The Solutions Network

Rochester, New York

Combined Heat & Power (CHP) The Concept

Presentation at
Energy 2004, Rochester, New York
Tuesday, August 10, 2004

Presentation Outline

- CHP: The Concept
- What Makes A Good CHP Application?
- What Is The Technical Risk?
- Messages Regarding CHP
- Panel Discussion

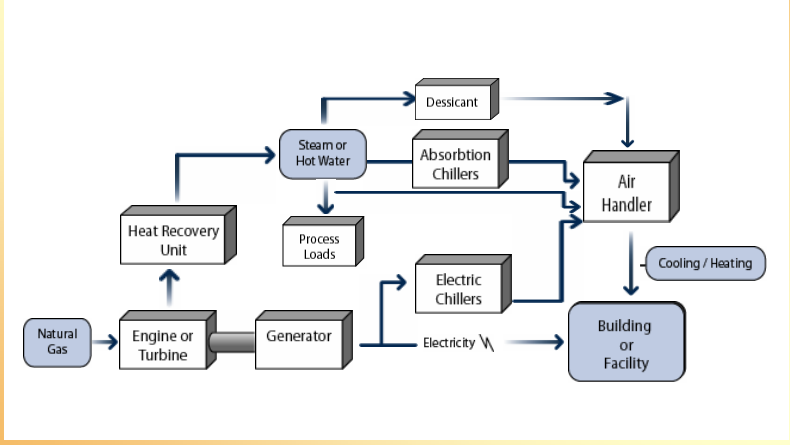
Acronyms

- Combined Heat & Power (CHP)
- Buildings Cooling, Heating & Power (BCHP)
- CHP for Buildings (CHPB)
- Integrated Energy Systems (IES)
- Total Energy Systems (TES)
- Trigeneration (Trigen)
- CHP for Industry
- Cogeneration

What is CHP?

- Integrated System
- Located At or Near a Building/Facility
- Provides a Portion of the Electrical Load
- Utilizes the Thermal Energy
  - Process Heating
  - Cooling
  - Heating
  - Drying

Typical Commercial CHP System



CHP System Sizes *(Terminology)*

System Designation	Size Range	Comments
Mega	50 to 100+ MWe	• Very Large Industrial • Usually Multiple Smaller Units • Custom Engineered Systems
Large	10's of MWe	• Industrial & Large Commercial • Usually Multiple Smaller Units • Custom Engineered Systems
Mid	10's of kWe to Several MWe	• Commercial & Light Industrial • Single to Multiple Units • Potential Packaged Units
Micro	<60 kWe	• Small Commercial & Residential • Appliance Like

Why is There an Opportunity?

- DOE/EIA Projects Over 360 GWe of New Capacity
  - Meet Growing Demand
  - Compensate for Plant Retirements
- Today's Central Station Plants Lose 23 Quads of Thermal Energy

Why is There an Opportunity?

- Aging Electric Transmission and Distribution Systems
  - Difficult to Site New Lines
  - Capacity Constrained
  - Costly to Maintain
- Rising Concerns Over
  - Energy Security
  - Blackouts/Brownouts
  - Power Supply Constraints
  - Electricity Prices

What Makes A Good CHP Application?

- Coincident Needs for Power & Thermal Energy
- Cost of Buying Electric Power from the Grid Relative to the Cost of Natural Gas
  a.k.a "Spark Spread"
- Installed Cost Differential Between a Conventional and a CHP System

Why CHP?

High Efficiency, On-Site Generation Means …

- Competitiveness
  - Lower Energy Costs
  - Better Reliability
  - Better Power Quality
- Environmental
  - Lower Emissions (including CO_2)
  - Conserve Natural Resources
- Synergies
  - Potential Generation Asset
  - Especially Municipal/Co-ops
- Support Grid Infrastructure
  - Fewer T&D Constraints
  - Defer Costly Grid Upgrades
- Facilitates Deployment of New Clean Energy Technologies

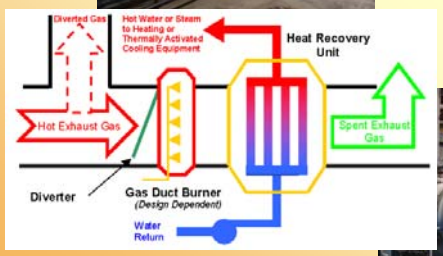
CHP Technologies

Reliable CHP Technologies

- Electric Generation Equipment
  - **Reciprocating Engines**
  - **Gas Turbines**
  - **Steam Turbines**

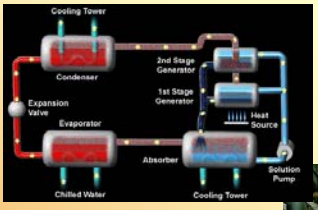
Reliable CHP Technologies

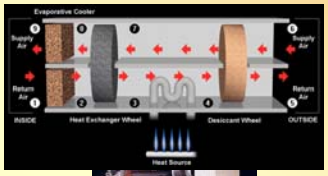
- Heat Recovery Systems
  - Steam and Hot Water
  - Exhaust Gases

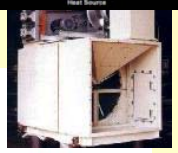


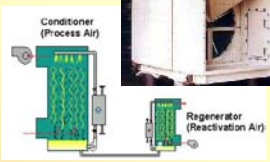
Reliable CHP Technologies

- **Thermally Activated Technologies**
  - **Absorption Chillers**
  - **Desiccant Dehumidification**









Other Components

- Grid Interconnect:
  - Isolation Switch
  - Switchgear
  - Protection Relays
    - » Voltage
    - » Current
    - » Frequency
    - » Power
  - Synchronizing Equipment
- Installation:
  - Equipment Footprint
  - Floor Loading
  - Proximity To HVAC Equipment
  - Number of Electrical Feeds

CHP Is A Low Technical Risk

- Utilize Proven Technologies
- Employ Standard Design Practices
- Incorporate Good Maintenance Practices

Candidate Applications for CHP

- Hospitals
- Colleges / Universities
- High Schools
- Residential Confinement
- High Rise Hotels
- Fitness Centers
- Food Processing
- Paper / Lumber Mills
- Chemical Plants
- Metal Fabrication
- Ethanol Plants
- Landfill / Water Treatment Plants

The Solutions Network

Rochester, New York

29 Palms Co-generation Project

Gary Morrissett
Energy Manager
29 Palms Marine Corps Base
Expert Panelist Today

7.2 MW Cogeneration Plant

- Total project cost $16 m
- Payback 3.5 years
- Applied project payback 19 years
- Completion of plant July 7, 2003
- Annual Yearly Savings - $5.8 m
- BTU output 35Mbtu

Plant Basics

- Basic Plant design
  - 7.2 MW Solar Turbine Taurus 60
    - Absorption chilling pre cooling
    - Gas compressors
    - SEMS monitoring and emissions controls
    - Heat rejection system
    - Breaker tie in
    - Central Heat Plant loading

Does CHP Make Sense In Your Application
Summary Messages

- CHP Is Not Right For Every Application In Every Location
- Where CHP Makes Sense, It Can & Will:
  - Lower Energy Costs
  - Increase Reliability
  - Improve Power Quality
  - Provide Standby Power
  - Lower Emissions

Summary Messages

- CHP Is A Low Technology Risk
  - Utilize Proven Technologies
  - Employ Standard Design Practices
  - Incorporate Good Maintenance Practices
- Each Application Must Be Evaluated
  - Initial Screening: Rules Of Thumb / Averages
  - Capital Investment: Detail Analysis Provides Accurate Estimates of Savings / Cash Flows

CHP is a Triple Win

- Saves Money --- Consumer
- Energy Efficiency and Cleaner Environment --- Government
- Provides Business Opportunity --- Industry

Bottom Line

Recovers / Recycles Energy that Otherwise Would be *Wasted!*

CHP – Further Assistance

- US EPA Combined Heat & Power Partnership
  - Launched in 2001
  - 138 Partners – 851 MW of Projects Assisted
  - Voluntary Public-Private Partnership To Help Get CHP Projects Installed
  - Education, Networking, Resources, Technical Assistance, Recognition
- Contact Luis Troche @ 202/343-9442

  WWW.epa.gov/chp

CHP – Further Assistance

- US DOE Sponsored Application Centers
- Midwest CHP Application Center
  - Serves 8 State Midwest Region
  - Information, Education, Technical Assistance
  - Contact: John Cuttica 312/996-4382

    WWW.chpcentermw.org
- Five Additional Centers Throughout the US

CHP – Further Assistance

- For Federal Facilities: US DOE Federal Energy Management Program, FEMP
  - Financing
  - Training (web-based and hands-on)
  - Energy reliability, security
  - Technical assistance
- www.eere.energy.gov/femp/

FEMP Assistance Examples

- Technical Assistance
  - Screenings, Feasibility Studies…
  - TA Call for Projects
  - Agency & Facility Reliability Assessments, Energy Security options analysis
- Private financing—ESPCs, UESCs, Other—measurement and verification
- Technology Demonstrations

The Solutions Network

Rochester, New York

Thank You

And Now

The Panel Discussion

FEMP CHP Contacts

For Assistance w/Federal Sites--Technical or Financial, contact FEMP at DOE Regional Offices, HQ and ORNL:

CHP Outreach Lead [also Biomass and Alternative Methane Fuels Contracting Officer's Rep]: Christopher Abbuehl (DOE Philadelphia Regional Office), 215-656-6995, Christopher.Abbuehl@ee.doe.gov

CHP Program Lead, Technical Assistance
Shawn Herrera (DOE/HQ), 202-586-1511, shawn.herrera@ee.doe.gov

CHP Financing Assistance
Tatiana Strajnic (DOE/HQ), 202-586-9230, tatiana.strajnic@ee.doe.gov

CHP Technical or Financing Support
Kirby Wilcher (ORNL), 865-574-0429, wilcherkl@ornl.gov