U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

CHP: Enabling Resilient Energy Infrastructure

April 3, 2013

Welcome to the Webinar

Please mute your phones

August 2012 Executive Order

DOE Activities in Support of Executive Order

- "CHP as a Clean Energy Resource" new report
- Regional Industrial Energy Efficiency & Combined Heat and Power Dialogue Meetings
- Better Buildings Better Plants
- SEEAction: State and Local Energy Efficiency Action Network
- CHP assistance: Regional Clean Energy Application Centers

Recognizing the benefits of CHP and its current underutilization as an energy resource in the United States, the Obama Administration is supporting a new National goal to achieve 40 gigawatts (GW) of new, cost-effective CHP by 2020

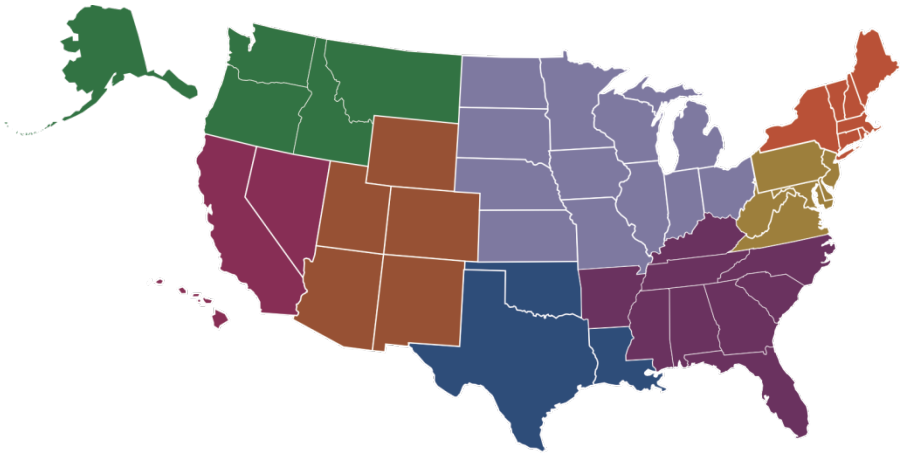
DOE CHP Technical Assistance

- **Market Assessments:** Analyses of CHP market potential in diverse sectors, such as health care, industrial sites, hotels, & new commercial and institutional buildings.
- **Education and Outreach:** Providing information on the benefits and applications of CHP to state and local policy makers, regulators, energy end-users, trade associations and others.
- **Technical Assistance:** Providing technical information to energy end-users and others to help them consider if CHP makes sense for them. Includes performing site assessments, producing project feasibility studies, and providing technical and financial analyses.

8 Regional Clean Energy Application Centers (CEACs)

and

International District Energy Association (IDEA)

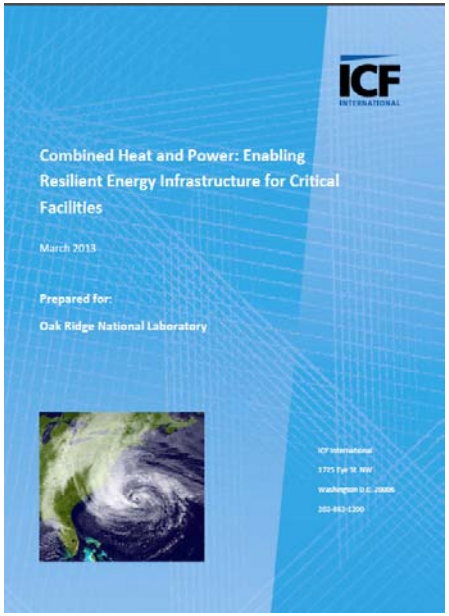


http://www1.eere.energy.gov/manufacturing/distributedenergy/ceacs.html

New Report on CHP in Critical Infrastructure

- **Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities**

- Provides context for CHP in critical infrastructure applications
- Contains 14 case studies of CHP operating through grid outages
- Policies promoting CHP in critical infrastructure
- Details how to design CHP for reliability



http://www.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_critical_facilities.pdf

Webinar Agenda

- How can CHP serve critical infrastructure facilities?
  - Tim Banach, Northeast Clean Energy Application Center
- CHP at South Oaks Hospital
  - Bob Chester, Director of Engineering, South Oaks Hospital
- Policies promoting CHP in critical infrastructure
  - Gavin Dillingham, Gulf Coast Clean Energy Application Center

Combined Heat and Power in Critical Infrastructure Applications

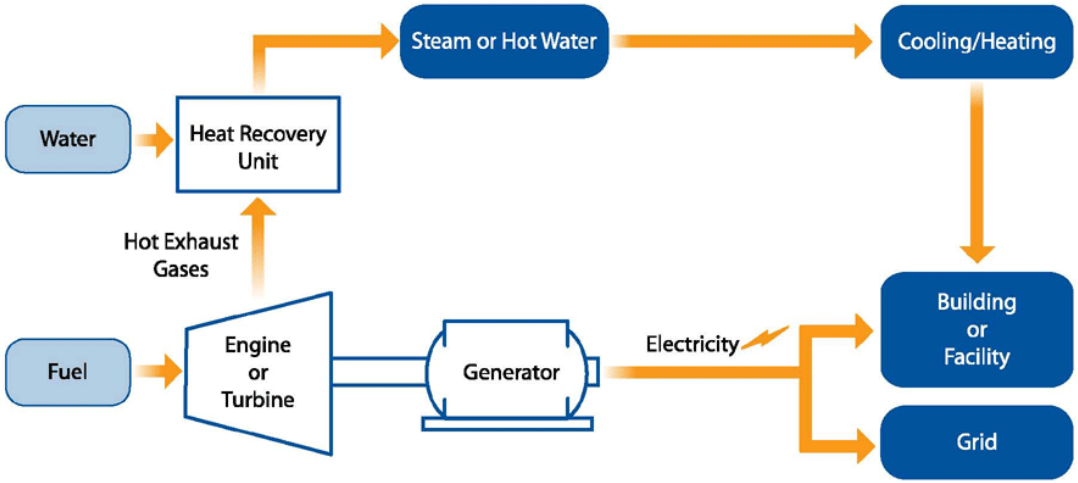
Tom Bourgeois and Tim Banach,
US DOE Northeast Clean Energy Application Center

U.S. Department of Energy
Northeast Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

What Is Combined Heat and Power?

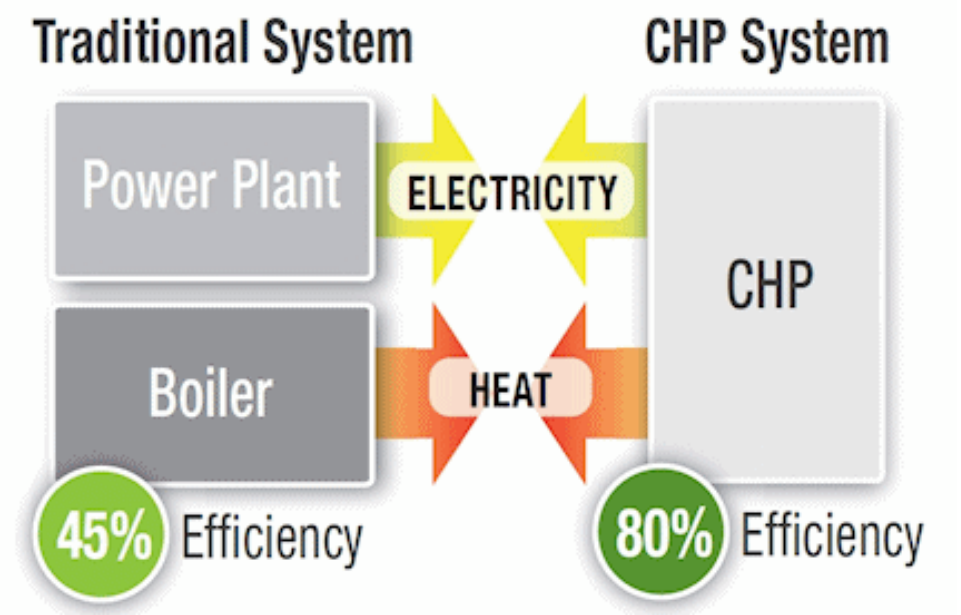
CHP is an *integrated energy system* that:

- Is located at or near a factory or building
- Generates electrical and/or mechanical power
- Recovers waste heat for:
  - heating,
  - cooling or
  - dehumidification
- Can utilize a variety of technologies and fuels



CHP Benefits

- Improved fuel efficiency & reduced emissions
- Improved power reliability
- Energy cost savings
- Energy security
- Grid congestion relief



Source: http://www.northeastcleanenergy.org/whatischp/About-CHP.php

CHP Is Used at the Point of Demand

4,100 CHP Projects

81,800 MW

Saves 1.8 quads of fuel each year

Eliminates 241 M tons of CO_2 each year

CO2 reduction equivalent to eliminating forty 1,000 MW coal power plants

Source: ICF International

U.S. Department of Energy
Northeast Clean Energy Application Center
Promoting CHP, District Energy, and Waste Heat Recovery

Reliability Benefits

- CHP systems are designed to provide continuous electric and thermal power for a host site and reduce operating costs
- When designed to operate independent from the grid, CHP systems can meet specific reliability needs and address the various risk profiles of different types of customers

Designing for Reliability

- CHP systems designed for reliability will incur additional costs ($45 - $170/kW depending on complexity of system)
- These additional costs however provide important benefits to the site, and to the community at large
- One estimate states that over $150 billion per year is lost by U.S. industries due to electric network reliability problems

Uninterrupted Operation Requirements

- **Black start capability**
  - allows the system to start up independently from the grid
- **Generators capable of grid-independent operation**
  - the system must be able to operate without the grid power signal
- **Ample carrying capacity**
  - system size must match critical loads
- **Parallel utility interconnection and switchgear controls**
  - the system must be able to disconnect from the grid, support critical loads, and reconnect after an event

CHP versus Backup Generation

- CHP provides continuous benefits to host facilities, rather than just during emergencies
- CHP can result in daily operating cost savings
- CHP offsets capital costs associated with investments in traditional backup power

CHP versus Backup Generation

	CHP	Backup Generation
System Performance	• Designed and maintained to run continuously • Improved performance reliability	• Only used during emergencies
Fuel Supply	• Natural gas infrastructure typically not impacted by severe weather	• Limited by on-site storage
Transition from Grid Power	• May be configured for "flicker-free" transfer from grid connection to "island mode"	• Lag time may impact critical system performance
Energy Supply	• Electricity • Thermal (heating, cooling, hot/chilled water)	• Electricity
Emissions	• Typically natural gas fueled • Achieve greater system efficiencies (80%) • Lower emissions	• Commonly burn diesel fuel

Power Outage Cost Estimates

Superstorm Sandy

- Nearly $20 billion in losses from suspended business activity
- Total losses estimated between $30 to $50 billion
- Two-day shutdown of the NY Stock Exchange, costing an estimated $7 billion from halted trading
- Rutgers estimates economic losses of $11.7 billion for New Jersey GDP

Critical Infrastructure

"Critical infrastructure" refers to those assets, systems, and networks that, if incapacitated, would have a substantial negative impact on national security, national economic security, or national public health and safety."

Patriot Act of 2001 Section 1016 (e)

Applications:

- Hospitals and healthcare centers
- Water / wastewater treatment plants
- Police, fire, and public safety
- Centers of refuge (often schools or universities)
- Military/National Security
- Food distribution facilities
- Telcom and data centers

Emergence of Resiliency as a Policy Priority

Critical Infrastructure Resiliency is a Fast Emerging Concern

- In July 2012, CT establishes Microgrid Pilot Program in Response to the Two Storms Report (Hurricane Irene, Oct. 29, 2011 Snowstorm) (P.A. 12-148 Section 7)
- NY Commission 2100 Report January 2013 calls for accelerated deployment of DG/Microgrids as component of future resiliency planning

Business Continuity

- Business downtime, economic losses (beyond traditional CI definition)
- Cascading problems affecting transport (unavailability of gas in NJ post Sandy)

Emergency Preparedness & Planning

- Developers reporting inquiries from campuses looking to keep students sheltered
- Nursing homes, public housing, large multi-family buildings keeping people "safe-in-place"

Critical Infrastructure & CHP Link

In New York, NYSERDA has long championed CHP's role in critical infrastructure resiliency and emergency preparedness.

To qualify, CHP systems must:

- be capable of continuing operation during grid outages
- locate equipment "high and dry" in flood zones

Bonus incentives are available for customers

- locating in Con Edison's constrained zones
- locating in a designated Center of Refuge

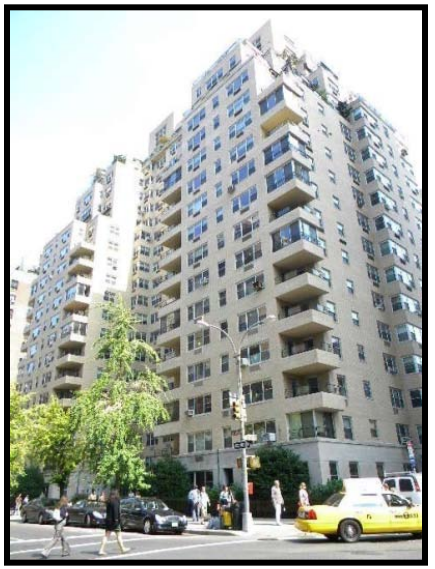
Sandy CHP Performance Survey

	Site Lost Grid Power			Site Never Lost Power	Did Not Reply
	Designed to Operate During Grid Outage		Induction Unit		
	CHP Operated as Expected	CHP Failed to Operate			
Number of Sites	3	0	6	11	4*

* Media reports suggest that one NYC hospital ran through the grid outage as expected, while the immediate areas lost power. This hospital did not reply to the survey and as a result were not counted in Category 1.

The Brevoort
Manhattan, NY

- Residential high rise with natural gas-powered CHP system
  - Four 100 kW CHP units powered all 290 apartments through Sandy
- Normal occupancy is 720 people. During Sandy, the Brevoort was able to house and provide power to 1,500 people through the storm.
- “Powered by our CHP system, we were the only building on lower Fifth Avenue able to provide energy and full service to our residents.” - Diane Nardone, President of the Brevoort coop board
- The Brevoort was able to maintain power for central boilers, domestic water pumps, all elevators and all apartments



Fairfield University

Fairfield, CT

- 4.6 MW on-campus CHP system
- Fairfield University only lost power for a brief period during the peak of Hurricane Sandy
- While the Town of Fairfield was without power, the University's CHP-powered buildings served as a refuge for off-campus students and the community as a whole

New York Presbyterian Hospital

Weill Cornell Medical Center, Manhattan, NY

- 7.5 MW natural gas-fired CHP system
- New York City's first hospital with grid-independent operating capability
- Maintained full service while the surrounding grid was shut down
- Due to its CHP system, New York Presbyterian not only cared for its own patients during the Hurricane Sandy blackout, but was able to admit patients from nearby hospitals that had lost power during the storm

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New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, Vermont, Maine

The Long Island Home

A Member of the North Shore-LIJ Health System

CO-GENERATION
CHP

Presented by:

Robert D. Chester

Director of Engineering

Who is The Long Island Home?

The Long Island Home is located on a 26-acre campus in the village of Amityville, New York. The Long Island Home (LIH) is a proud provider of services to the community for more than l30 years. The Long Island Home is comprised of South Oaks Hospital (Behavioral Health Services) and Broadlawn Manor Nursing & Rehabilitation Center (subacute and long term care).

The Long Island Home

- South Oaks Hospital
- 197 Inpatient Beds
- Robust Outpatient Services

- Broadlawn Manor
- 320 Inpatient Beds
- 60 Registrants 7 days a week at the Adult Day Health Center.

The Long Island Home employs more than 1,100 employees. The campus consists of 7 major buildings accounting for over 325,000 square feet of space.

CO-GENERATION

WHAT IS IT?

A power system that simultaneously produces heat and power in a single thermodynamic process. The newer term is combined heating & power (CHP).This refers to systems that produce electricity and recycle the generated heat.

COGENERATION

Using one fuel to produce two types of energy.

- Electricity
- Thermal Energy

THE LONG ISLAND HOME COGENERATION PAST

LIH installed one of the first Cogeneration Plants in the Northeast. The Plant operated from June l990—September 2006

1990

Two dual fuel engines producing 667 KW each

Electrical Energy

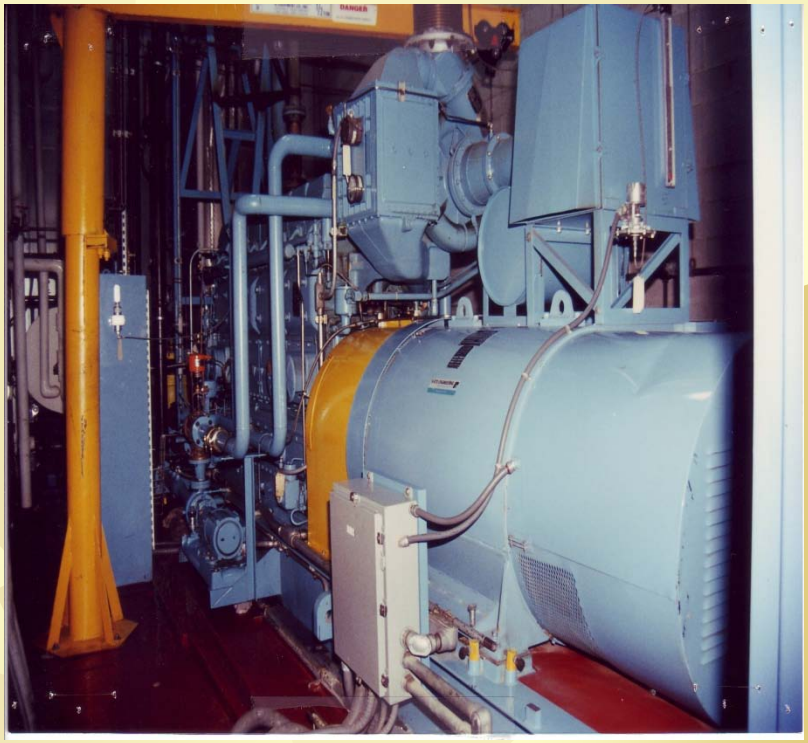
Total electric generated 1334 KW per hour

1990

- Thermal Energy Produced
- A) High pressure steam (I00 PSI) – from heat recovery boiler
- B) Low pressure steam (15 PSI) from engine jacket water

1990

- Total Plant Thermal Energy Produced
- A) High pressure steam 1,600,000 BTU per hour
- B) Low pressure steam 2,200,000 BTU per hour



1990-2006

Over 120,000 run hours on each engine

Generated over 145,000,000 KWH of electricity

Produced over 850 Billion BTU'S of thermal energy

NORTHEAST BLACKOUT AUGUST 2003

LIH SEAMLESS CONTINUATION OF SERVICES

NO LOSS OF POWER

During the major blackout, we never lost power, while the area around LIH lost power for 14 hours. Employees were not even aware of the blackout at first because they saw no interruption in their service. We chose to stay off the grid for five days following the blackout because of concerns about instability in the grid.

COMMUNITY OUTREACH

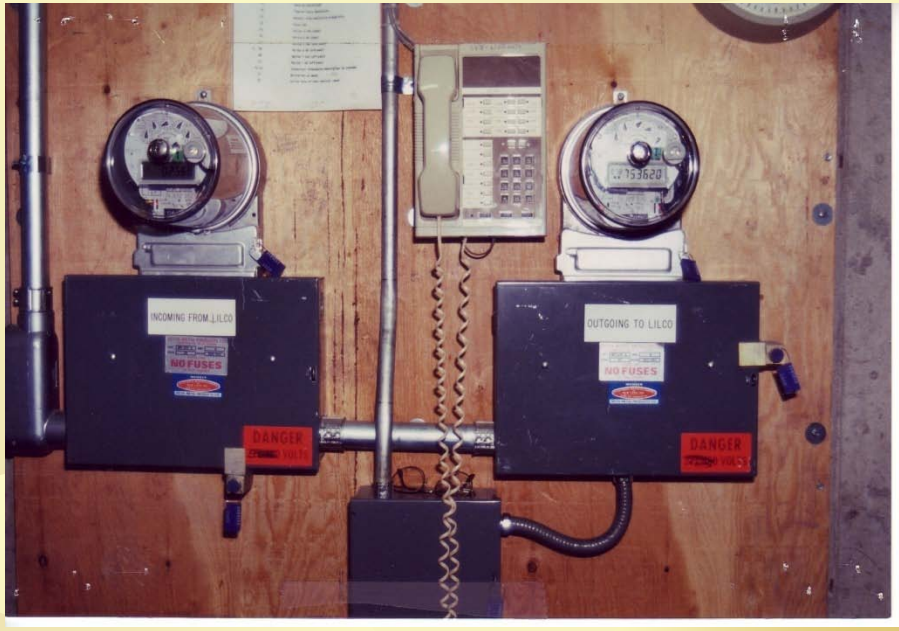
We also contacted community officials to advise the facility was operating at full power and we were willing to provide services as needed.

FINANCIAL BENEFITS TO LIH AS A RESULT OF COGENERATION

1990-2006

Electric Savings	$10,444,000
Power Sellback	3,480,000
Fuel Savings	4,250,000
CHP Fuel Costs	-7,000,000
CHP Maintenance	-1,500,000
LIPA Interconnect	- 504,000

- **TOTAL SAVINGS OVER THIS TIME SPAN:**
- **$9,166,000**



CHP 2007
"The Need for Change"

- In January 2003, the New York State DEC notified all independent power producers that the new NYS DEC *Air Emission Guidelines* must be met by April 2006.
- The new DEC regulation called for a reduction in oxides of nitrogen (NOx) from 9.0 grams per break horsepower to 1.5 grams per break horsepower.
- The existing dual fuel diesel CHP Plant would have to be replaced for the following reasons:

REASONS FOR CHANGE

- The existing Plant was l6 years old
  - High maintenance cost
  - Decreased efficiency
- The existing dual fuel diesel units could not meet the NYS DEC Air Emission Guidelines

CHP 2007

NEW CHP PLANT WILL PROVIDE THE FOLLOWING ADVANTAGES

- Meet the new NYS DEC Air Emissions Guidelines.
- Increase energy savings and provide energy cost avoidance for the life of the plant.
- The new plant would be fully automated and monitored for easier maintenance and more reliable and cost effective operations.

CHP 2007

- The plant will be synchronous and operate in parallel with LIPA.
- The plant would provide emergency power for the entire facility should there be an extended LIPA power outage.

CHP 2007 PLANT DESIGN

May 2005, Energy Concepts provided an Engineering Feasibility Report. This report contained three options for the new CHP Plant.

- **Option A**: Install Four (4) 250 KW units with heat recovery. Provide all power to the facility only.
- **Option B**: Install Five (5) 250 KW units with heat recovery and a sixth unit could be installed in the future. Provide all power to the facility and allow power to be sold to the utility.
- **Option C**: Install Five (5) 250 KW units with heat recovery and expansion for sixth unit, sell power to utility. As well as, install a Hot Water 400 Ton Chiller as a backup to the existing 750 Ton Steam Chiller.

OPTION C SELECTED WHY?

- LIH “Peak” electrical demand in the Summer is approximately 1000KW.
- Five (5) 250 KW units would allow for one unit to be out of service for maintenance and the plant would still provide full power in a Blackout.

OPTION C – THE RIGHT CHOICE

- The 400 Ton Chiller would provide air conditioning for the BLM Nursing Center and Valentine Hall at South Oaks should the 750 Ton Chiller (37 years old) be out of service.
- Allow power to be sold to utility.

CHP 2007 PLANT SPECS

- Five (5) Natural Gas Engines generating 250 KW each for a total of 1250 KW.
- Low pressure steam (15 PSI) produced from engine exhaust in heat recovery boiler 541,200 BTU's per hour per engine.
- Engine jacket water providing 958,800 BTU's per hour per engine.
- Engines meet DEC air emission requirements producing less than .15 grams per break horsepower of NOx.

ANNUAL FINANCIAL BENEFITS

- Total Electric Generated 6,500,000 KWH

Used by LIH	6,250,000 KWH	$1, 187,500
Sold to LIPA	250,000 KWH	$ 25,000
Total Electric Savings		$1, 212,500
Total Thermal Savings	300,000 Therms	255,000

Total Electric &

Total Thermal Savings $1,467,500

ANNUAL FINANCIAL BENEFITS -----CONTINUED

CHP OPERATING COST

CHP Fuel Input 800,000 Therms	$600,000
CHP Maintenance Contract	190,000
LIPA Interconnect	40,000
LIPA KWH Imported (Demand Charge)	100,000
Total Operating Cost	$930,000

ANNUAL FINANCIAL BENEFITS -----CONTINUED

Total Annual Savings

Total Electric & Thermal Savings	$1,467,500
Total Operating Cost	- 930,000
Total Savings Projected in 2013	$ 537,500

COGENERATION ENVIRONMENTAL BENEFITS

- The new Cogeneration Plant is fueled by natural gas using ultra low emission engines that resulted in the following:

- ► The plant went from a Title V operating permit to a State Facility permit for the life of the plant that only requires two simple reports annually.
- ► Reduced our carbon footprint by more than 1,900 tons per year.
- ► Reduced yearly Oxides of Nitrogen (Nox) produced from 110,000 pounds to 5,698 pounds in 2012.

CONTINUED BENEFITS

- Cogeneration Plant efficiency at 100% load.
- Electrical-32%
- Thermal/ Mechanical-56%
- Total Combined Efficiency: 88%

- In addition to the Cogeneration Plant, we recently installed a 47KW Solar System on the roof of our nursing home that produced 58,000 KWH in 2012.

HURRICANE SANDY
OCTOBER 29, 2012

Standard Procedure for all major storms is to isolate from the Grid

1. On October 28, 2012, we notified the Long Island Power Authority (LIPA) we would be isolating from the *grid*.
2. The facility load was approximately 700kw to 750kw.
3. We put a fourth 250kw engine on line before isolating from the *grid.*
4. Isolated from LIPA at 5:45pm on October 28, 2012.
5. Each engine was carrying a load of approximately 175kw.
6. While we were isolated from the *grid,* the facility load varied from 650kw at night to 750-800kw during the day.

Continued Procedure During Hurricane Sandy

7. With four engines on line, the plant was capable of providing up to 1000kw.
8. We operated with four engines at all times from October 28, 2012 through November 13, 2012 at 4:40pm.
9. LIPA was able to restore power to the sub-station that services our facility about five days after the storm. However, the *grid* was not stable.
10. LIPA requested we remain isolated due to continued loss of power and phases in our area.
11. LIPA did not want us supplying power to the *grid* so we remained isolated for **I5 Days** supplying all power to the facility.
12. During the 15-Days we were isolated, the four engines generated approximately 224,000kwh.

Additional Benefits to The Long Island Home & Community

- Once isolated, enabled LIPA to provide power to over 400 homes.
- Pre-planning and cogeneration enabled us to feel confident in purchasing and stocking to capacity all essentials such as food for walk-in refrigerators and freezers. This afforded us the ability to seamlessly provide food for patients, residents, registrants and employees for a full seven days without replenishment.
- 100% capacity to operate main kitchen and all pantries.
- Maintained a 24-hour Emergency Operation Center in concert with the entire North Shore-LIJ Health System.

Continued Additional Benefits

•Notified local police and fire departments we were 100% operational on our cogeneration plant. Offered opportunities for responders and local residents to use charging stations and refrigerate medications as well as providing ability to charge electrical medical equipment.

•Our cogeneration plant affords us the ability to become a Shelter –in-Place facility for patients, residents, evacuees and staff. Broadlawn Manor was able to assist low lying nursing homes by providing inpatient care to ten evacuees. South Oaks Hospital provided behavioral health services for 16 evacuated adults from low lying hospitals. The Long Island Home provided 24-hour temporary housing for many employees encompassing, sleeping accommodations, meals, showers and charging stations.

Thinking of Installing a Cogeneration Plant, I recommend the following:

- Assemble an engineering team to oversee the Plant from start to finish.
- Select an engineering firm specializing in power generation with experience in design installation of several cogeneration plants.
- Evaluate several manufacturers of cogeneration equipment that best meet your requirements.
- Ask manufacturer if they have local service technicians and will provide a full maintenance contract.
- Visit several facilities with operating plants especially those designed by your selected engineering firm and manufacturer.
- During Onsite visits, speak directly to operators who will provide a lot of insight on how well the plant performs.

In closing, I would like to thank the Department of Energy for inviting me to participate in this valuable webinar. In addition, my thanks to The Long Island Home for supporting the vision of the two Cogeneration Plants I have been instrumental in designing, installing and operating for the past twenty-three years.

These two plants demonstrate Cogeneration can provide substantial savings over the life of the plant, operating with efficiency approaching 90%, are good for the environment by reducing CO^2 , CO and NOx emissions and have the capability of providing independence from the Utility during loss of normal power.

Policies Promoting CHP in Critical Infrastructure

Gavin Dillingham

Gulf Coast Clean Energy Application Center

Critical Infrastructure Policies

- Effective critical infrastructure resolutions or policies will facilitate the deployment of CHP by:
  - Ensuring inclusion of CHP in the emergency planning process;
  - Reducing regulatory barriers to CHP;
  - Providing incentives for the development of CHP;
  - Improving coordination between government emergency planners, facilities and utilities;
  - Reducing permitting and interconnection costs for critical infrastructure;

Critical Infrastructure CHP: Texas and Louisiana

- **Critical Infrastructure Legislation:**
  - TX HB 1831 and HB 4409
  - LA SR. 171 -2012

- **Requirements:**
  - Identify which government owned buildings and facilities are critical in an emergency situation.
  - Prior to constructing or making extensive renovations to a critical governmental facility, the entity in control of the facility must obtain a feasibility study to consider the technical opportunities and economic value of implementing CHP.

Critical Infrastructure CHP: Texas and Louisiana

- Applies to all state agencies and all political subdivisions of the state
  - Cities
  - Counties
  - School districts
  - Institutes of higher education
  - Municipal utility districts

Critical Infrastructure CHP: Texas and Louisiana

- **A critical facility :**
  - Is owned by the state or a political subdivision of the state;
  - Serves a critical public health or safety function throughout a natural disaster or other emergency situation, even when a widespread power outage may exist for days or weeks;
  - Is continuously occupied and maintains operations for at least 6,000 hours each year; and
  - Has a peak electricity demand exceeding 500 kilowatts.

Critical Infrastructure CHP: Texas and Louisiana

- **Facility Types:**
  - Water or Wastewater facilities
  - Hospitals and nursing homes
  - Command and control centers
  - Datacenters
  - Food Processing and food storage
  - Hazardous waster operations
  - Shelters
  - Prisons and jails
  - Police and fire stations

Critical Infrastructure CHP: Texas and Louisiana

- **CHP Requirements:**
  - Deemed feasible if it can provide a facility with 100% of its critical electricity needs; primary source of thermal energy;
  - Can sustain emergency operations for at least 14 days;
  - Meets a minimum efficiency of 60%;
  - Energy savings must exceed installation, operating and maintenance costs over a 20-year period;
  - CHP must be on-site.

Learn more at: http://www.txsecurepower.org/ or at http://legiscan.com/LA/text/SR171/id/649813/Louisiana-2012-SR171-Introduced.pdf

Critical Infrastructure CHP – New York

NYSERDA created a strategic partnership with the New York State Office of Emergency Management

- **Purpose:**
  - Educate the state's emergency managers about CHP for inclusion in strategic plans for emergency and place of refuge facilities.
  - Provide the "connecting links" between homeland security and regional/state infrastructure resilience activities.
- **Outcome:**
  - Outreach and presentations to State Emergency Management staff & critical infrastructure facilities

Critical Infrastructure CHP – New York

- New York Governor Andrew Cuomo announced that a $20 million investment will be made towards clean energy projects providing continuous power and heat during power outages
- Administered by NYSERDA (PON 2568 - CHP Acceleration Program)
- Incentives up to $1.5 million per project

Critical Infrastructure CHP – New York

- **Eligibility:**
  - 50 kW to 1.3 MW systems;
  - **ONLY** Fund CHP systems that can continue operations during grid outages;
  - Only systems installed at sites that pay the System Benefits Charge;
    - All Investor Owned Utilities in New York pay the Systems Benefits Charge
  - Flood zone applicants must meet a "high and dry" requirement*; providing extra level of reliability in major storm events
  - First-come, first-serve basis through December 31, 2016

Learn more at: http://www.nyserda.ny.gov/PON2568

*Lesson learned and new requirement added after Hurricane Sandy.

Critical Infrastructure CHP – New Jersey

- 2008 NJ Energy Master Plan calls for 1,500 MW of CHP in NJ by 2020*.
  - Reduce energy costs & capacity requirements
  - Reduce emissions & improve grid reliability

*Post Sandy, the programs have been amended to emphasize grid resiliency benefits by awarding additional merit points for being able to operate in grid island mode and act as a place of refuge in a long-term grid outage.

Critical Infrastructure CHP – New Jersey

Program Specifics:

- Small CHP Program:
  - $12MM in rolling application for CHP systems less than 1 MW
  - <501 kW $2.00 per watt
  - 501 kW to 1,000 kW $1.00 per watt
  - Maximum incentive $1MM; Maximum percentage of project costs: 30% or 40% if including cooling
  - Fuel cells with heat recovery are rebated at $4.00 per watt with a cap of $2MM or 60% of project costs
- Large CHP Program
  - $25 million available
  - Systems greater than 1 MW
    - 1 MW to 3 MW $0.55 per watt
    - 3 MW or greater $0.35 per watt
  - Maximum incentive $3 million; Maximum percentage of project cost: 30%
  - Fuel cells with heat recovery are rebated at $2.00 per watt with a cap of $3MM or 45% of project costs

Critical Infrastructure CHP – New Jersey

- **Eligibility:**
  - New Jersey-based Government, Commercial, Institutional or Industrial entity
  - First come, first served – rolling grant
  - Contributor to the Societal Benefits Charge fund

Learn more at:

http://www.njcleanenergy.com/commercial-industrial/programs/combined-heat-power/combined-heat-power

Recent National Activity

- House of Representatives Sustainable Energy and Environment Coalition (SEEC) encourages HUD to consider issuing guidance to states and localities regarding the installation of CHP to improve resiliency. (Congressman Steve Israel New York's 3rd Congressional District)

Learn more at: http://seec-israel.house.gov/press-release/house-members-hud support-hurricane-resilient-energy-systems

Emergency Planning

Emergency Planning

- Mitigate the effects of natural disaster or other events that would shut down power supplies
- Develop secure, safe and more resilient electrical power infrastructure

Emergency Planning

- **Expectations:**
  - Focus on the crucial points of infrastructure interdependence, relatively small investments in distributed energy provide marked increases in the resilience.
  - Critical assets across sectors can be insulated from disruption to the grid through the use of CHP.
  - Compromised components resume functionality in as short a time as possible

Emergency Planning

- **Possible Planning Framework:**
  - DHS National Infrastructure Protection Plan (NIPP)– helps to identify and prioritize critical infrastructure
    - Assess which facilities and services are most important to recovery of community and what is their priority
    - Consider human impact; economic impact; public confidence and government continuity

NYSERDA and the NIPP

- Conducted an assessment with NIPP
  - Risk Assessment: Identified appropriate facilities
    - 1st priority - Hospitals, WWTP, nursing homes, prisons, food processing, pharmaceuticals and shelters
    - 2nd priority – Gas stations, mass transit operations and police and fire stations
  - Feasibility Assessment:
    - Technical analysis of the potential for CHP in each of these facility types

Questions?

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Serving: Texas, Louisiana, Oklahoma