# Combined Heat and Power (CHP) for Hospitals

*An Energy Efficiency Education and Implementation Program*

**Module #1**

# CHP: The Concept

**March 18, 2003**

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# Benefits of CHP

*High Efficiency, On-Site Generation Means …*

- Improved Reliability
- Lower Energy Costs
- Better Power Quality
- Lower Emissions (including $CO_2$)
- 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

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# 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

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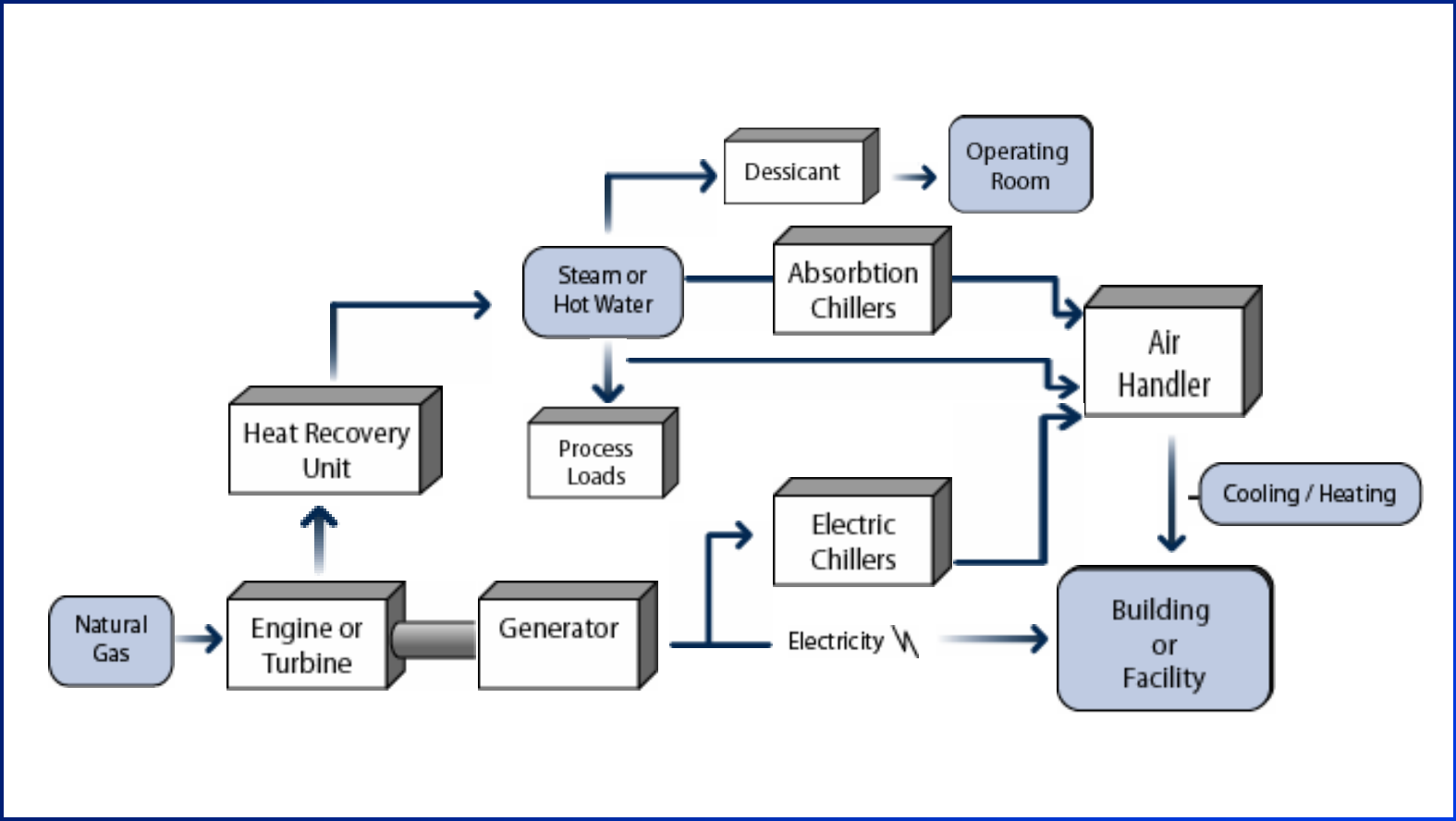
# What is CHP?

- 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

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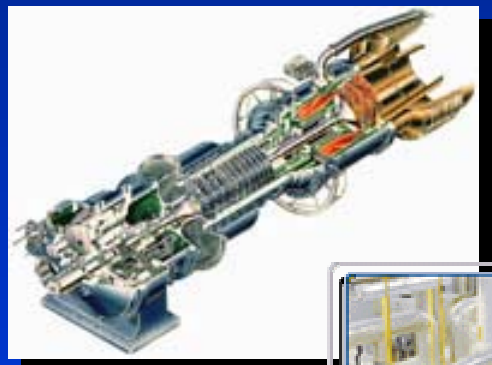
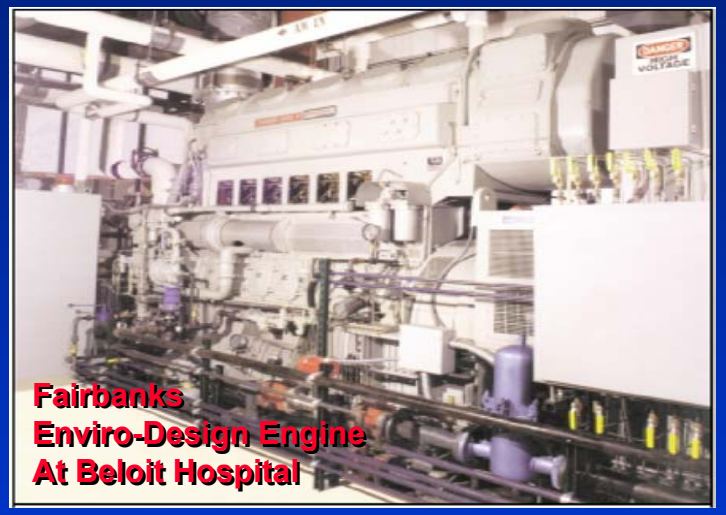
# Reliable CHP Technologies for Healthy Hospitals

- 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

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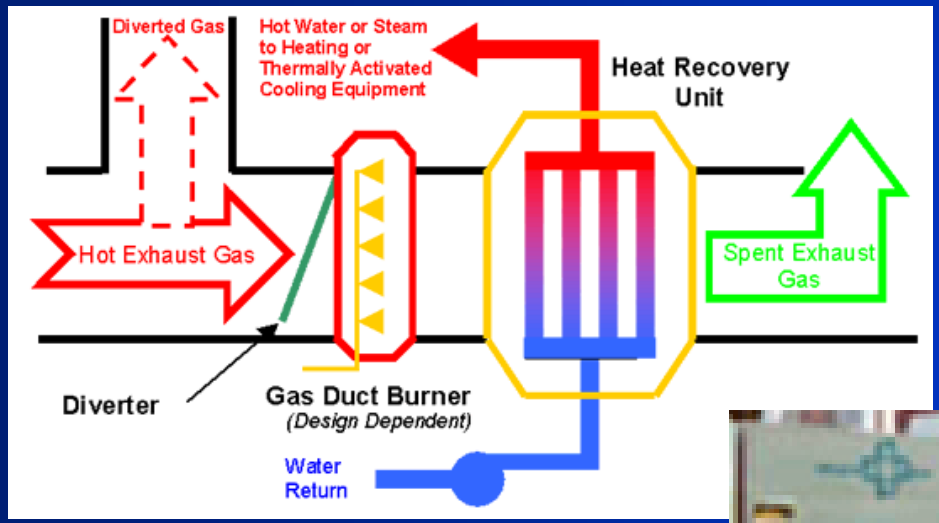
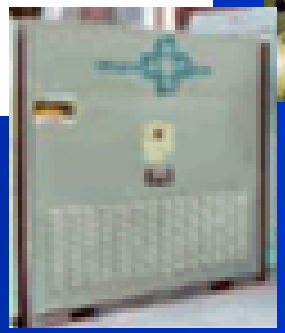
# Reliable CHP Technologies for Healthy Hospitals

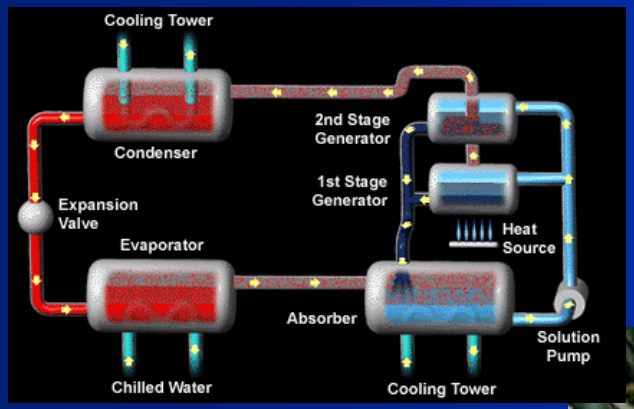
- Heat Recovery Systems
  - Steam and Hot Water
  - Exhaust Gases

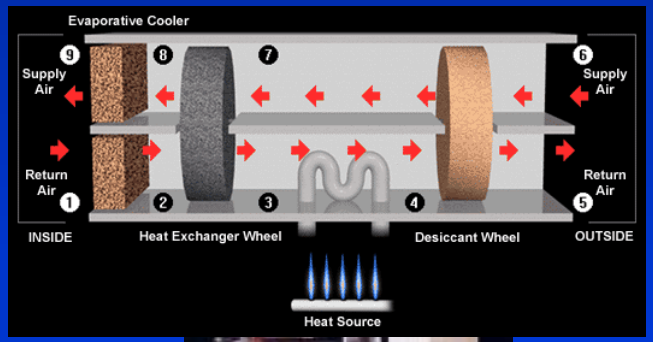


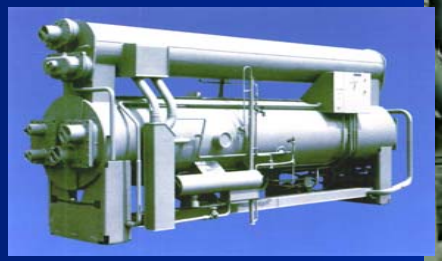



# Reliable CHP Technologies for Healthy Hospitals

- Thermally Activated Technologies
  - Absorption Chillers
  - Desiccant Dehumidification



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# 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*

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# 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*

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# 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**