CHP and Energy Assurance (Is There A Match?)

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Dark Mountain
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Presented By:
John Cuttica
Midwest CHP Application Center
University of Illinois at Chicago

CHP and Energy Assurance

- Combined Heat & Power (CHP) can be an Effective Tool to Keep Critical Facilities Up & Operating During Instantaneous and/or Prolonged Electric Outages. For Example, CHP can Restore Power and Avoid:
  - Loss of lights & critical air handling / space conditioning
  - Failure of water supply, purification, & sewage systems
  - Closure of healthcare and other critical facilities
  - Closure of key businesses and industrial sites

Distributed Generation

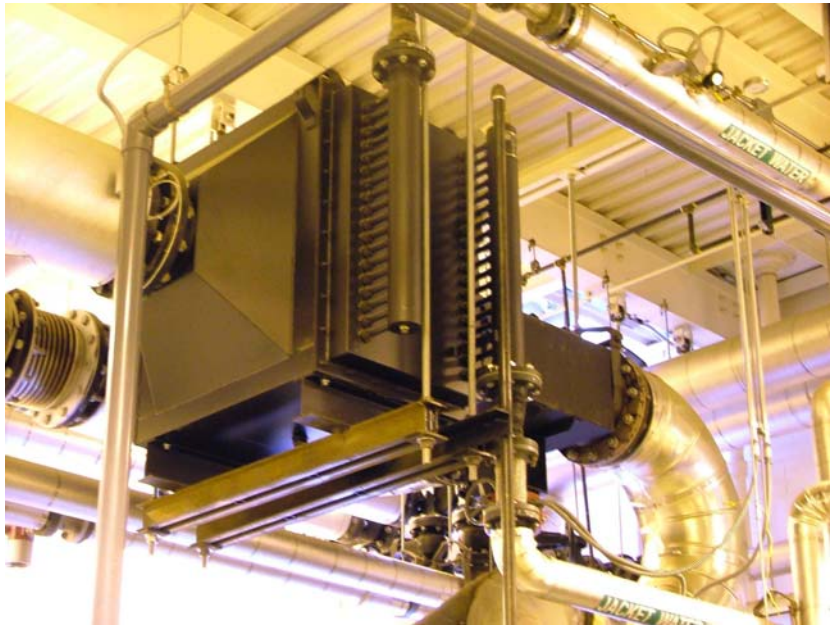
DG is …

- An Electric Generator
- Located At a Substation or Near a Building / Facility
- Generates at least a portion of the Electric Load

DG Technologies …..

- Solar Photovoltaic
- Wind Turbines
- Engine Generator Sets
- Turbine Generator Sets
  - Combustion Turbines
  - Micro-Turbines
  - Steam Turbines
- Fuel Cells

Combined Heat & Power (CHP)
A Form of Distributed Generation

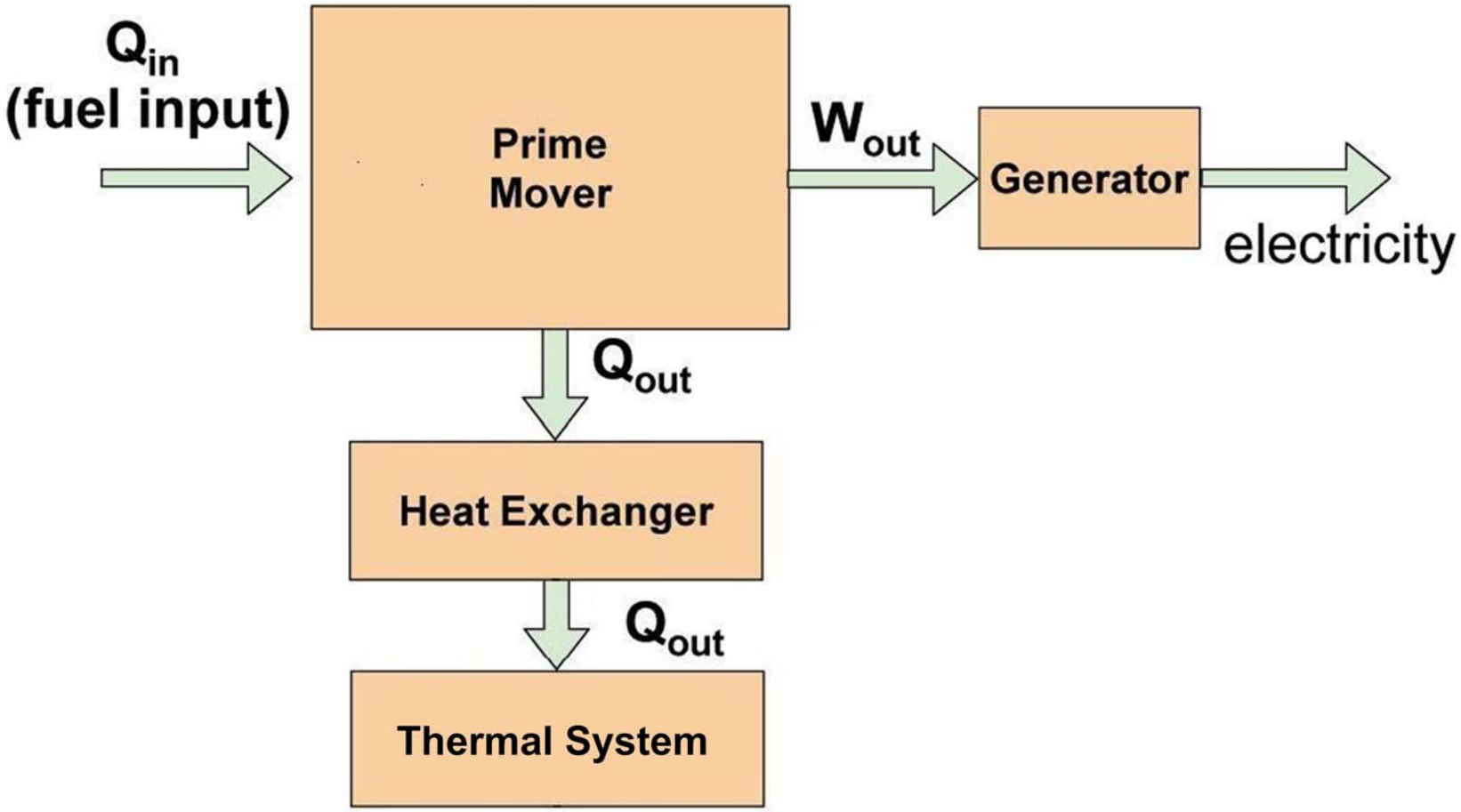


CHP is …

- An Integrated System
- Located At or Near a Building/Facility
- Provides at Least a Portion of the Electrical Load and
- Recycles the Thermal Energy for
  - Heating
  - Cooling
  - Dehumidification
  - Process Heat

Picture Courtesy of UIC

Combined Heat and Power



Normal CHP Configuration

- CHP Systems are Normally Installed in Parallel with the Electric Grid (CHP does not replace the grid)
- Both the CHP and Grid Supply Electricity to the Customer
- Recycled Heat From the Prime Mover Used for:
  - Space Heating (Steam or Hot Water Loop)
  - Space Cooling (Absorption Chiller)
  - Process Heating and/or Cooling
  - Dehumidification (Desiccant Regeneration)

Generators

Two Types of Generators

Induction

- Requires External Power Source to Operate (Grid)
- **When Grid Goes Down, CHP System Goes Down**
- Less Complicated & Less Costly to Interconnect
- Preferred by Utilities

Synchronous

- Self Excited (Does Not Need Grid to Operate)
- **CHP System can Continue to Operate thru Grid Outages**
- More Complicated & Costly to Interconnect (Safety)
- Preferred by CHP Customers
- **Provides Resilience for the Customer (stay on-line)**

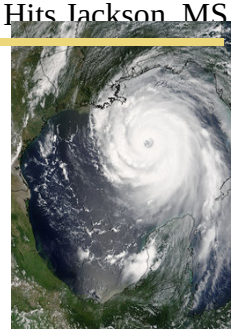
Examples of CHP in Energy Emergency Situations

Hurricane Katrina
August 29th, 2005

- Mississippi Baptist Medical Center (Jackson, MS.)
- 624 bed capacity
- Full-service urban hospital with a medical staff of 497 with 3,000 employees

Medical Center Response

August 29, 2005
Hurricane Katrina
Hits Jackson, MS



-Connection to MPG Restored
-Load Shed performed (1.2 MW disconnected)
-Pumping Trucks Supply Water to Physical Plant

- Connection to MPG Restored

3 hr

57 hr

1 hr

-Main Power Grid (MPG) Failed
-Alternate Power Grid Enabled
-City Water Lost

5 hr

- 52 hrs of 100% operation on CHP
- Only Hospital in the Jackson Metro Area to be Nearly 100% Operational!!

-Power Reliability Problems
-Switched to CHP Operation Only
-Elevators on Emergency Generators
-Restricted use of MRI Equipment

Value of CHP

Mississippi Baptist Medical Center

- remained open and treated a high volume of patients
- provided clothing, food, and housing for displaced citizens during the first night of the disaster
- opened a round-the-clock day care to allow employees to focus on patient care

Blackout of 2003

- Affected Portions of the Midwest, Northeast, and Ontario Canada
- Ohio, Michigan, Pennsylvania, New York, New Jersey, and Connecticut
- Power Out for up to Four Days in Some Locations
- Over 50 Million People Affected

Example CHP System Operations

- Montefiore Medical Center; New York City
  - Site down for 5 minutes, then fully operational throughout the duration of the outage
- Parke-Davis Pharmaceutical; Rochester, Michigan
  - CHP trips off line at first, shortly restored and operated successfully throughout the outage
- Spring Creek Towers; New York City
  - Independent of grid, never lost power and was able to provide for some needs of the community
- Norwalk Hospital; Norwalk Connecticut
  - System down for 1 hour, then fully operational for duration of outage

CHP – A Known & Utilized Technology

- 82,400 MW Installed at Approx. 3000 Sites (Nationally)
- Represents Approx. 9% of Total US Generating Capacity
- Saves an Estimated 3 Quads of Fuel per Year
- Eliminates Over 400 Million Tons of CO_2 Emissions Annually

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- Many of the CHP Systems Installed Today were not Sized or Installed for Energy Assurance Operation

Optimal Size/Installation for Energy & Cost Savings
Versus
Optimal Size/Installation for Energy Emergency

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Requirements for CHP Energy Assurance Applications

- Configured With Synchronous (not Induction) Generators
- Grid Connected With Stand-Alone Capabilities:
  - Paralleled to the Grid During Normal Operation
  - Ability to Either Disconnect From Grid and Operate in an Island Mode or Stay Connected & Ensure No Feedback of Power to the Downed Grid
- Sized to Handle all or a Major Portion of the Facility's Electric Loads

Requirements for CHP Energy Assurance Applications

- Have “Black Start” Capability (if CHP system shuts down when grid is down, it can restart without any grid power)
- Have a Continuous Source of Fuel (usually natural gas or dual fueled natural gas and/or fuel oil)
- Recycle the Heat for Space Heating, Cooling, and Possibly Dehumidification

CHP & Energy Assurance

- Is There a Match? I Believe So
- CHP is One of Several Tools to be Considered in Energy Assurance Planning
- CHP is a Well Known & Utilized Technology
- CHP Can Keep Critical Facilities / Businesses Operating During Prolonged Outages

Contact Information

John Cuttica

University of Illinois at Chicago

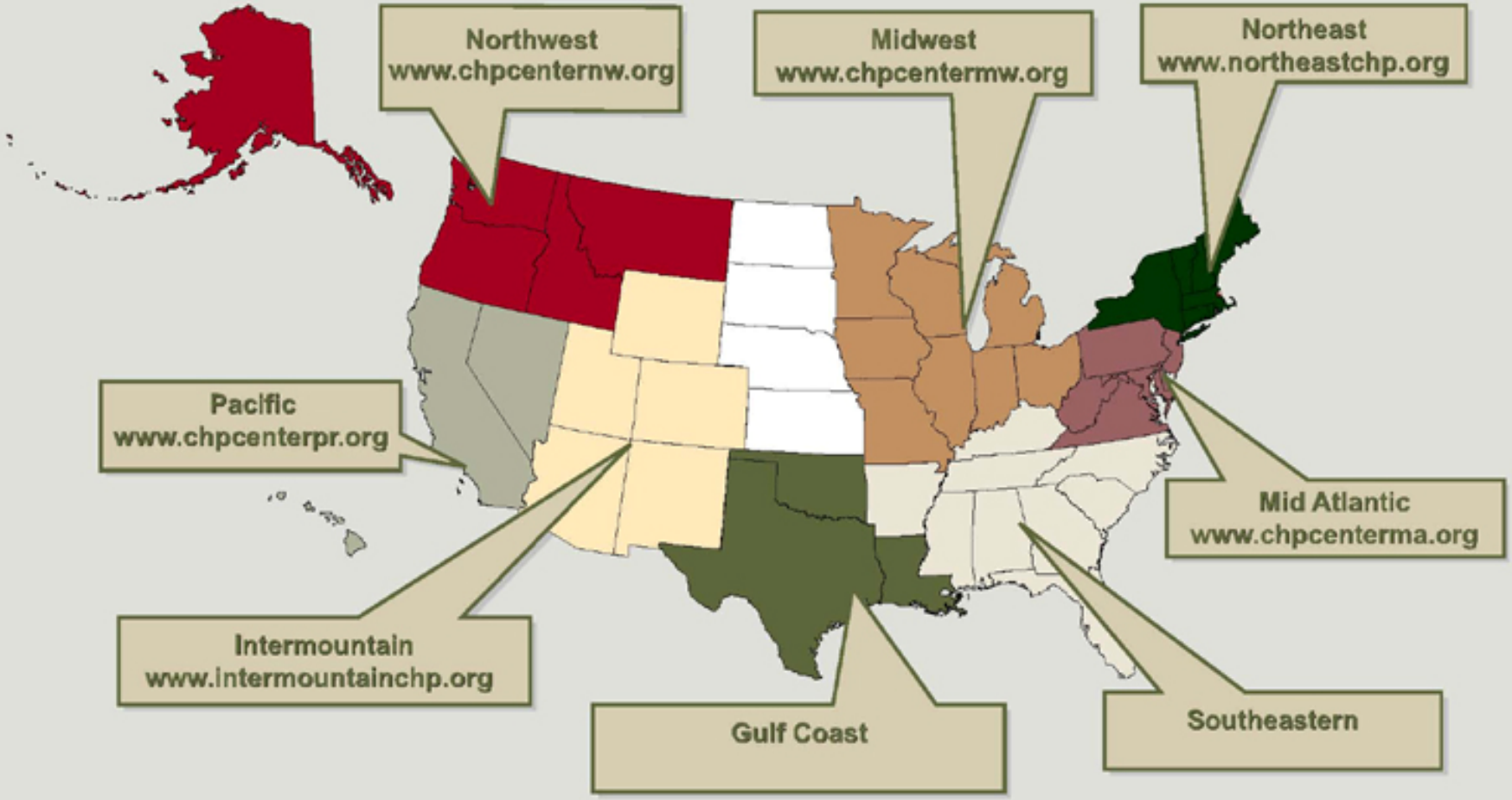
Midwest CHP Application Center

312/996-4382

cuttica@uic.edu

www.chpcentermw.org

CHP Regional Resource Center



Questions?