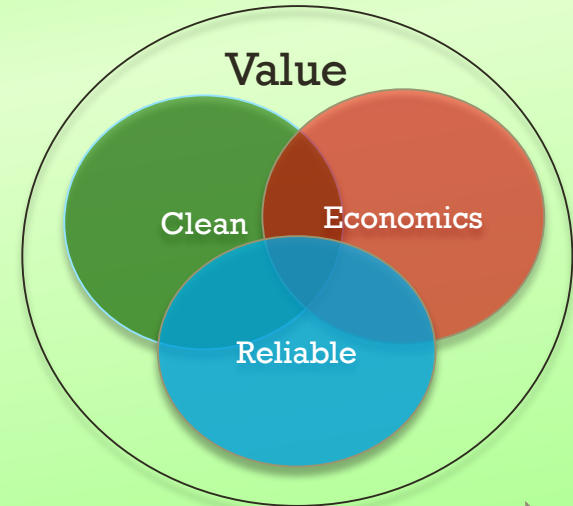
Economic Advantage = Positive Correlation to Customer Acquisition



Understanding the Customers Needs

- **Fuel Choice**
- **Budget Stability**
- **Convenience**
- **Clean**
- **Simple**
- **Economical**
- **Reliable**

Design Incentives to Remove Barriers to Entry & Provide Value



Customer Feedback

Customer Value

Leveraging all Available Tools

Layer Programs & Incentives

The collage features several key documents and logos:

- 2013 Comprehensive Energy Strategy for Connecticut**: A report from the Connecticut Department of Energy and Environmental Protection.
- CLEAN ENERGY FINANCE AND INVESTMENT AUTHORITY**: Logo for the state's clean energy financing body.
- FCFIRST Since 1947**: Logo for the Connecticut First Energy Fund.
- cpace**: Logo for the Connecticut Power and Energy Assistance Center.
- energize CONNECTICUT**: Logo for the state's energy efficiency program.
- NATURAL GAS RATE ANALYSIS AND COMPARISON**: A document comparing natural gas rates for residential and commercial customers.
- MANUFACTURER REBATE**: A document offering a rebate for energy-efficient equipment.

Distributed Generation Rebate (Rider DG)

Customer Side Distributed Resource means (A) the generation of electricity from a unit with a rating of not more than sixty-five megawatts on the premises of a retail end user with the transmission and distribution system including, but not limited to, **fuel cells**, photovoltaic systems or small wind turbines

+ LREC's

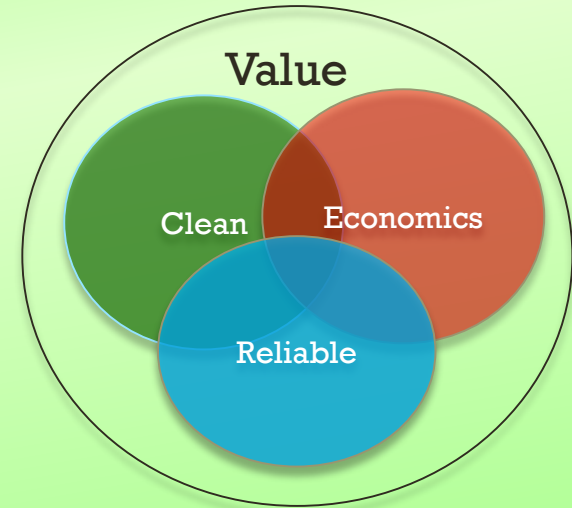
=Long-Term Economic Viability

East Hampton Expansion



Summary

- Hedge against rising electric costs
- Budget stability
- Access to natural gas
- Increased tax revenue
- Sustainability
- Power reliability



Thank you.

Erik Robie Manager
Commercial & Industrial
Sales



UIL HOLDINGS COMPANIES