ON-SITE POWER EXPO

Featuring Combined Heat and Power (CHP), Solar PV, and Energy Storage
On-Site Power Expo Partners

**Batteries/Fuel Cells:**
New York Battery and Energy Storage Technology Consortium - NY-BEST

**Solar PV:**
New York Solar Energy Industries Association - NYSEIA
Solar Energy Industries Association - SEIA

**Combined Heat and Power (CHP):**
Northeast Clean Heat and Power Initiative - NECHPi
CHP Association
World Alliance for Decentralized Energy - WADE
International District Energy Association - IDEA
On-Site Power Expo Partners

**Government:**
- U.S. Department of Energy
- U.S. Environmental Protection Agency
- NYS Department of Public Service
- NYC Department of Buildings
- NYC Retrofit Accelerator

**Utilities:**
- Con Edison
- National Grid
- New York Power Authority
- Long Island Power Authority / PSEG-Long Island

**Finance:**
- NY Green Bank
- NYC Energy Efficiency Corporation - NYCEEC

**Clean Energy Implementation Support:**
- Sustainable CUNY
- Pace Energy and Climate Center
On-Site Power Systems can positively impact your triple-bottom-line

- **Financial** - Energy cost savings
- **Sustainability** - Reduced carbon footprint
- **Reliability** - Some configurations can provide power during a utility grid outage

When considering an On-Site Power System, it is good to also consider Energy Efficiency

- Energy Efficiency is the first, best investment (upgrade to better lighting, better motors, better insulation, better appliances, etc.)
- Fulfilling your needs by using energy more efficiently will minimize the size and installation cost of an On-Site Power System
NYSERDA Advice

An Individual Technology can deliver a successful On-Site Power solution

- Solar PV - Photovoltaics
- Energy Storage - Batteries
- Combined Heat and Power (CHP) - Also known as Cogeneration

A Hybrid (integrated, multi-technology) On-Site Power System can offer extra value in some cases, such as

- Solar + Storage provides firm production despite periodic cloudiness
- CHP + Solar + Storage provides robust resiliency and economically vibrant flexibility

Choose from an ample cadre of competent solution providers
What is combined heat and power (CHP)?

CHP is an integrated energy system that:

• Is located at or near a factory or building
• Generates electrical and/or mechanical power
• Recovers byproduct heat for
  ➢ heating,
  ➢ cooling or
  ➢ dehumidification
• Can utilize a variety of technologies and fuels
What is combined heat and power (CHP)?

CHP is the simultaneous production of electricity and heat from a single fuel source. CHP is also commonly referred to as cogeneration.
Compared to separately producing electricity and heat, CHP is much more efficient.

Efficiency = lower energy costs = lower total emissions
CHP can use a Variety of Technologies and Fuels

Fuels:
- Natural Gas
- Biogas
- Propane

Technologies:
- Microturbines
- Gas Turbines
- Reciprocating Engines
- Fuel Cells

Power Ranges:
- 50 kW
- 100 kW
- 1 MW
- 10 MW
- 20 MW
What are common uses for CHP?

• Produce onsite some of your everyday electrical power and continue to buy remainder from the utility grid, while

• Recycling the electric generator’s byproduct heat for use in heating and/or cooling, and

• Keep power flowing to your priority loads during grid outages
CHP is a great option for many market sectors

**Industrial**
- Chemical manufacturing
- Ethanol
- Food processing
- Natural gas pipelines
- Petrochemicals
- Pharmaceuticals
- Pulp and paper
- Refining
- Rubber and plastics

**Commercial**
- Data centers
- Hotels and casinos
- Multi-family housing
- Laundries
- Apartments
- Office buildings
- Refrigerated warehouses
- Restaurants
- Supermarkets
- Green buildings

**Institutional**
- Hospitals
- Schools (K – 12)
- Universities & colleges
- Wastewater treatment
- Residential confinement

**Agricultural**
- Concentrated animal feeding operations
- Dairies
- Wood waste (biomass)
CHP Is Used Nationwide

- >4,300 CHP Sites (2013)
- 82,700 MW – installed capacity (2013)
- Saves 1.8 quads of fuel each year
- Avoids 241 M metric tons of CO₂ each year
- 86% of capacity – industrial
- 69% of capacity – natural gas fired

Source: DOE CHP Installation Database (U.S. installations as of Dec. 31, 2013)
What are the benefits of CHP?

- CHP is *more efficient* than separate generation of electricity and heat.
What are the benefits of CHP?

- Higher efficiency translates to lower operating cost, (but requires capital investment)
What are the benefits of CHP?

• Higher efficiency *reduces emissions of all pollutants*
What are the benefits of CHP?

• CHP can also *increase energy reliability and enhance power quality*
  
  • CHP provides reliable dispatchable power
  
  • CHP provides thermal energy during grid outages
  
  • CHP can offset some capital costs associated with investments in traditional backup power
  
  • Avoid business shutdowns or act as “shelter-in-place” centers of refuge

Ride through the storm with electricity and heat!
Resilient CHP systems in Hurricane Sandy

- **The College of New Jersey (NJ) – 5.2 MW CHP**
  - “Combined heat and power allowed our central plant to operate in island mode without compromising our power supply.” - Lori Winyard, Director, Energy and Central Facilities at TCNJ

- **Fairfield, University (CT) – 4.6 MW CHP**
  - 98% of the Town of Fairfield lost power, university only lost power for a brief period at the storm’s peak
  - University buildings served as area of refuge for off-campus students

- **Princeton University (NJ) – 15 MW CHP**
  - CHP/district energy plant supplies all heat and hot water and half of the electricity to campus of 12,000 students/faculty
  - "We designed it so the electrical system for the campus could become its own island in an emergency. It cost more to do that. But I'm sure glad we did." – Ted Borer, Energy Manager at Princeton University

- **Danbury Hospital (Danbury, CT) – 4.5 MW CHP**
  - Supplies 371 bed hospital with power and steam to heat buildings, sterilize hospital instruments & produce chilled water for AC
  - $17.5 million investment, 3-4 year payback, cut AC costs 30%

- **The Long Island Home (Long Island, NY) – 1.3 MW CHP**
  - Serves 197 bed South Oaks Hospital and 320 resident Broadlawn Manor
  - Stayed operational and isolated from LIPA grid for 15 days

- **Bergen County Utilities Wastewater (Little Ferry, NJ) - 2.8 MW CHP**
  - Process sewage for 47 communities
CHP provides the benefit of backup generation and so much more!

• 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

<table>
<thead>
<tr>
<th></th>
<th>CHP</th>
<th>Backup Generation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>System Performance</strong></td>
<td>• Designed and maintained to run continuously&lt;br&gt;• Improved performance reliability</td>
<td>• Only used during emergencies</td>
</tr>
<tr>
<td><strong>Fuel Supply</strong></td>
<td>• Natural gas infrastructure typically not impacted by severe weather</td>
<td>• Limited by on-site storage</td>
</tr>
<tr>
<td><strong>Transition from Grid Power</strong></td>
<td>• May be configured for “flicker-free” transfer from grid connection to “island mode”</td>
<td>• Lag time may impact critical system performance</td>
</tr>
<tr>
<td><strong>Energy Supply</strong></td>
<td>• Electricity&lt;br&gt;• Thermal (heating, cooling, hot/chilled water)</td>
<td>• Electricity</td>
</tr>
<tr>
<td><strong>Emissions</strong></td>
<td>• Typically natural gas fueled&lt;br&gt;• Achieve greater system efficiencies (80%)&lt;br&gt;• Lower emissions</td>
<td>• Commonly burn diesel fuel</td>
</tr>
</tbody>
</table>
What are the public benefits of CHP?

• On-site electric generation *reduces grid congestion and avoids distribution costs*
  • New York is developing markets to compensate CHP and other on-site generation owners for reducing grid congestion
Project Snapshot: Gurwin Jewish Nursing & Rehabilitation Center

- **Location**: Commack, NY
- **Fuel**: Natural gas
- **Size**: Three 150kW CHP systems (450kW total)
- **Operation**: 24/7
- **Use of thermal energy**: Domestic hot water, space heating
- **Annual electricity**: 3.7 megawatt-hours
- **Annual Savings**: $375,000
- **Simple payback period**: 3 years
- **Began operation**: 2010

See full project profile at www.NortheastCHPTAP.org
Project Snapshot: Boa Vista Apartments

- **Location:** New Bedford, MA
- **Facility size:** 99 apartment units, 80,000 sq. ft.
- **Fuel:** Natural gas
- **Size:** 75 kW CHP system
- **Operation:** 24/7
- **Use of thermal energy:** Domestic hot water, space heating
- **Annual Savings:** $58,000
- **Began operation:** 2009

See full project profile at www.NortheastCHPTAP.org
Am I a good candidate for CHP?

• CHP-compatible building-types should have:
  • Significant annual energy consumption for both electricity and heat
  • Master-metered is best
  • Many hours per year for “coincident” need of electricity and heat

• Thermal distribution piping:
  • Must have: building heating via centralized hot water distribution pipes
  • Helpful: building cooling via centralized chilled water distribution pipes
What does it cost to install CHP?

<table>
<thead>
<tr>
<th>System Size</th>
<th>Typical Customer (these are real examples)</th>
<th>Total Cost</th>
<th>NYSERDA Incentive</th>
<th>Out-of-pocket Expense</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 kW</td>
<td>Hotel 150 rooms</td>
<td>$478,000</td>
<td>$180,000</td>
<td>$298,000</td>
</tr>
<tr>
<td></td>
<td>Multifamily 100 units</td>
<td>$370,000</td>
<td>$198,000</td>
<td>$172,000</td>
</tr>
<tr>
<td>200 kW</td>
<td>Multifamily 500 units</td>
<td>$625,000</td>
<td>$350,000</td>
<td>$275,000</td>
</tr>
<tr>
<td></td>
<td>Multifamily 450 units</td>
<td>$850,000</td>
<td>$350,000</td>
<td>$500,000</td>
</tr>
<tr>
<td>300 kW</td>
<td>Multifamily 700 units</td>
<td>$1,800,000</td>
<td>$561,000</td>
<td>$1,239,000</td>
</tr>
<tr>
<td>400 kW</td>
<td>10-story @ 60,000 sq.ft. mixed-use residential &amp; commercial</td>
<td>$1,170,000</td>
<td>$454,000</td>
<td>$716,000</td>
</tr>
<tr>
<td>600 kW</td>
<td>Hotel 400 rooms</td>
<td>$1,800,000</td>
<td>$930,000</td>
<td>$870,000</td>
</tr>
<tr>
<td>800 kW</td>
<td>7-story @ 200,000 sq.ft. mixed-use commercial</td>
<td>$3,400,000</td>
<td>$1,276,000</td>
<td>$2,124,000</td>
</tr>
</tbody>
</table>

In this size range, NYSERDA incentives are, on average, about 40% of the overall cost of the project.
How much would I save?

Savings will depend on your purchase style, and is influenced by your preference for a deal either with low upfront costs or with best lifetime savings:

- Buy
- Lease
- Lease-to-own
- Power Purchase Agreement
- PPA with Buy-out Clause

*NYSERDA incentive helps you achieve a simple payback period of approximately 4-6 years.*

*Equipment lifespan of at least 15 years is typical.*

*No Money Down! Save approximately 10% off your electric bill starting on day-one.*
Incentives for CHP

• NYSERDA offers incentives for the installation of grid-connected CHP systems at customer sites that pay the System Benefits Charge (SBC) on their electric bill (PON 2568)
  • Bonus incentives for:
    • At sites of “critical infrastructure” such as hospitals, nursing homes, food distribution centers, emergency command posts, other
    • Sites within Con Edison’s “CHP Target Zone” circuits

• Innovative financing might be available through NYC Energy Efficiency Corporation
Con Edison Target Zones

CHP Target Zones: Manhattan

CHP Target Zones: Bronx
Con Edison Target Zones

CHP Target Zones: Brooklyn

CHP Target Zones: Queens
Con Edison Target Zones

CHP Target Zones: Staten Island
The U.S. Department of Energy’s CHP Technical Assistance Partnerships can help!

www.NortheastCHPTAP.org

- **Technical Assistance (Top priority!)**
  Providing technical assistance to potential CHP host sites from initial CHP screening to installation.

- **Market Opportunity**
  Supporting key end-user stakeholders (associations, utilities, commissions, etc) to further the installation of CHP.

- **Education and Outreach**
  Providing information on the energy and non-energy benefits and applications of CHP to state and local policy makers, regulators, end users, trade associations, and others.
DOE CHP Technical Assistance Partnerships (CHP TAPs)

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The U.S. Department of Energy’s CHP Technical Assistance Partnerships can help!

www.NortheastCHPTAP.org

Services offered to CHP end users:

**Screening and Preliminary Analysis**
- Quick screening questions with spreadsheet payback calculator.

**Feasibility Analysis**
- Uses available site information. Estimates savings, installation costs, simple paybacks, equipment sizing and type.

**Investment Grade Analysis**

**Procurement, Operations, Maintenance, Commissioning**
- Review specifications and bids, limited operational analysis.
Northeast Clean Heat and Power Initiative

- 501(c)6 non-profit corporation dedicated to accelerating the deployment of efficient clean heat and power applications in the Northeast.
- Members include prominent CHP development firms, non-profit organizations, and regional utilities.
- Active across the Northeast in regulatory proceedings and other initiatives.

www.nechpi.org