

EPA CHP PARTNERSHIP & CHP ASSOCIATION WEBINAR:

SCORING LEED® POINTS WITH CHP

July 22, 2:00 – 3:00 PM ET



WEBINAR LOGISTICS

- All attendees are in listen-only mode.
- Attendees can submit questions and comments in writing via the online control panel.
- These questions will be asked during the Q&A session in the order that they are received and as time allows.
- Presentations will posted to EPA's CHP website in the next week:



Questions

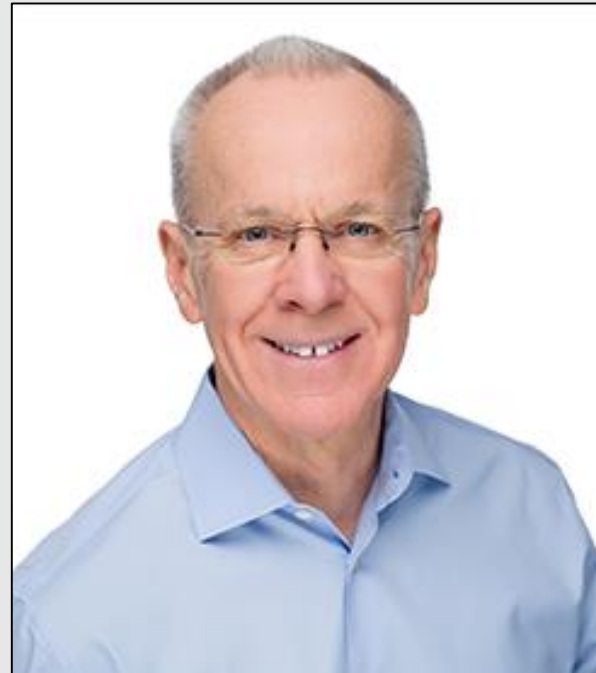
[Enter a question for staff]

Send

<http://www.epa.gov/chp/events/webinars.html>

TODAY'S MODERATOR

Gary McNeil
U.S. EPA CHP Partnership

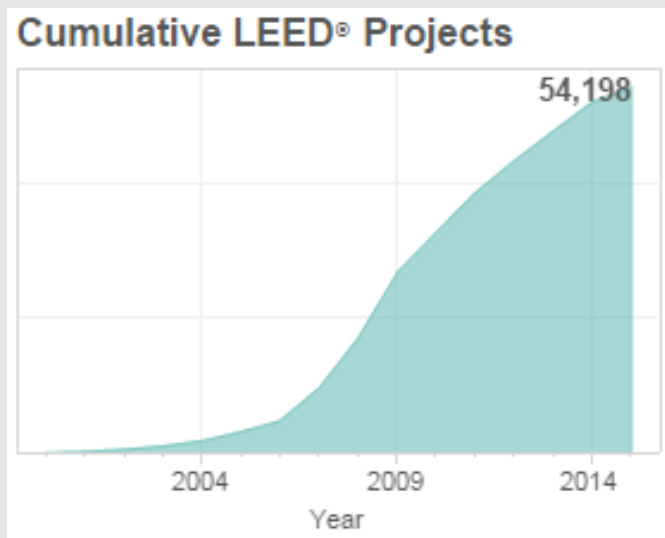


CHP PARTNERSHIP

- Information and tools to support CHP project development
- Advance CHP-friendly
 - emissions regulations
 - permitting practices
- Epa.gov/chp

GROWTH OF LEED® GREEN BUILDING PROGRAM

- LEED® green building program launched in 2000
- In the U.S. (as of July 2015):
 - More than 23,000 LEED®-certified commercial projects (3.3 billion GSF)
 - More than 30,000 additional LEED®-registered commercial projects (5.1 billion GSF)



TODAY'S PRESENTERS



Charlie Goff
Eastern Research Group



Doug Davis
Broad U.S.A. INC



Diane Molokotos
Aegis Energy Services



Jeff Beiter
E-finity

TREATMENT OF CHP IN LEED® FOR BUILDING DESIGN AND CONSTRUCTION: NEW CONSTRUCTION AND MAJOR RENOVATIONS

Charlie Goff

Eastern Research Group

July 22, 2015

OVERVIEW

- CHP's value for LEED® projects
- How CHP is accounted for in LEED®
- CHP Partnership LEED® resources

LEED® 2009 CERTIFICATION LEVELS

Level	Points
Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80-110

56 credits worth a potential 110 points

IMPORTANCE OF ENERGY & ATMOSPHERE: OPTIMIZE ENERGY PERFORMANCE CREDIT

LEED® Version	Total # of Pts. Available	Total # of Pts. Needed to Earn LEED® Certified™	Total # of Optimize Energy Performance Pts. Available
LEED® v2009	110	40	19

➔ Achieving all of the available Optimize Energy Performance credits would represent 47.5 percent (LEED® v2009) of the points needed to earn certification at the “LEED® Certified™” level.

CHP'S DEMONSTRATED POINT IMPACT

Building	# of Apts.	CHP Type/Size	Pts. w/out CHP	Pts. w/CHP
1	620	130 kW MT	2	8
2	340	65 kW MT	2	10
3	500	200 kW MT	2	7
4	100	65 kW MT	1	7
5	185	65 kW MT	3	9
6	250	65 kW MT	1	7
7	230	200 kW MT	0*	9
8	40	75 kW Recip	0*	4

* Would not meet Prerequisite w/out CHP

OPTION 1: WHOLE BUILDING ENERGY SIMULATION

- LEED® v2009
 - Projects must demonstrate savings of 10% (new construction) or 5% (major renovations) in the Design Building compared to a Baseline Building meeting the minimum requirements of ASHRAE 90.1-2007.
- Savings are based on energy costs and determined by running energy models for the Design and Baseline Buildings

USGBC METHODOLOGY FOR MODELING CHP

Methodology for Modeling Combined Heat & Power for EAp2/c1 in LEED® 2009

<http://www.usgbc.org/resources/methodology-modeling-combined-heat-amp-power-eap2c1-leed-2009>

- Guidance on how to account for CHP in the energy model required by Option 1
- Applies to on-site CHP systems which can either have the same ownership as the project (Case 1) or different ownership (Case 2)

USGBC METHODOLOGY FOR MODELING CHP

1. Energy requirements for the Baseline Building (which must meet requirements of ASHRAE 90.1) are estimated using an energy model.
 - ➔ Based on the model output, the cost of purchased grid electricity and purchased fuel to generate thermal energy is calculated.

USGBC METHODOLOGY FOR MODELING CHP

2. The same process is used with the Design Building (the one with CHP).
 - ➔ The cost of fuel for the CHP and any purchased electricity or fuel used to produce thermal energy is calculated.

USGBC METHODOLOGY FOR MODELING CHP

- Optimize Energy Performance points are calculated based on the percentage reduction in energy cost for the Design Building.

Percent Improvement Over Baseline	Points
12%	1
14%	2
16%	3
26%	8
34%	12
48%	19

CHPP RESOURCES

- **Treatment of CHP in LEED® for Building Design and Construction: New Construction and Major Renovations**
 - Introduces CHP and its benefits to architects and engineers
 - Summarizes how CHP is treated under LEED® BD+C: New Construction

 - **LEED® CHP Calculator**
 - Estimates the energy cost savings and “Optimize Energy Performance” points a building meeting the requirements of ASHRAE 90.1 can achieve with CHP
 - Intended to be used at very early stages of building design so that CHP is given consideration as an energy option
- ➔ Both resources available at www.epa.gov/chp.

KEY TAKEAWAYS

- CHP can have a dramatic LEED® point impact
- CHP has lots of other benefits for buildings
- Think of CHP for your next project
- We're here to help!

CONTACT INFORMATION

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WHAT IS AN ABSORBER – WHAT’S NEW?

- Thermally Driven Chiller that makes cold water
- Typical application is 44 F (+ or -) “HVAC”
- Commonly applied in chilled water systems for HVAC in almost any type of building
- AKA “absorption chillers” or “Chiller/Heaters”
- What’s different with **Modern** Units?
- Better part load COP/NPLV and unloading ..10%
- Better materials, controls & vacuum standards

COMMERCIAL ABSORPTION - 70 YEARS LAST 14 YEARS HAS BEEN SIGNIFICANT



Monitoring via the web
Modern PLC controls
demystifies operation

UNAF
UNIVERSITY OF ALASKA
FAIRBANKS

	Run 'F'	Set 'F'	Refc. Level
Chilled water inlet	43.7	44	
Chilled water outlet	36.2		
Cooling water inlet	36.7		
Cooling water outlet	34.8	34.8	
RTU Temp.	185.1		
Heat exchanger Temp.	336.1		
Coolant exchanger Temp.	332.8		
Inductor	34.8		

Heat Follow/ON

Chilled Water Pump: 18 Hz, 18 Chilled K, 18 Cooling K, 18 Cooling W, Presence, All Hz

Refrigerant Pump: 36.2 Hz, 36 Chilled K, 36 Cooling K, 36 Cooling W, Presence, All Hz

COOLING 制冷

Operation Info
Parameter Setting
Real-time Alarm
Compressor/Condenser
Refr. Substation
Heat Substation
Change Password
Start
Closest Service



BROAD MANUFACTURES, MONITORS, SERVICES AND PROVIDES TRAINING ON ABSORBERS



WHY **MODERN** ABSORBERS ARE GOOD FOR LEED PROJECTS

- Many Building designs have traditional heat loads that make CHP effective.
- Cooling loads can be viewed as “heat loads” with the utilization of thermal chillers
- No Chemical Refrigerants equals
- **1 LEED point directly!**
- H₂O is a “**Natural Refrigerant**”
- <http://www.r718.com/>

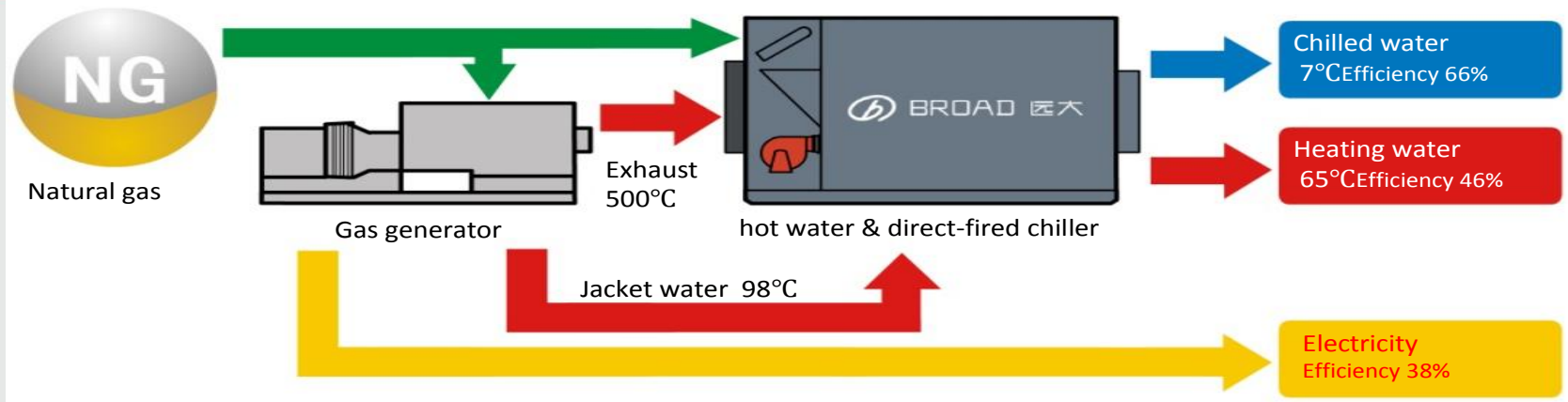
*Stable
Nontoxic
Low cost
Readily available
Environmentally
friendly – no EPA
phase out date!*



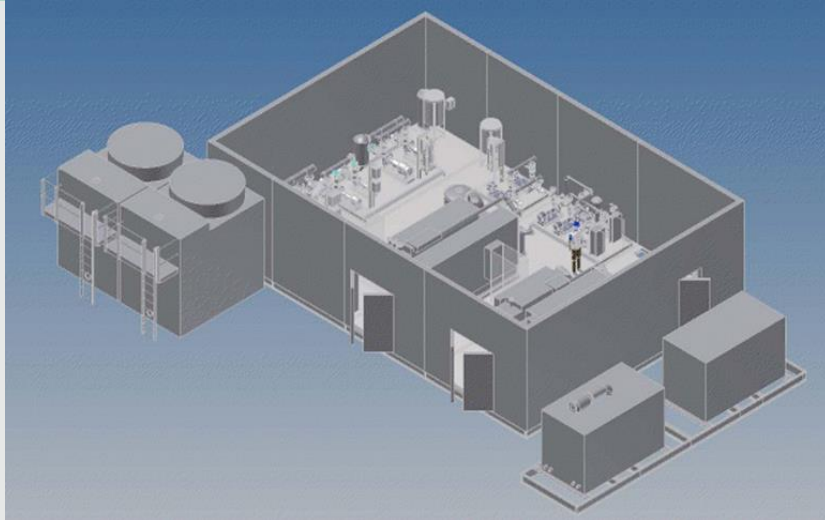
ANY TYPE OF HEAT INPUT WORKS IN A **MODERN** ABSORBER

- PRIME MOVERS applied in CHP generate usable waste heat in various forms. All of which can be used to drive the cycle of **Modern** Absorber
- Some Fuel cells = Hot Air = 750 F
- Turbines (Large & Micro) = Hot Combustion Air
- Reciprocating Engines = “Tail pipe exhaust” & “Jacket Water” – keeps engine from overheating
- Using waste heat in cooling operation often aids in the proper design of CHP or CCHP

TYPICAL ARRANGEMENT RECIPROCATING ENGINE (LEED PLATINUM!) 4GG



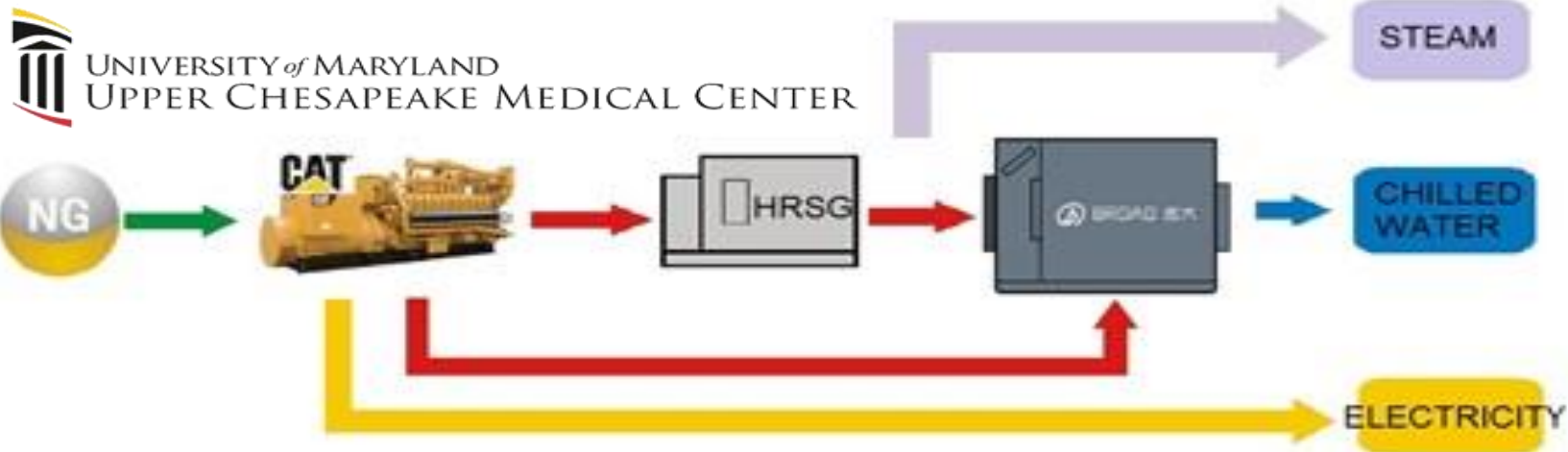
MULTI-ENERGY ABSORPTION SIMPLIFIES OPERATION, DESIGN & IS FLEXIBLE



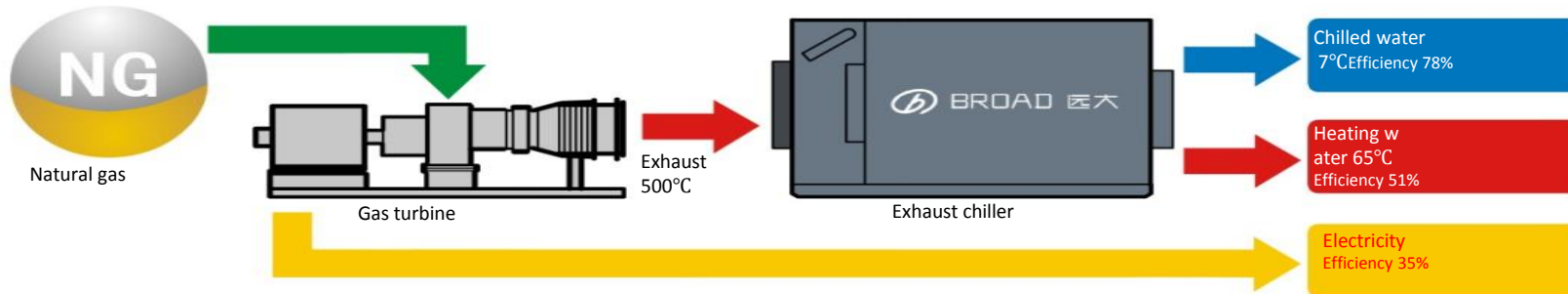
MULTI ENERGY ABSORPTION APPLIED IN CCHP CAN GENERATE LEED POINTS AND PROVIDE MANY OTHER BENEFITS

- Smaller Mechanical Equipment Room
- Lowers cost to recover heat (Less Units)
- Simple sequence of operation & flexibility
- Increases Up-time via higher reliability with less moving parts i.e. points of failure
- Maximizes loading of chiller (10 to 100%)
- LEED points “indirectly” by enabling CHP in building that might be difficult to do without thermal chillers (i.e. heat sink in summer)

TYPICAL ARRANGEMENT FOR HOSPITAL WITH VARYING STEAM DEMANDS AND AN EXAMPLE OF THIRD PARTY OWNERSHIP



LARGE TURBINE APPLICATION— DATA CENTER & OFFICES IN CALIFORNIA





CHP DEVELOPER EXPERIENCE WITH LEED

Diane Molokotos
Project Engineer

AEGIS ENERGY SERVICES: WHO WE ARE

- Largest developer of small modular CHP (Northeast and Mid-Atlantic)
- 500+ CHP systems installed.
- NYSERDA qualified, EPA CHP Partner
- Vertically integrated
- Single point responsibility
- Privately held company headquartered in MA
- In business for 30+ years.

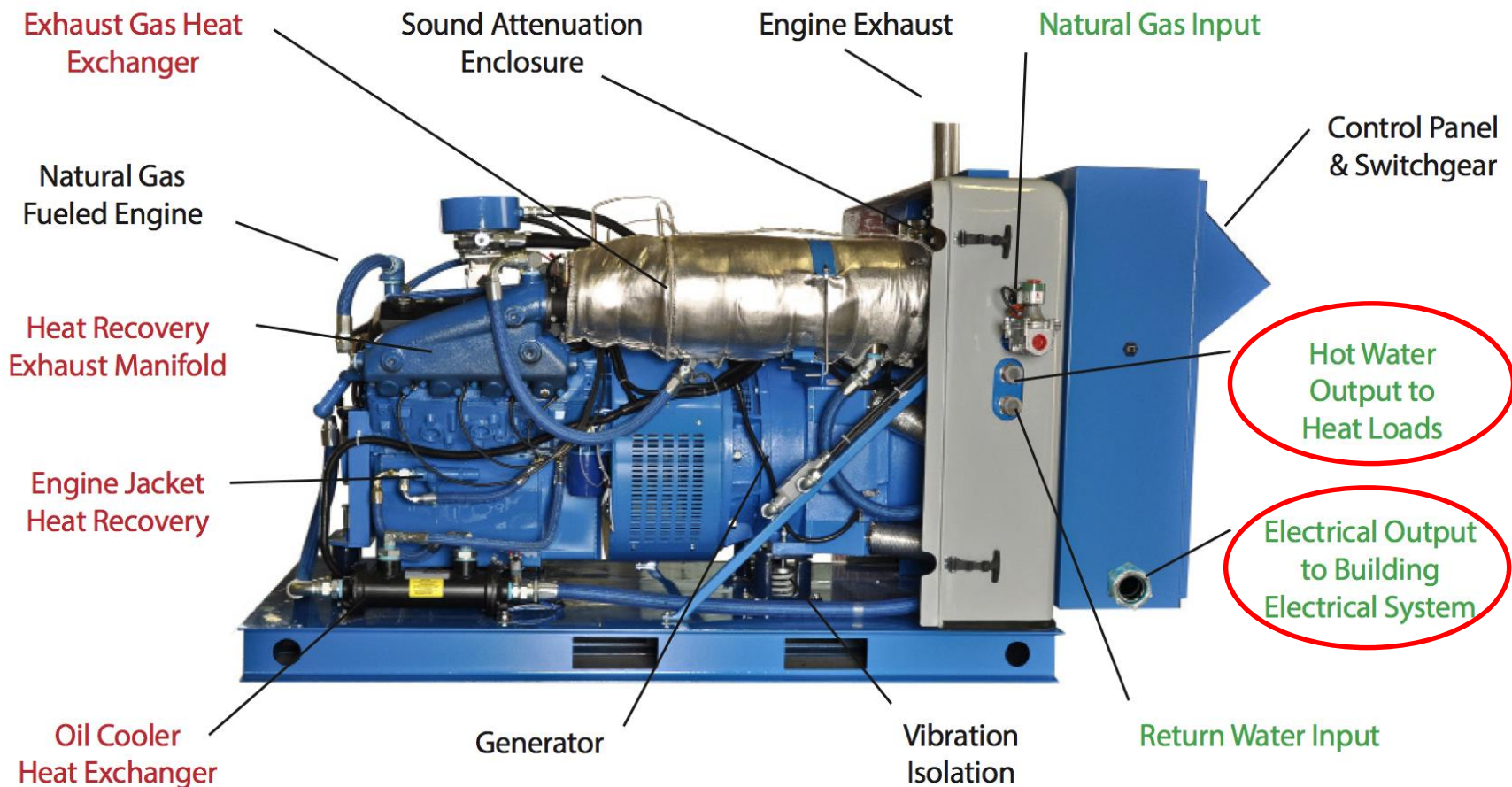
AEGIS CHP MODULES

AEGEN THERMOPOWER 75 LE MODULES



AEGIS
ENERGY SERVICES, INC.

AEGIS PRODUCT ARCHITECTURE



AEGIS
ENERGY SERVICES, INC.

PLUG & PLAY MODULAR SYSTEMS



Modular and scale-able!

WHAT ARE GOOD CHP PROJECTS?

- Building heated by hot water
- 40,000 + therms of gas annually
- 100+ apartments, beds or residents
- One electric and one gas meter
- High electric rates
- Heated pools

TO MAXIMIZE ENERGY SAVINGS..

Design system to be *thermal load following*

- Size overall CHP system to match thermal needs
- Employ hot water storage tanks for peaks
- Aegis CHP modules adjust power (30kw-75kw) to match building heat/hot water
- If thermal demand below low, system pauses to avoid heat dump
- Only time heat dump may occur is if performing electric peak shaving

CASE STUDY 1: “THE LARSTRAND” (NYC)

- 184 Residential Units;
Retail spaces
- 200,000 sq ft, 24 stories
- Market rate and
affordable rental
apartments
- Final stage of comments
awaiting SILVER
certification

2182 Broadway, New York, NY



THE LARSTRAND CHP PLANT

- Aegen Thermo Power TP-75
- Provides 100% domestic hot water and 20% of building's electrical needs
- Estimated 12% energy cost savings for 6 EAc1 points using Equest (DOE2) modeling



LEED CALCULATIONS (LEED v2009)

PRE - CHP TOTAL

41	3	66	Project Totals (pre-certification estimates)	110 Points
Yes	?	No	Certified 40-49 points Silver 50-59 points Gold 60-79 points Platinum 80-110 points	

*Estimated 12% Energy Savings
(building envelope & other measures)*

POST - CHP TOTAL

47	3	66	Project Totals (pre-certification estimates)	110 Points
Yes	?	No	Certified 40-49 points Silver 50-59 points Gold 60-79 points Platinum 80-110 points	

Estimated total 24% Energy Savings Pending USGBC Approval*



LESSONS LEARNED FROM “THE LARSTRAND”

- Feasibility studies are paramount to success
- Proper CHP sizing results in high efficiency = high energy cost savings
- CHP is a valuable source of LEED points (6 points earned)
- The Larstrand goal was primarily energy savings and efficiency, LEED was a secondary goal.

FINANCIAL SUPPORT OF CHP/LEED POINTS

Grants and Incentives for CHP

- Pepco and Delmarva Power Savings Program: Combined Heat and Power (PA/DE/VA)
- New Jersey Clean Energy Program for CHP \$2,000/kW up to 30% project cost
- NYSERDA PON 2568: CHP Acceleration Program (NY) \$135,000 per 75 kW system
- MA/NSTAR: \$750/kW up to 50%
- Efficiency Maine-50% of project cost
- Rhode Island- Ngrid incentive
- CT PACE- \$450/kw through DEEP

LOOKING FOR ADDITIONAL FINANCIAL SUPPORT?

- Visit the EPA CHP Partnership database of financial incentives for CHP projects
- <http://epa.gov/chp/policies/database.html>

GET YOUR CHP LEED POINTS FOR FREE!

Aegis Shared Savings Agreement

- ✓ No capital outlay/maintenance fees/fuel expense
- ✓ Heat/Hot water at market
- ✓ Electricity at discount to market
- ✓ 15 year agreement
- ✓ Site can purchase equipment anytime at reduced cost

CASE STUDY 2: “315 ON A” (BOSTON)



- 255,000 square feet
- Multi-family
- Completed in 2013
- GOLD certified (v2009)
- Heat is building operating expense (not pro-rated)

CHP PLANT AT “315 ON A”



- Aegen ThermoPower 75kW
- Provides domestic hot water heating (100%) and (80%) building heat
- Provides 28% of building's electrical load
- System garnered 4 of the 8 points under Optimize Energy Performance credit

LESSONS LEARNED FROM “315 ON A”

- Shared Savings agreement avoided risk and provided no-cost LEED points to building
- Energy savings was the main driver for CHP, not LEED points
- System efficiency and savings scaled up as occupancy grew

PARTING THOUGHTS

- CHP: Highly efficient & proven technology
- = Major savings potential for building operating costs.
(Designing systems to be thermal load following ensures high efficiency).
- = Attractive opportunity for LEED points / LEED certification for architects, developers & new gen building tenants.
(LEED points from CHP must be considered early in design process).
- Financial support opportunities for CHP in grants, incentives, 3rd party ownership
- Building owners / developers value sole source accountability vendors

THANK YOU!

Look forward to your questions...

PENNSYLVANIA STATE EMPLOYEES CREDIT UNION



Presented by

Jeff Beiter, Managing Partner

E-Finity Distributed Generation,
an exclusive Capstone Turbine distributor



PSECU

- Located in Harrisburg, PA
- The company serves hundreds of thousands of members and is one of the largest credit unions in the state of Pennsylvania
- Newly constructed headquarters is a modern, leading edge, technology-driven structure
- 239,000-square-foot LEED Gold-certified facility and data center on a 47-acre campus



PSECU

In 2011, PSECU realized it was time to invest in natural gas power generation to reduce their overall cost of operation and become more environmentally friendly

Turned to E-Finity for a combined cooling, heating and power (CCHP) solution to contribute 8 points to their LEED certification

LEED CERTIFICATION

- 3 years of schematic and design development
- 2 years of construction under Alan Brunner, Project Manager
- CCHP plant start-up October 2013
- Only 352 buildings in Pennsylvania hold the Gold certification level



REQUIREMENTS FOR THE SYSTEM

- Onsite energy efficient electricity, space heating, cooling, and chilled water
- Teamed with local energy provider UGI Performance Solutions to develop an onsite power generation system utilizing Capstone natural gas powered microturbines



LEED CERTIFICATION

Optimized energy performance as the building has a 37.4% energy savings due to the use of a **cogeneration system** that allows the building to create its own energy and occupancy sensors that control the lighting in the building



CHP SYSTEM

- Capstone C800 Capstone Power Package
- 250-ton exhaust-fired absorption chiller
- 4 MMBTU hot water heat exchanger
- (mTIM) PLC control system
- The installation was completed in October 2013
- Three components – small, modular footprint



CHP SYSTEM



250-ton flue gas fired absorption chiller



4 MMBTU hot water heat exchanger

CHP SYSTEM

- Standalone clean power for data center UPS
- Also operates in dual mode – it is able to communicate with and work independently from the local utility grid to maximize efficiency
- 24/7 remote monitoring of site through mTIM
- Fixed cost, 9-year preventative maintenance (FPP) including 40k microturbine overhaul
- Provide backup power to site's data center
- Provide baseload electricity to building



WHY CAPSTONE FOR CHP?

- Capstone microturbines are air lubricated and air cooled
- They offer very low emissions without the need for exhaust treatment
- The C800 system is constructed of 4 individual C200 microturbines providing inherent redundancy
- Inherent redundancy allows maintenance without an interruption in power generation



WHY CAPSTONE FOR CHP?

- PSECU is controlled by E-Finity's mTIM controller with remote monitoring, which exchanges key energy production data between the power plant and PSECU's building automation system to maximize thermal priority performance
- The mTIM monitors, diagnoses, and troubleshoots the Capstone system 24/7 and allows E-Finity's customer service department to fix the units remotely
 - minimizing downtime
 - maximizing uptime for the end user



IN NUMBERS

- LEED status – Gold with 8 points
- 800kW gross electrical capacity
- 4.25 MBH gross thermal output
- 250-ton chilling output
- Reduces carbon emissions by 1,468 tons per year – equivalent to removing 243 cars from the road



FOR FURTHER INFORMATION

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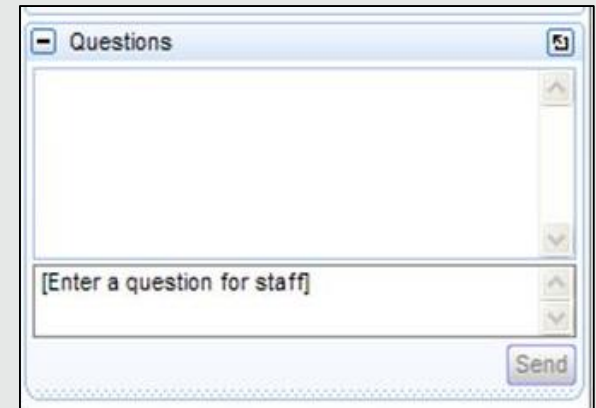
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Power to be Independent

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