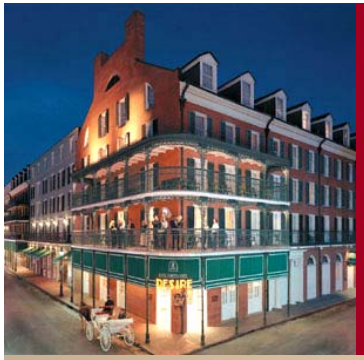

Performance Contracting: Recipes for Success

New Orleans • July 27 – 29, 2005

"Co-Gen Case Studies"

LSU Cogeneration Project

LSU

Presented By:

Tim Staley, PE, CEM

and

Juno Guedry, PE

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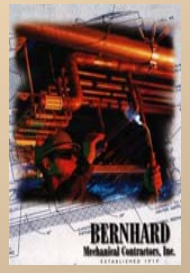

Agenda

Overview of LSU Cogeneration

- What is Cogeneration / CCHP?
- Project Background / Development
- Project Description
- Project Design and Installation
- Environmental Issues
- Energy Savings
- Questions and Answers

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LSU Cogeneration Mechanical Team

- Bernhard Mechanical Contractors
- LSU Energy and Facilities Management
- TME, Inc.
- Stone & Webster
- Daniel Calongne Engineers
- Cajun Constructors
- E.P. Breaux Electrical
- Enviro One

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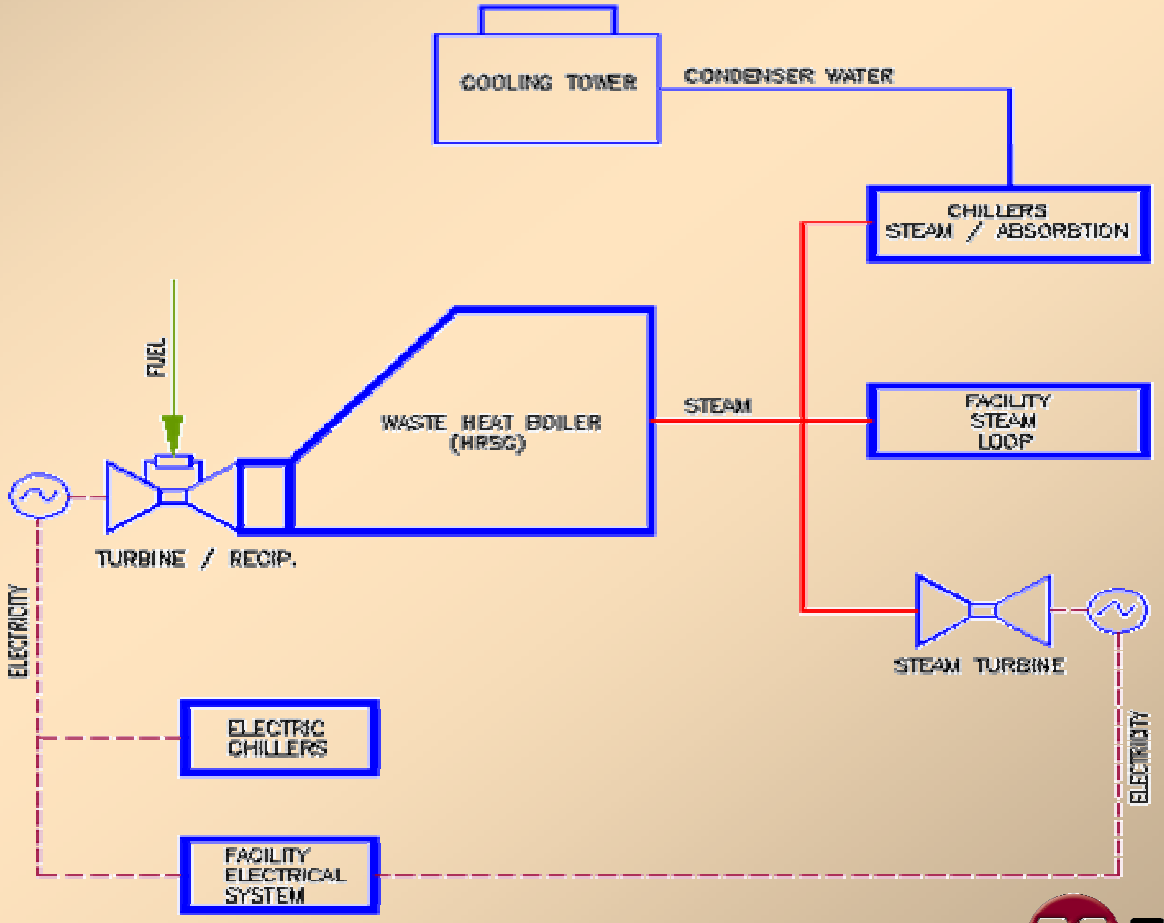
What is Cogeneration?

Combined Cooling Heating and Power (CCHP) Generation



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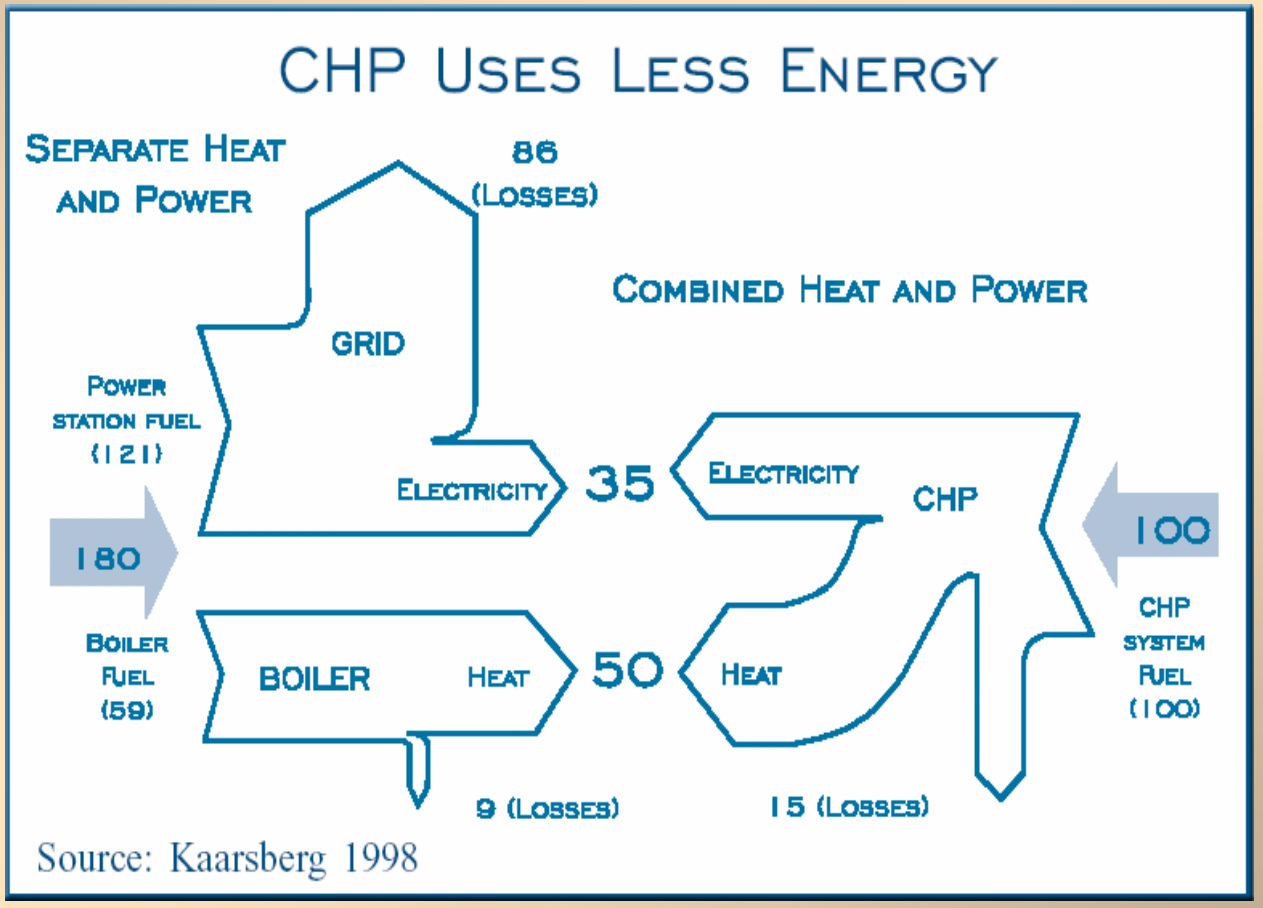
Energy Savings



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Benefits of CCHP

- Converts as much as 70%+ of fuel into usable energy as compared to 30-50% conventional power production
- Reduces energy consumption that translates into cost savings
- Reduces air pollution emissions
- Power reliability and quality

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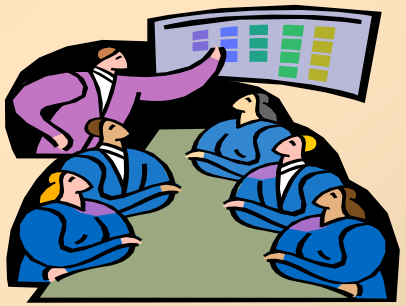
Project Background

- Feasibility Study - January 2000
- Performance Contracting RFP
- RFP reissued early 2001
- BMC proposal selected
- Detailed Study Completed



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Project Background

- Contract Negotiations
- Design Initiated
- Construction Started
- Plant Startup - December 2004

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Benefits for LSU

- Lower Overall Energy Cost
- Additional Steam and Chilled Water Generation Capacity
- Campus Electrical Distribution System Upgrade
- Research Instrumentation
- Power Reliability
- Replacement of Obsolete Equipment
- Reduced Infrastructure Replacement Cost

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Project Description

- 17 MW Gas Turbine Generator
- 900 kW Blackstart Capability
- Heat Recovery Steam Generator
  - 72 KPH Unfired waste heat recovery
  - 150 KPH with supplemental firing
- 6195 tons Steam Turbine Driven Chillers
- 170 MMBTUH Cooling Tower
- Replace Water Treatment Equipment
- Replace Air Compressor
- Research Instrumentation
- Campus Electrical Distribution System
- Replace Switchgear

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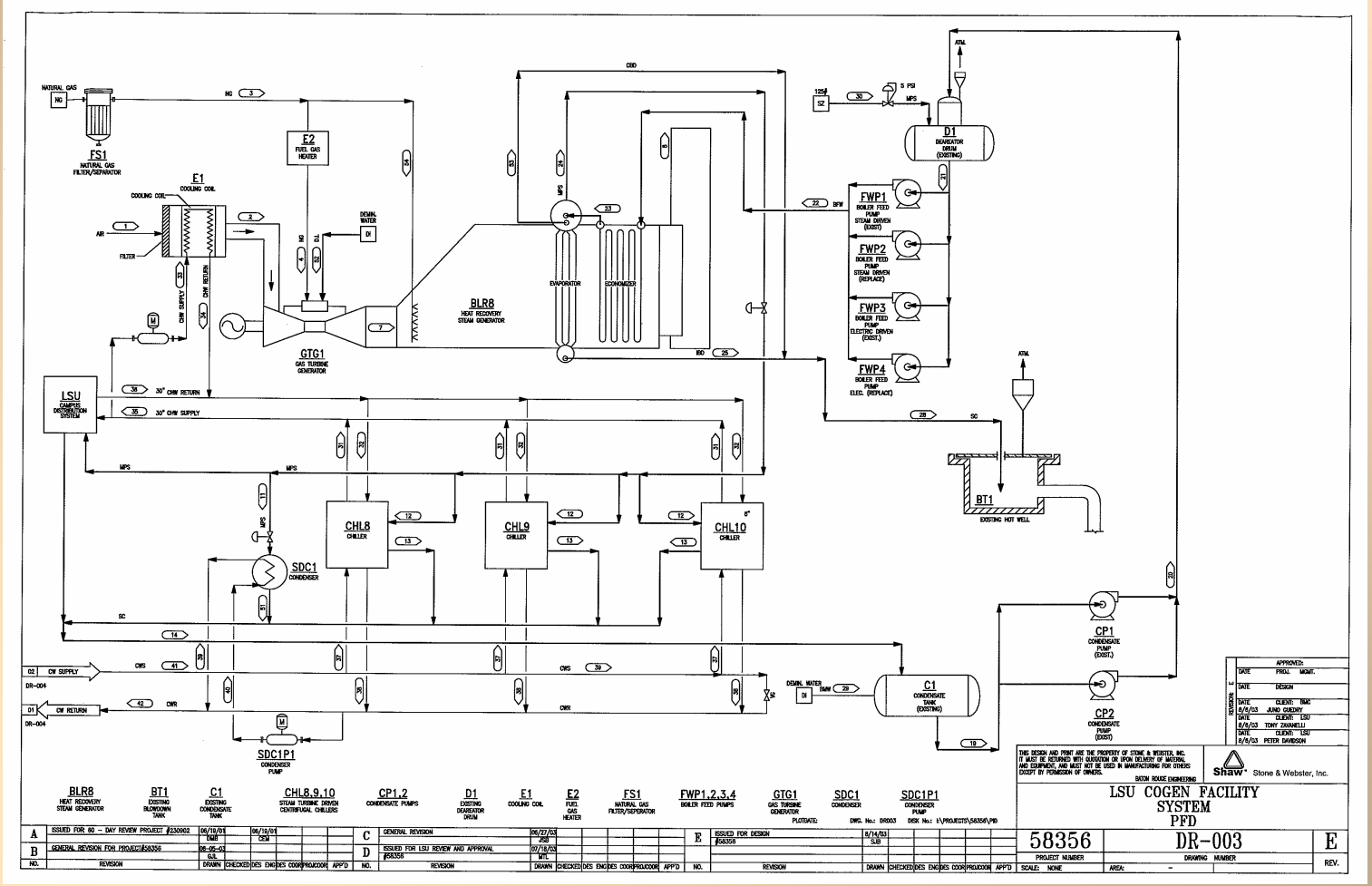
LSU Cogeneration Flow Diagram



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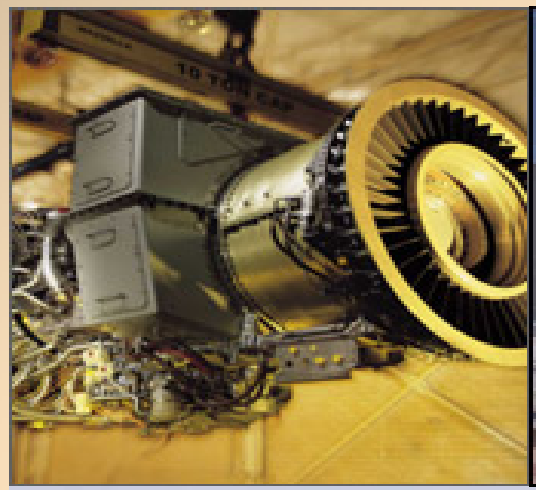
GE LM-2000 Aero-derivative Turbine



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GE LM-2000 Turbine Enclosure and Generator

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Heat Recovery Steam Generator (HRSG)

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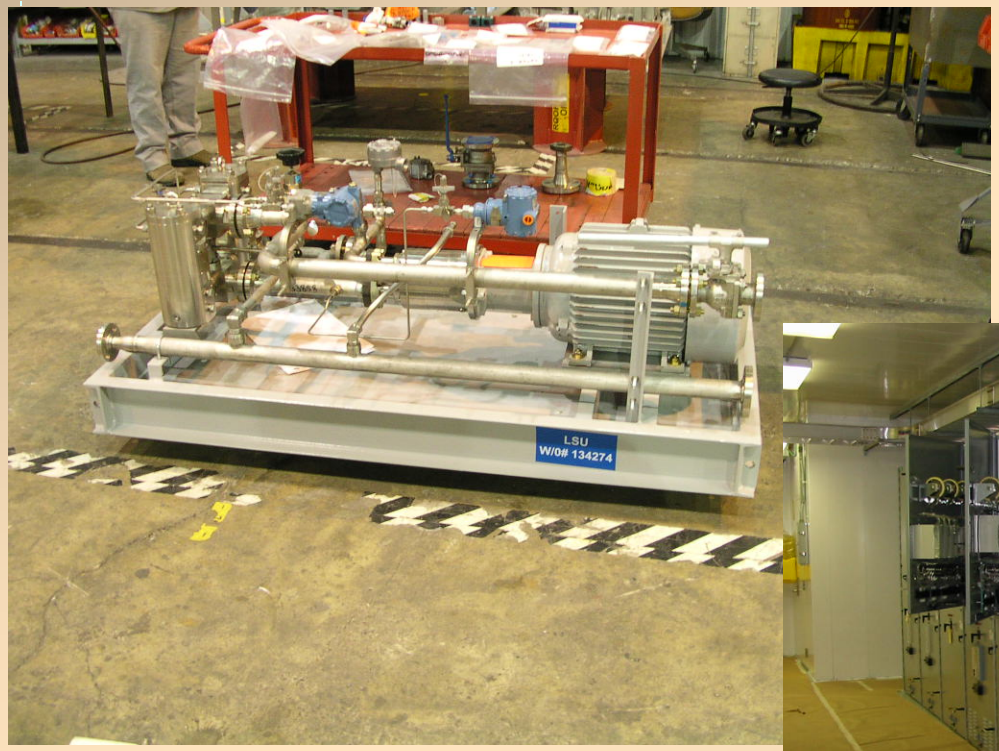
Water Injection Skid & Power Distribution Center



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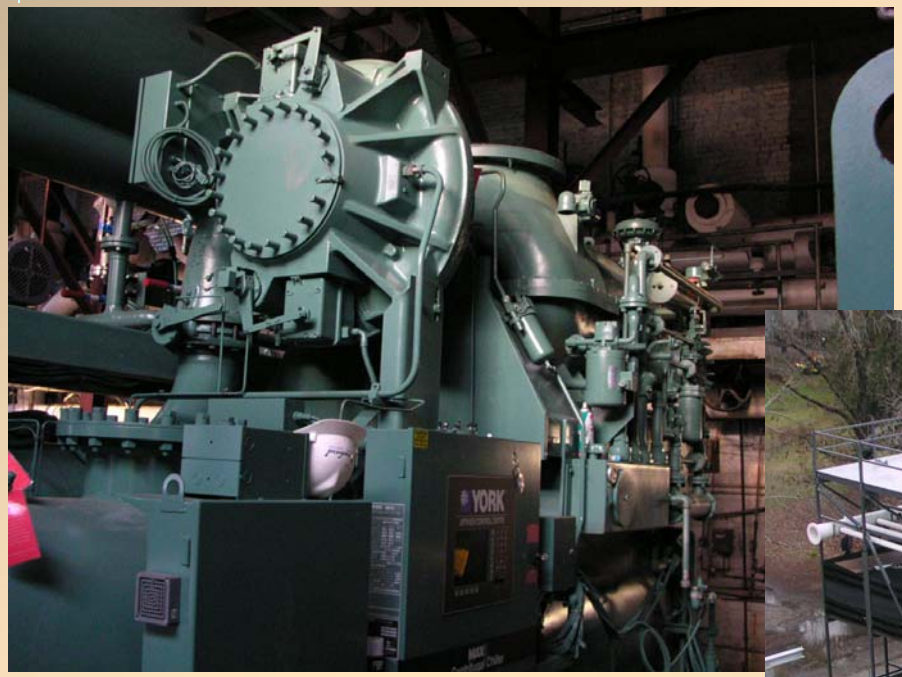
Chiller Compressor, Turbine & Cooling Tower



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Substation and PDC

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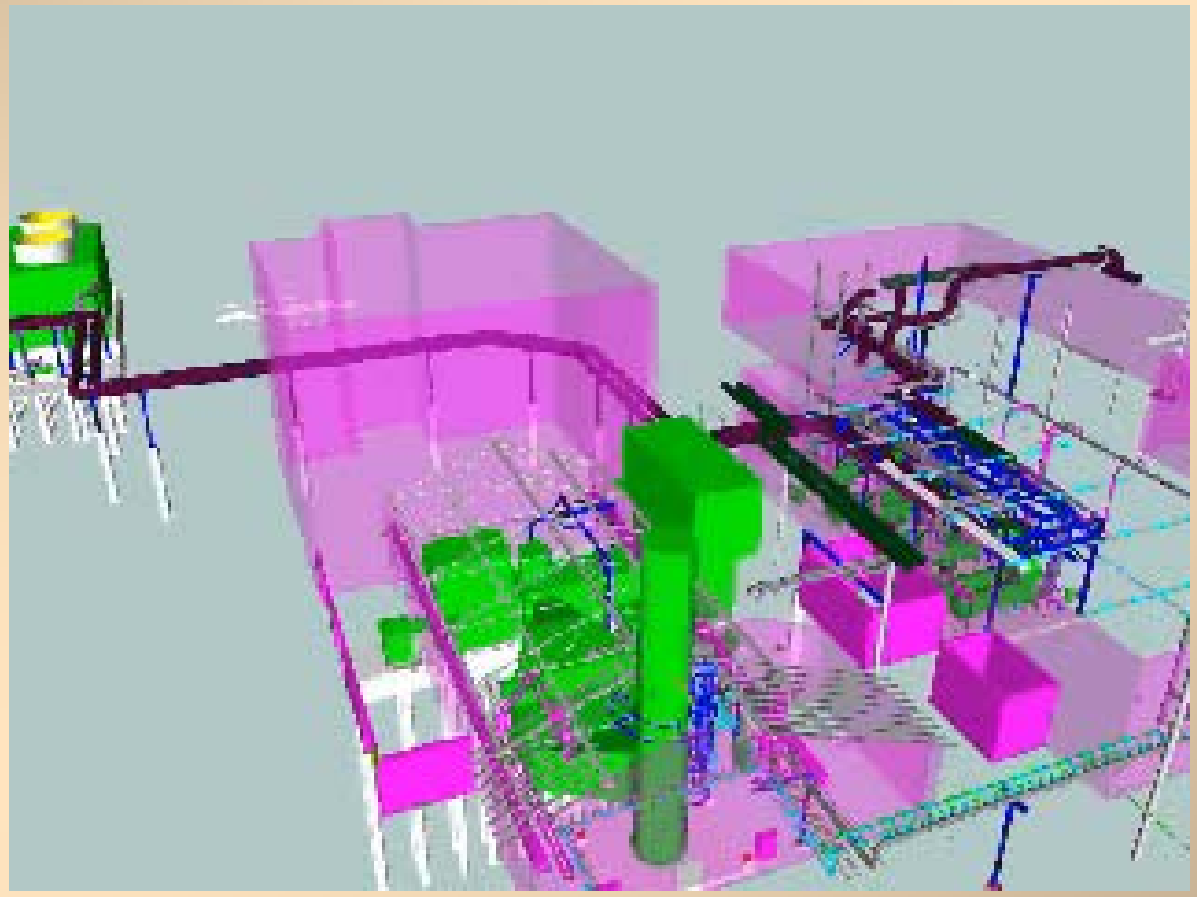
LSU 3-D Model



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Environmental Issues

EXTREME	Los Angeles, CA			
SEVERE	Baltimore, MD	Milwaukee, WI	Phildelphia, PA-NJ-DE	
	Chicago, IL-IN-WI	Muskegon, MI	San Diego, CA	
	Houston, TX	New York, NY-NJ-CT		
SERIOUS	Atlanta, GA	El Paso, TX	Portsmouth, NH-ME	Washington, DC-MD-VA
	Bakersfield, CA	Freseno, CA	Providence, RI	
	Baton Rouge, LA	Hartford, CA	Sacramento, CA	
	Beaumont, TX	Huntington, WV-KY-OH	Sheboygan, WI	
	Boston, MA	Parkersburg, WV-OH	Springfield, MA	
MODERATE	Atlantic City, NJ	Greensboro, NC	Portland, ME	Visalia, CA
	Charleston, WV	Jefferson Co, NY	Raleigh, NC	Worcester, MA
	Charlotte, NC-SC	Kawaunee Co, WI	Reading, PA	
	Cincinnati, OH-KY-IN	Knox Co, ME	Richmond, VA	
	Cleveland, OH	Louisville, KY-IN	Salt Lake City, UT	
	Dallas, TX	Memphis, TN-AR-MS	San Francisco, CA	
	Dayton, OH	Miami, FL	Santa Barbara, CA	
	Detroit, MI	Modesto, CA	Smyth Co, VA	
	Edmonson Co, KY	Nashville, TN	St. Louis, MO-IL	
	Grand Rapids, MI	Pittsburgh, PA	Toledo, OH	
MARGINAL	Albany, NY	Fayetteville, NC	Lake Charles, LA	Poughkeepsie, NY
	Allentown, PA	Greenbrier Co, WV	Lancaster, PA	Scranton, PA
	Altoona, PA	Greenville, SC	Lewiston, ME	South Bend, IN
	Birmingham, AL	Hancock Co, ME	Lexington, KY	Stockton, CA
	Buffalo, NY	Harrisburg, PA	Lincoln Co, ME	Sussex Co, DE
	Canton, OH	Indianapolis, IN	Livingston Co, KY	Tampa, FL
	Columbus, OH	Johnson City, TN-VA	Manchester, NH	Waldo Co, DE
	Erie, PA	Johnstown, PA	Montgomery, AL	York, PA
	Essex Co, NY	Kansas City, MO	Norfolk, VA	Youngstown, OH
	Evansville, IN-KY	Knoxville, TN	Owensboro, KY	

Source: Cogeneration Design Guide, ASHRAE 1996

Environmental Issues

- **Existing Title V Permit**
  - Minor Modification
  - Non-Attainment Zone
  - Offsets from Existing Equipment
- **Requested Increased Emission Levels**
  - NO_x
  - VOC
  - PM_{10}
  - CO
- **Predictive Emissions Monitoring**
  - Regression Curve
  - Performance Factors
  - Initial Emissions Testing

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Energy and Economic Summary

- **Fuel Correlation**
- **Measurement and Verification Plan**
- **Cogeneration Plant Performance**
  - **19 to 19.5 MW Generated Electricity**
  - **13 MW Purchased Electricity**
  - **115,000 MMBtu/Month Natural Gas**
  - **78,000 Pounds per Hour Steam**
  - **1.1 Million Ton-Hours/Month of Cooling**
- **M&V Operating Cost Savings**
  - **Approximately $200,000 per month**
- **850,000 MMBtu in Annual Source Energy Savings**

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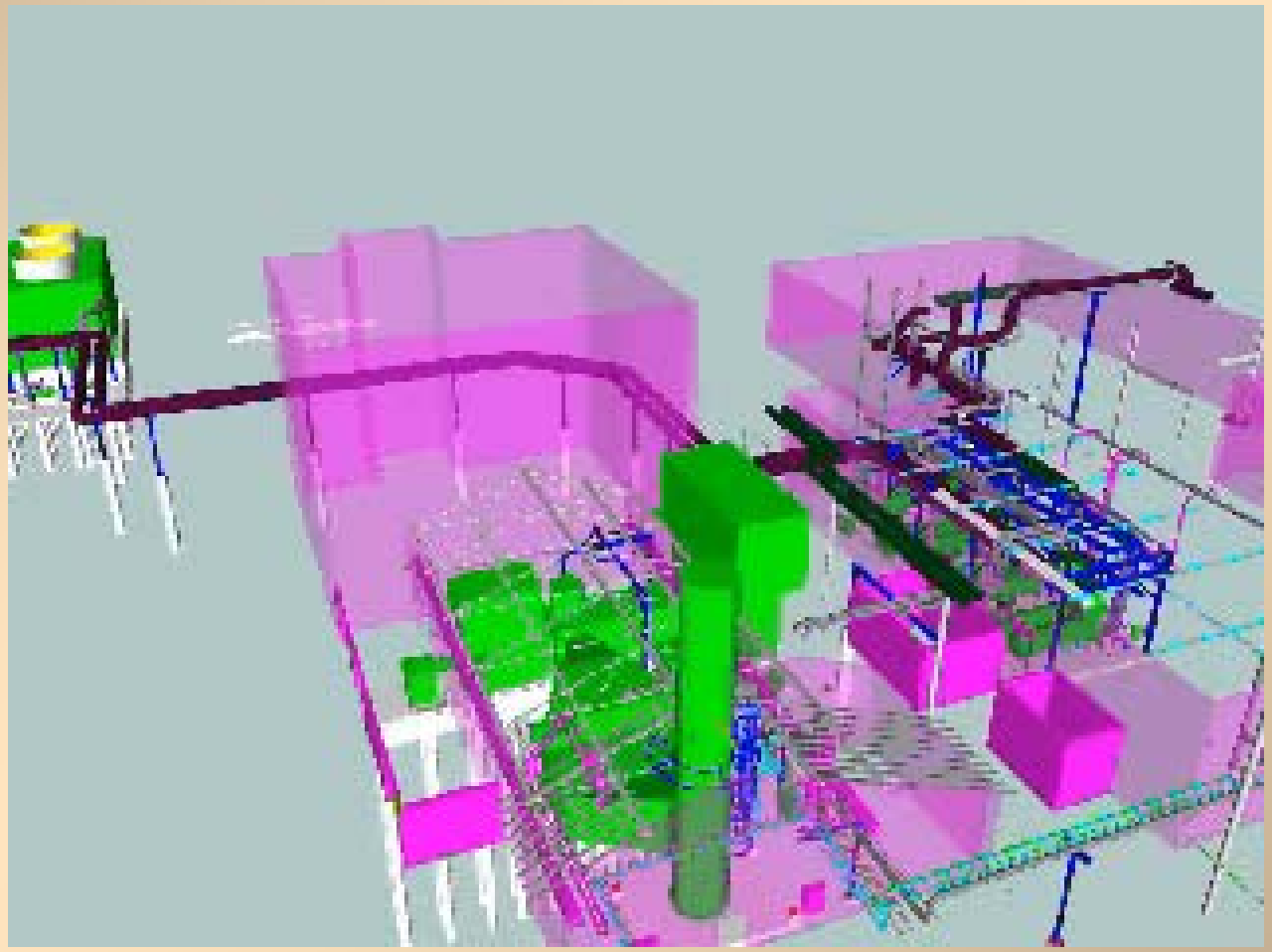
Questions and Answers



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