

Combined Heat and Power (CHP) for Hospitals

*An Energy Efficiency
Education and Implementation Program*

Module #1

CHP: The Concept

March 18, 2003



Benefits of CHP

High Efficiency, On-Site Generation Means ...

- Improved Reliability
- Lower Energy Costs
- Better Power Quality
- Lower Emissions (including CO₂)
- Conserve Natural Resources
- Support Grid Infrastructure
 - Fewer T&D Constraints
 - Defer Costly Grid Upgrades
 - Price Stability
- Facilitates Deployment of New Clean Energy Technologies
- Enhances Competition

CHP Is A Triple Win

- **Saves Money While Increasing Reliability --- Hospitals**
- **Energy Efficiency and Cleaner Environment --- Government**
- **Provides Business Opportunity --- Industry**

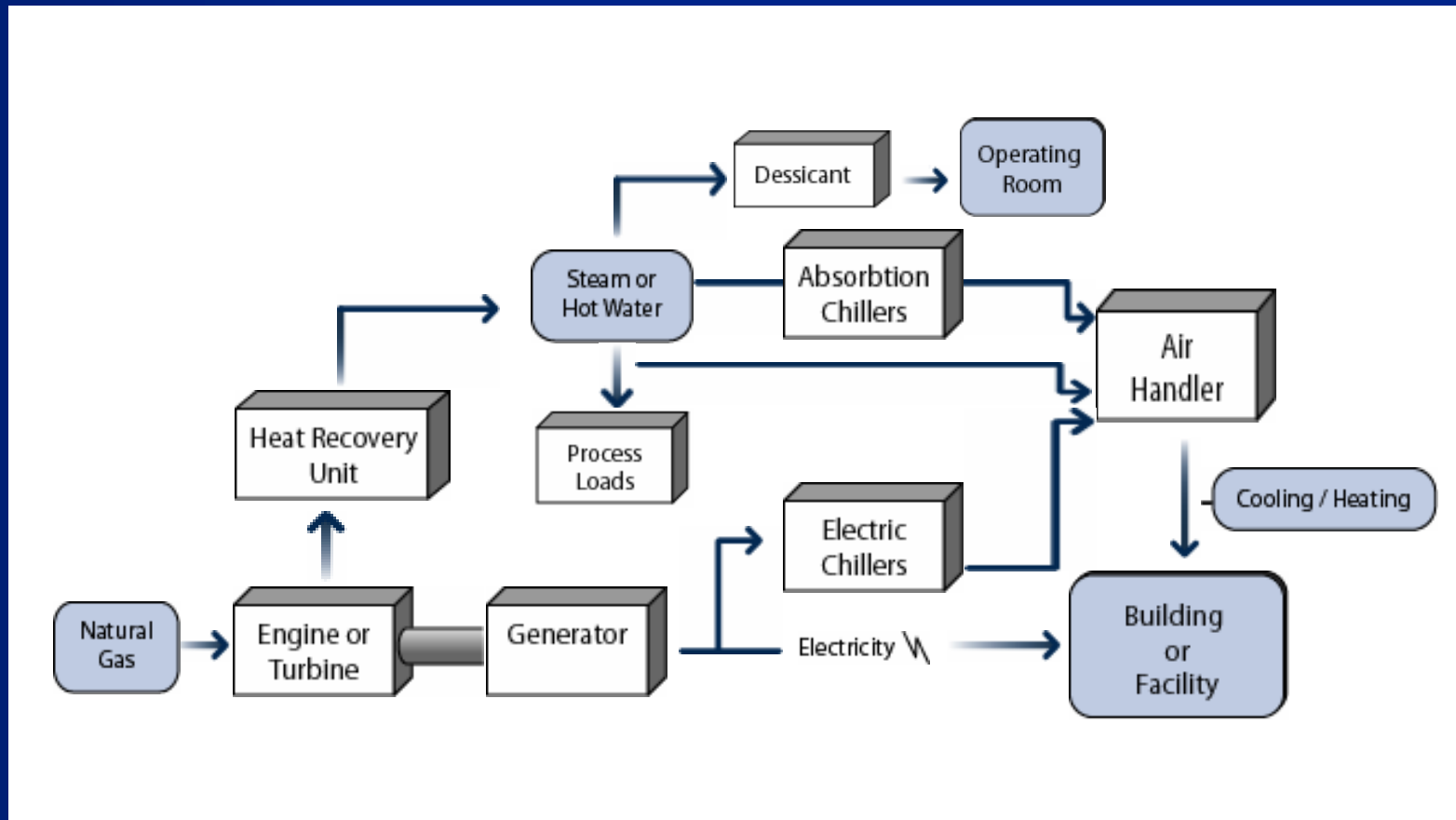
Why CHP in Hospitals?

- **High Energy Users**
 - Thermal and Electric
- **Thermal and Electric Energy Loads**
 - Generally Well Matched in Time
 - Needed 24/7/365
- **Saves Energy and \$\$\$**
 - Reduces Energy Bills
 - Addresses High Electrical Cost
- **Improves Electric Service Reliability**
 - Addresses Momentary Interruptions that Cause
 - » Equipment Resets
 - » Patient Inconvenience
 - » Lost Revenues

What is CHP?

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

Typical Commercial CHP System



Emergency Generators vs. CHP Systems

Emergency Generators

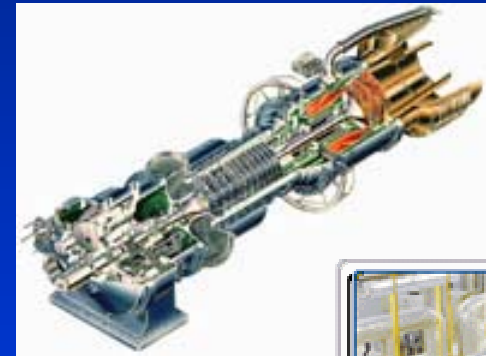
- **Sized to Meet Life Safety and Critical Loads**
- **Diesel Fueled**
 - High Emissions
 - Meet Emergency Startup Requirements
- **Results in Instantaneous Outage if Needed to Start**
- **Not Capable of Running Continuously**
- **Rarely Run**
- **No Financial Payback**

CHP Systems

- **Sized Based on Electric and Thermal Loads**
- **Natural Gas Fueled**
 - Low Emissions
 - Normally Cannot Meet Emergency Startup Requirements
- **Reduces/Eliminates Instantaneous and/or Prolonged Outages**
- **Capable of Running Continuously**
- **Normally Run During Peak Energy Periods**
- **Good Financial Payback**
- **Uses Utility Grid as Backup**
 - Emergency Generators are Backup to Backup

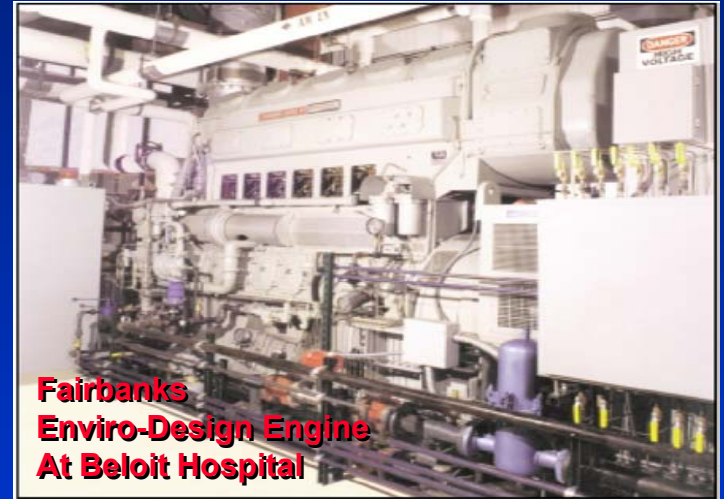
Reliable CHP Technologies for Healthy Hospitals

- **Electric Generation Equipment**
 - Reciprocating Engines
 - Turbines / Microturbines



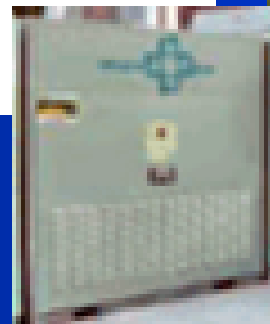
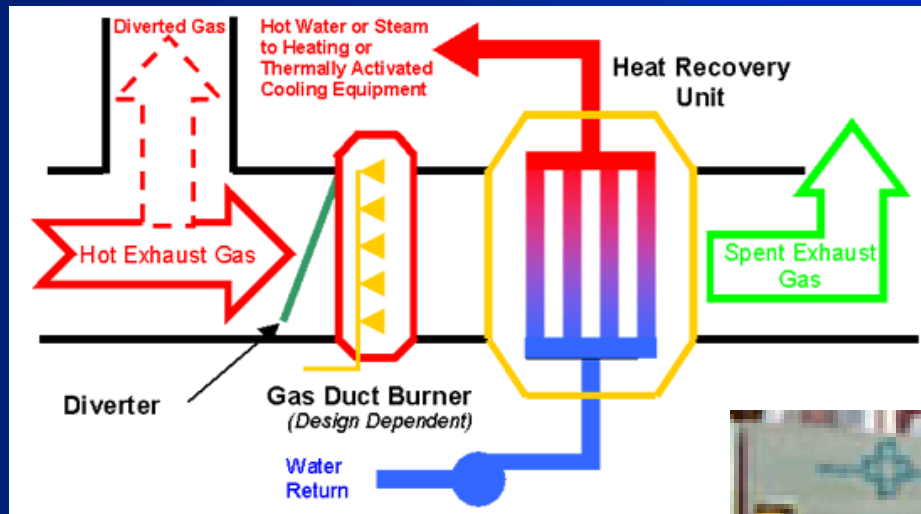
Newer Technology Well Suited for Hospitals

- **CHP Systems with Natural Gas Engines are Not Suitable for Life Safety Back-Up**
 - Can't Start in 10 Seconds
 - Some Areas Do Not Consider Gas an "Assured" Fuel Source
- **Unfortunate – Diesel Engine Redundancy Cost Money**
- **New CHP Potential with Dual Fuel Engines**
 - Start Up in <10 Seconds on Diesel
 - Can Switch on the Fly to 99% Gas Operation and Back to Diesel
 - <1% Oil Operation Positively Impacts Emissions Issues



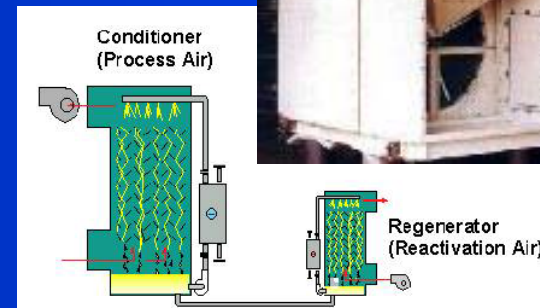
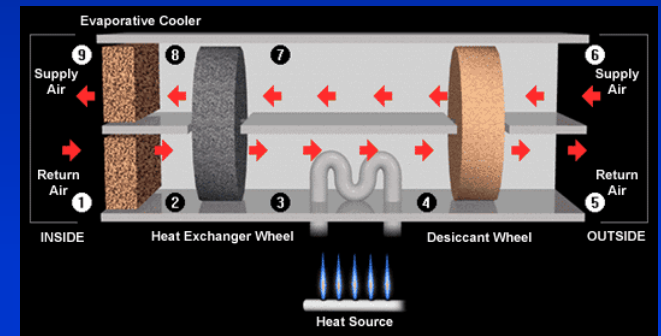
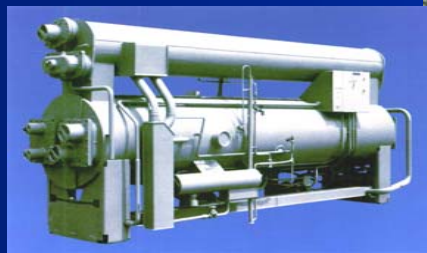
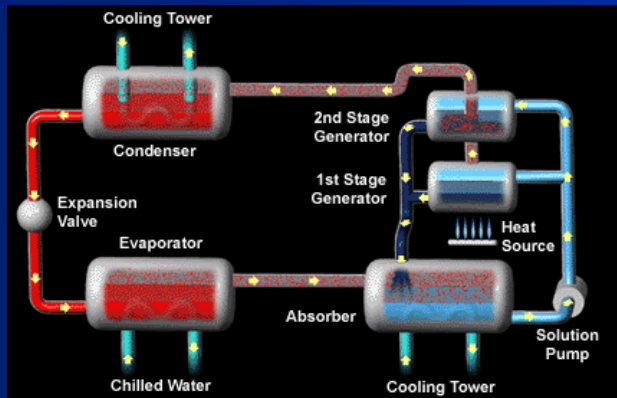
Reliable CHP Technologies for Healthy Hospitals

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



Reliable CHP Technologies for Healthy Hospitals

- Thermally Activated Technologies
 - Absorption Chillers
 - Desiccant Dehumidification



Top 10 Impediments to CHP

6. Assessing CHP Value (Beyond Energy Cost Reduction)

Hard to Identify, Quantify, and Allocate Among Parties

7. Stakeholder Apathy

Lack of Incentive for Facility Managers and Engineering Firms to Try Something Different

8. High First Cost

Discourages Investment Despite Life Cycle Benefits

9. Electric Restructuring

Creates Uncertainty and a “Wait and See” Attitude

10. Too Few Case Studies

Inconsistent, Hard to Find, and Often Incomplete in Financial Details

Top 10 Impediments to CHP

1. Interconnection

Inconsistent Standards, Complex Process, Network Issues and Unpredictable or High Costs

2. Utility Tariffs

Standby Charges and General Rate Design

3. Electric Utility Response

Often Times Ambivalent at Best, Hostile at Worse

4. Lack of Familiarity

With CHP Technologies, Concepts, and Environmental Benefits

5. Permitting Process

Sometimes Long, Cumbersome, and Costly

Key Factors for CHP Attractiveness

- **Coincident Needs for Power and Thermal Energy**
- **Cost of Buying Electric Power from the Grid Relative to the Cost of Natural Gas**
a.k.a. “Spark Spread” > \$11 MMBTU
- **Installed Cost Differential Between a Conventional HVAC and a CHP System**

Things to Watch For



- **Proper Size to Get Best Payback**
- **Financial Opportunities**
 - **Grants**
 - **Low Cost Loans**
- **Credibility of Assessment**