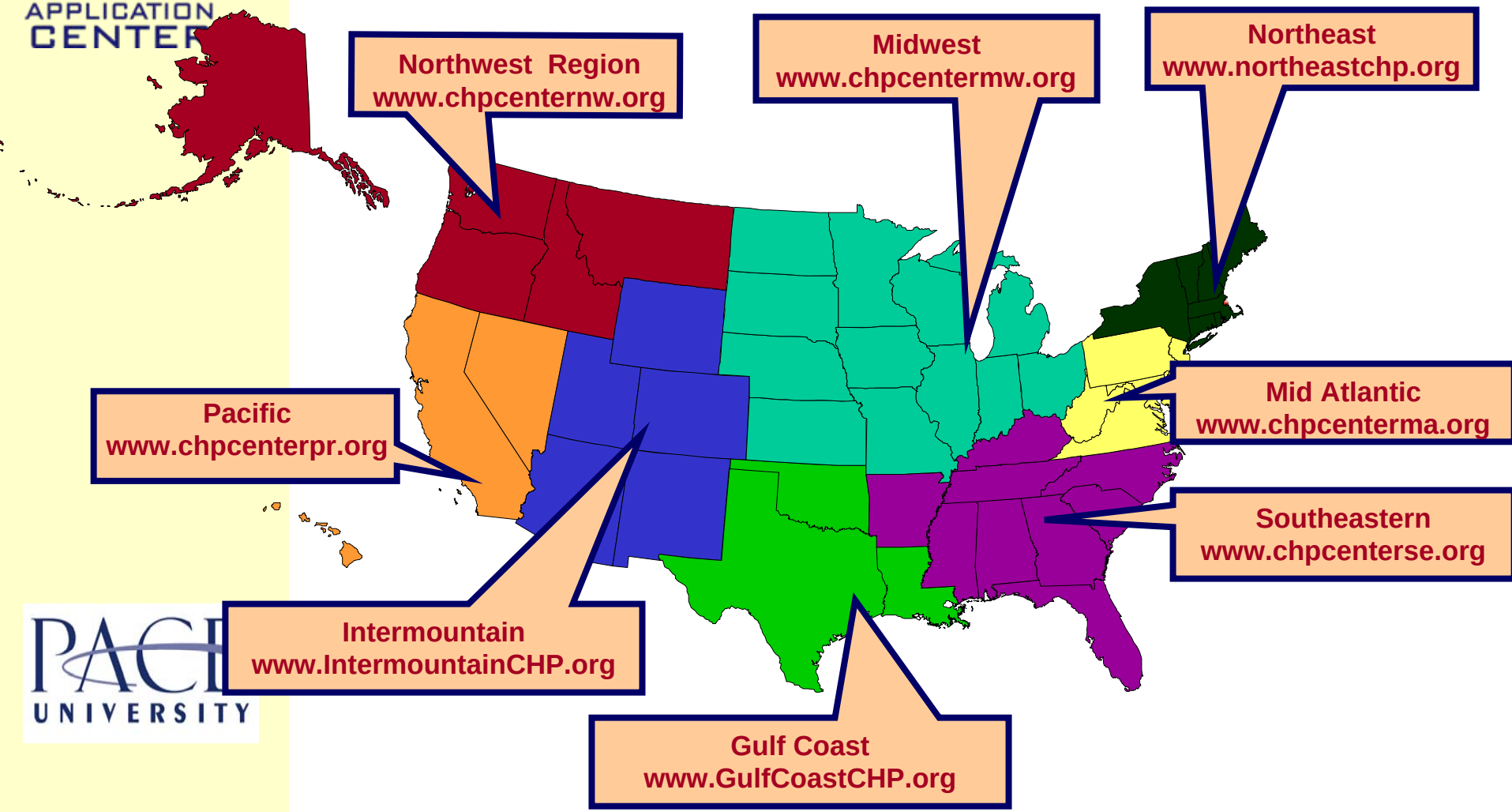
Overview of Issues Pertaining to Combined Heat and Power (CHP) Systems in Hospitals

Prepared for US EPA CHP Partnership
"CHP for Hospitals / Health Care Facilities"
Webinar on December 18, 2008

Tom Bourgeois
Northeast Combined Heat and Power Application Center

Regional Application Centers

The regional application centers promote combined heating and power (CHP) technology and practices, serve as a central repository and clearinghouse of CHP information, and identify and help implement regional CHP projects.



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What is CHP?

- Integrated System
- Provides a Portion of the Electrical Load
- Utilizes the Thermal Energy
  - Cooling
  - Heating
  - Dehumidification
  - Process Heat

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Benefits of CHP
High Efficiency, On-Site Generation Means

- Improved reliability
- Lower energy costs and price volatility
- Better power quality
- Lower emissions (including CO_2)
- Conserve natural resources
- Support grid infrastructure
  - Fewer T&D constraints
  - Defer costly grid upgrades
- Facilitates deployment of new clean energy technologies

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Why is There an Opportunity?

- Rising concerns over
  - Blackouts/Brownouts
  - Power supply constraints
  - Marked increases in electricity & fuel prices
- Selected power outage costs

Industry	Avg. Cost of Downtime
Cellular Communications	$41,000 per hour
Telephone Ticket Sales	$72,000 per hour
Airline Reservations	$90,000 per hour
Credit Card Operations	$2,580,000 per hour
Brokerage Operations	$6,480,000 per hour

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CHP Technologies

- Electric Generation Equipment
  - Reciprocating Engines
  - Turbines / Microturbines
  - Steam Turbines
  - Fuel Cells
- Heat Recovery Systems
  - Hot Water
  - Steam
  - Exhaust Gases
- Thermally Activated Technologies
  - Absorption Chillers
  - Desiccant Dehumidification
  - Thermal Storage

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Overview of CHP Technologies

Technology	Pros	Cons
Fuel Cell	- Very low emission - Exempt from air and permitting in some areas - Comes in a complete "ready to connect" package	- High initial investment - Limited number of commercially available units
Gas Turbine	- Excellent service contracts - Steam generation capabilities - Mature technology	- Requires air permit - The size and shape of generator package is relatively large
Micro-turbine	- Lower initial investment - High redundancy - Low maintenance cost - Relative small size and installation flexibility	- Relatively new technology - Requires air permit - Synchronization problems possible for large installations
Recip. Engine	- Low initial investment - Mature technology - Relatively small size	- High maintenance costs - Low redundancy

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Energy Concerns of Hospitals and CHP Basics

- Issues Facing Hospital Facility Managers
  - Escalating Cost of Energy
  - Power Quality & Reliability
  - Facing Capital Constraints
    - Competing for capital with clinical equipment budgets and other systems core to the mission

- Energy Systems at Hospitals
  - Aging Infrastructure, and
  - Ever Increasing Power demands
  - Leaner budgets and fewer staff

  How assess viable energy service alternatives?

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DOE Recently Published a Hospital CHP Guide

Combined Heat & Power (CHP) Resource Guide for Hospital Applications

Published In 2007

Prepared by:

Midwest CHP Application Center

With the assistance of:

Avalon Consulting, Inc.

Energy and Environmental Analysis

PEA, Inc.

see: http://www.chpcentermw.org/pdfs/USHospitalGuidebook_111907.pdf

National Hospital CHP Guide Book

Issues Covered in the National Guidebook include:

*Energy Concerns of U.S. Hospitals

*CHP Basics

*Energy Systems at Hospitals

*CHP and Hospitals – A Good Match

*CHP Equipment

*Feasibility Evaluation

*Hospital Energy Loads

*Hospital CHP Installations

APPENDICES; including

..Emergency Generators vs. CHP Systems

..Estimating “Spark Spread”

..CHP Software Evaluation Tools

..Electric Energy Distribution in Hospitals

..Number of CHP Installations & Installed Capacity at U.S. Hospitals

NYS Hospital CHP Guide Book is in Process

- It will use the National Hospital Guidebook as a foundation
- This Guide will cover issues including
  - Overview of general Hospital Energy needs
  - CHP basics and equipment
  - Feasibility evaluation and software evaluation tools
  - Existing CHP installations and lessons learned
- In Addition will contain analysis of New York specific policies and case studies.
  - Certificate of Need (CON) Process
  - Code and Permitting Issues
  - regulatory context
- The State guide will expand the discussion of Financing concerns.
  - Self finance, 3rd Party finance
  - State Tax Exempt Sources such as the Dormitory of the State of New York (DASNY) and other sources

Questions on End-User's Minds

Some of the recurring themes that come up in our analysis and discussions with Hospitals and other involved parties

Who has done this successfully (often looking for sites similar to their own location)?

What are the investment costs?

What have been the **realized** energy savings and return on investment (years to payback, NPV, and so on)

What makes a hospital a good candidate for CHP?

Additional Questions Important to Sites

How much space is the facility going to require (e.g. we have serious constraints on space)

Where do the funds come from to finance these projects given;

* the current balance sheet of hospitals
* limited access to capital
* competing against capital investments in equipment that is core to the mission of the hospital

Do we want to be in the energy generation business?

Investing in CHP versus putting more loads on emergency generators

What are the ongoing O&M costs and requirements?

NOTE: Increasingly, there is interest in "greening" campuses so that hospitals may find the environmental aspects attractive

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Among the most frequently asked question….

Where can we get incentives to help us pay for this?

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Factors Inhibiting CHP in Hospitals

* Interaction with the distribution utility, particularly complex interconnection issues
* Relatively long payback periods
* Space is at a premium, where do we put it and what other uses of the space are precluded
* How will it affect the hospital's financial condition
* Regulatory process (CON) can be time consuming and slow, but not a major deterrent to CHP
* Getting the attention of senior management (CEO, CFO), education, crafting an effective business case

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Factors Promoting Interest in CHP

More hospital loads placed on emergency backup

Rather than using Emergency Generators (a “Dead Asset) Why not consider CHP?

Far greater volatility in energy costs

CHP can permit a hospital to better manage energy budget

Increased attention to the environmental footprint of the hospital

States and Cities creating GHG reduction “challenges”

Hospitals and other large users under scrutiny

CHP is an effective greenhouse gas mitigation measure

CHP offers LEEDS points (Dell Childrens Hospital in Austin, TX seeking LEEDS Platinum, CHP offers 10 LEEDS points)

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Inventory of Incentives:
all are different, and work differently

- ✓ **Installed Capacity Payments** (fixed $/kW of nameplate)
- ✓ **Project Grants** (XX% of project costs, capped at $X Million)
- ✓ **Peer Reviewed Project Grants**
- ✓ **Production Tax Credits** (PTC)
- ✓ **Investment Tax Credits** (ITC)
- ✓ **Low-Interest Loan Programs**
- ✓ **Net Metering** (Payments for “excess” production)
- ✓ **Renewable or Efficiency Portfolio Standards** (RPS) / (EEPS) Utility Purchase Obligations
- ✓ **Special Gas Purchase Rates** (Discount for gas usage)
- ✓ **Locational Payments** or **Time Specific Payments**
- ✓ **Carbon Cap and Trade** (RGGI, CA)
- ✓ **Carbon Tax** (price on emitted carbon increases spark spread)

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The Market **DOES** Respond To Incentives

In July 2005 the Connecticut Legislature passed and the Governor signed House Bill No. 7501, Public Act No. 05-1

"AN ACT CONCERNING ENERGY INDEPENDENCE"

Created a suite of CHP incentives including

- Capital grants at $450/kW to $500/kW
- Low interest loans
- Discounts for the cost of natural gas
- An exemption for certain costs related to backup charges
- Incentives paid to utilities for CHP installed

Resulted in 79 new CHP projects totaling 278 MW's in 2 years

Hospitals seeking application in the last 18 months

Danbury Hospital , Saint Mary's Hospital, Greenwich Hospital Association, Waterbury Hospital, Hospital of St. Raphael, Norwalk Hospital, Windham Mem. Com. Hosp.

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Incentives: New, Old and Overlooked

On October 3, 2008 as part of the Emergency Economic Stabilization Act (P.L. 110-343). a.k.a. “Bailout Bill”, the The Energy Improvement and Extension Act of 2008, was signed into Law

* 10% ITC for qualifying CHP systems up to 50 MW’s
* Accelerated Depreciation for CHP Equipment (5 yrs, MACRS schedule)

Below Market Rate Loans may be available from Health Facilities Financing Agencies in most all of the States (e.g. DASNY in NY, CHEFA in CT, etc)

Potential environmental revenue streams from

* Cap & trade programs; e.g. NOx Budget Trading Program, RGGI, Western Climate Initiative
* Offset programs; emission reduction credits, CO_2 offsets
* REC’s; renewable energy credit compliance programs

CHP = Economic + Environmental Benefits

Where CHP is Economically Attractive these Systems

- Lower business costs
- Improve productivity
- Make the site more competitive generating higher profits, better services and greater tenant satisfaction.

Clean, High Efficiency CHP & Sustainability/GHG Activities

Significant reductions in Emissions of Criteria (regulated) pollutants as compared with traditional power

Lower NO_X emissions, Lower SO_2 emissions, Lower emissions of Particulate Matter PM_{10}, $PM_{2.5}$

LEEDS Points available for CHP

Reduces Greenhouse Gas Emissions

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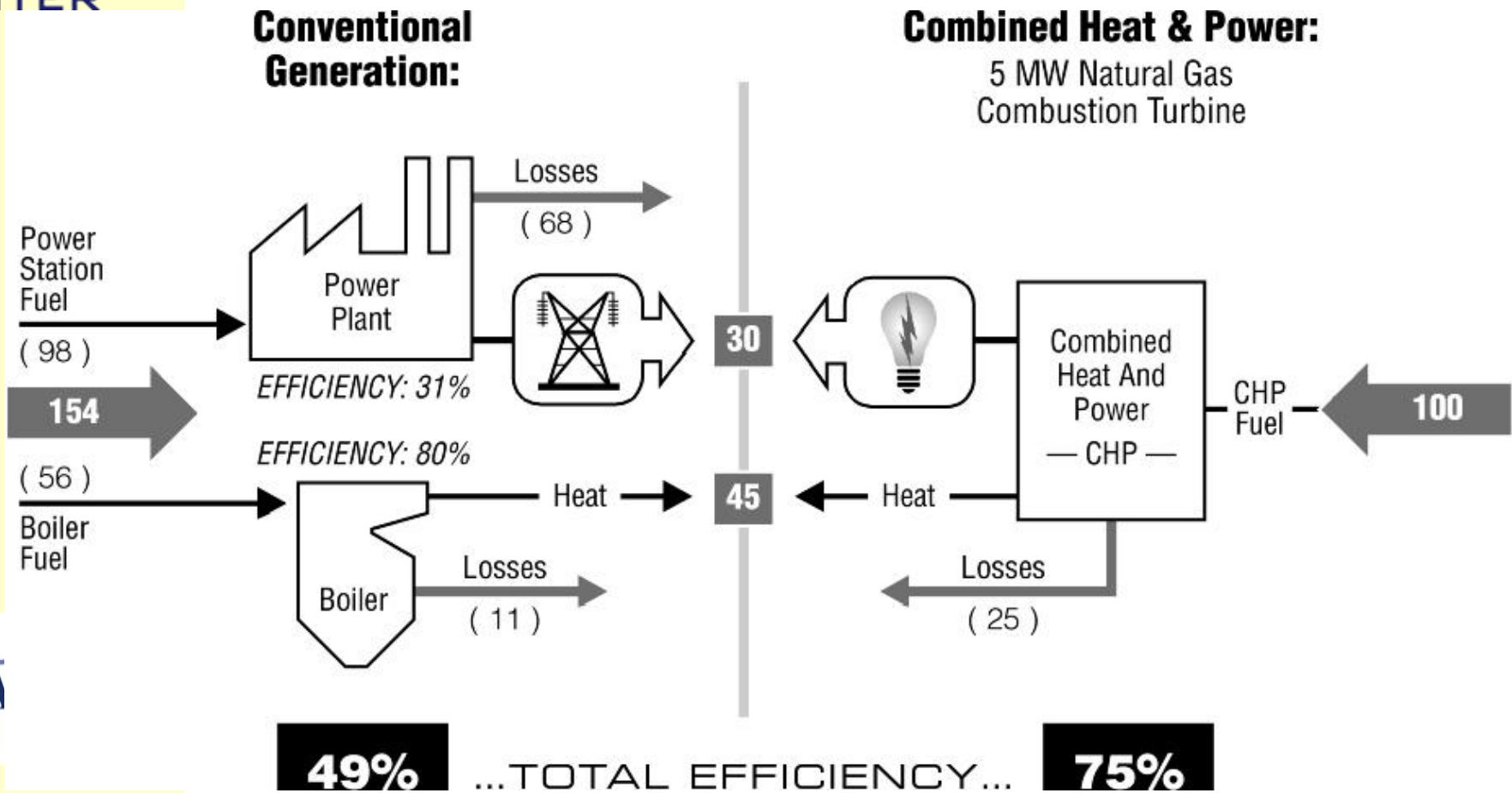
Efficiency Benefits of CHP



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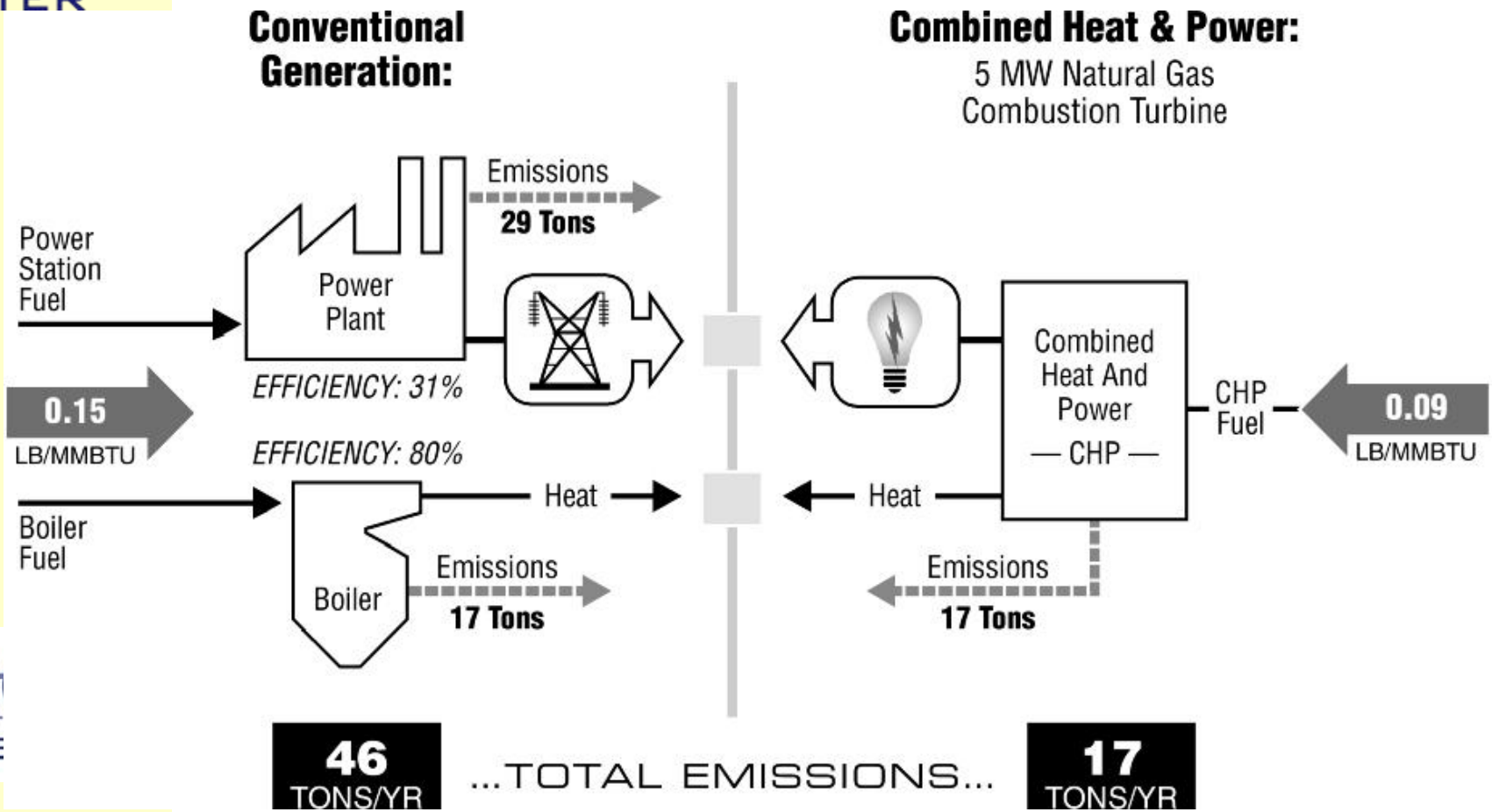
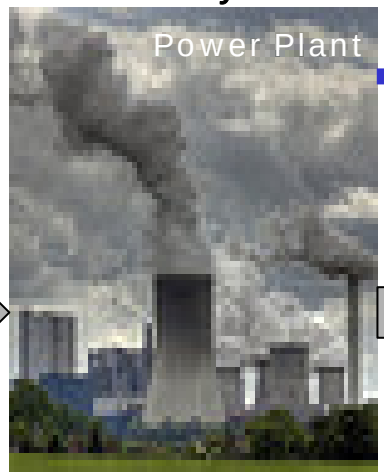
Environmental Benefits of CHP (NO_x)



CO_2 Emissions Reductions from CHP

Conventional Generation

Efficiency: 31%



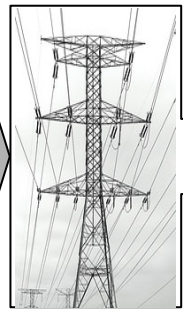
Power Station Fuel (U.S. Fossil Mix)

186

lb/MMBtu

CO_2 Emissions

52k Tons/yr



6.0 MWe

Combined Heat & Power:

Taurus 65 Gas Turbine

Efficiency: 82.5%

CHP Fuel (Gas)

117

Lb/MMBtu

Efficiency: 80%

Boiler Fuel (Gas)

117

Lb/MMBtu

Boiler

Steam

70,000 pph

Steam

CO_2 Emissions

43k Tons/yr

CO_2 Emissions

56k Tons/yr

95k Tons **...TOTAL ANNUAL CO_2 EMISSIONS...** **56k Tons**

39,000 Tons CO2 Saved/Year

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In the right circumstance CHP Is A Triple Win

Saves Money; reducing energy costs, improving margins and reducing price volatility

Energy efficiency and environmental benefits, lowering criteria pollutants and GHG emissions

Improves electric service reliability and power quality

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Northeast Application Center Contacts

Beka Kosanovic

NAC Co-Director for Technical Assistance

(413) 545-0684 (voice)

kosanovi@ecs.umass.edu

Tom Bourgeois

NAC Co-Director for Education and Outreach

(914) 422-4013 (voice)

tbourgeois@law.pace.edu

http://www.northeastchp.org/nac/index.htm