Combined Heat & Power at UNC Chapel Hill

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Introduction

- Energy Supply systems overview
- Cogeneration Facility
- Chilled Water System Features
- CHP Performance

Energy Supply Systems

- District Energy
- Central Steam Production
- Central Chilled Water Production
- Integral Electricity Generation, Purchase, & Distribution

Definitions

Combined Heat & Power (CHP)

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Cogeneration

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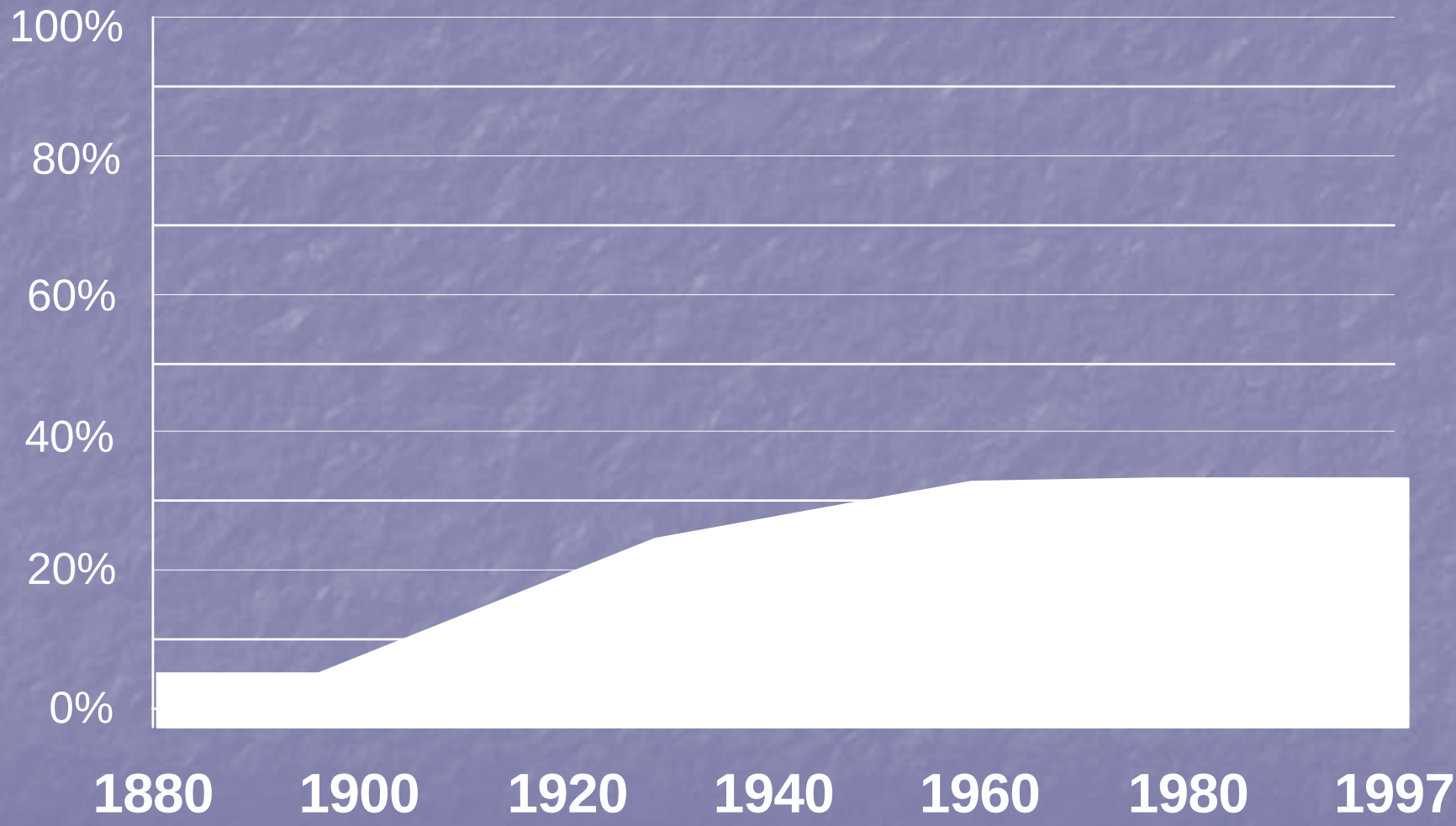
Simultaneous generation of steam and electricity

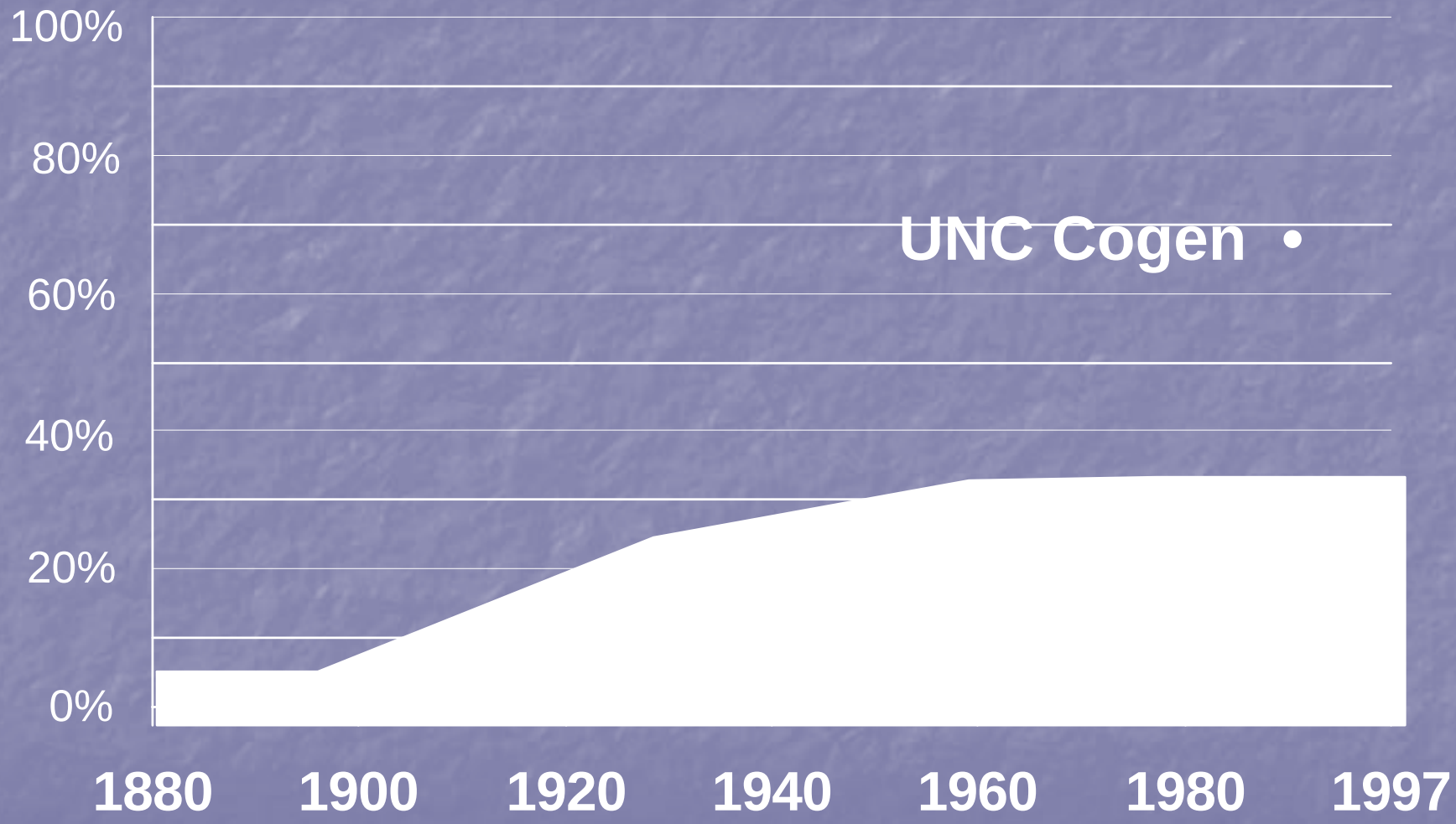
Cogeneration (CHP)

- Simultaneous production of electricity and steam
- High thermal efficiency
- Low environmental impact

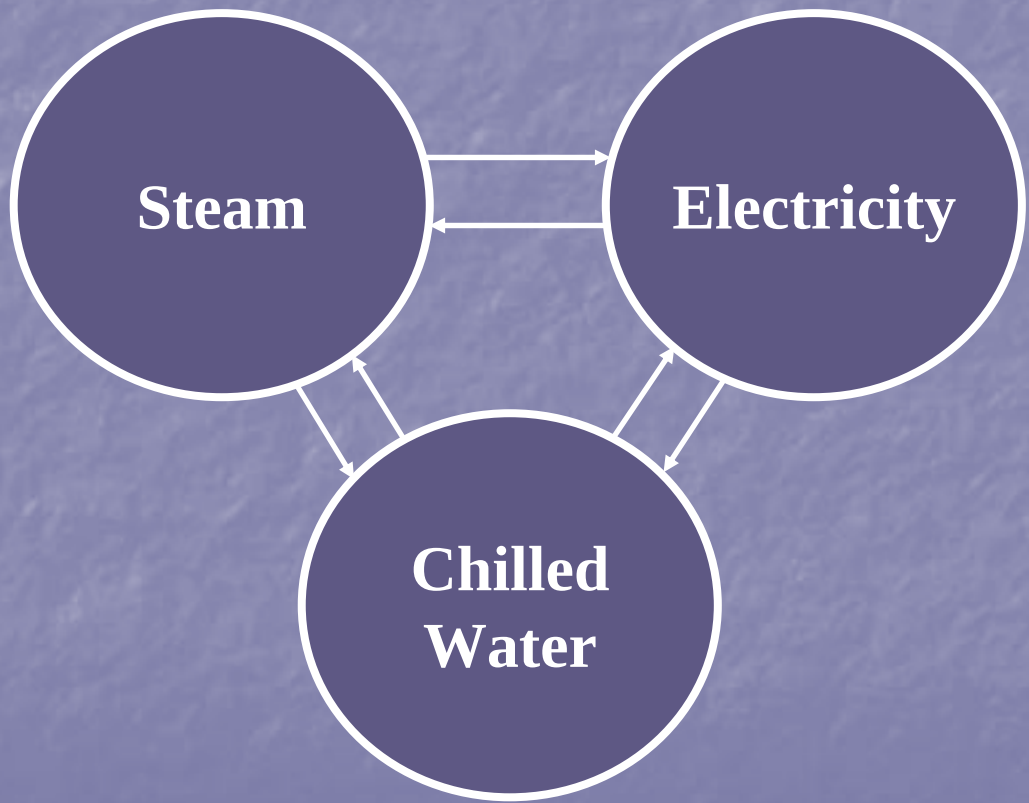
U.S. Average Generating Efficiencies



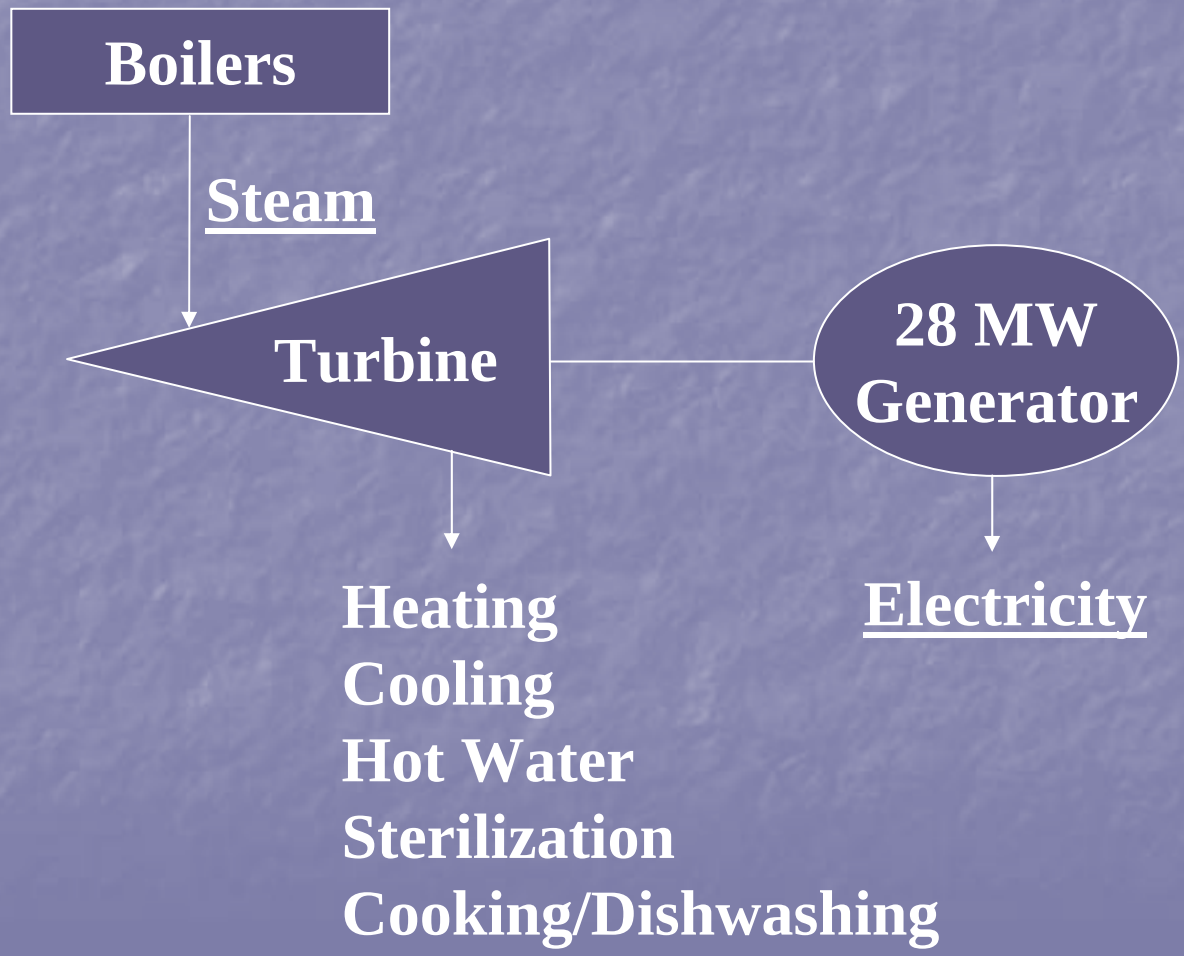
U.S. Average Generating Efficiencies



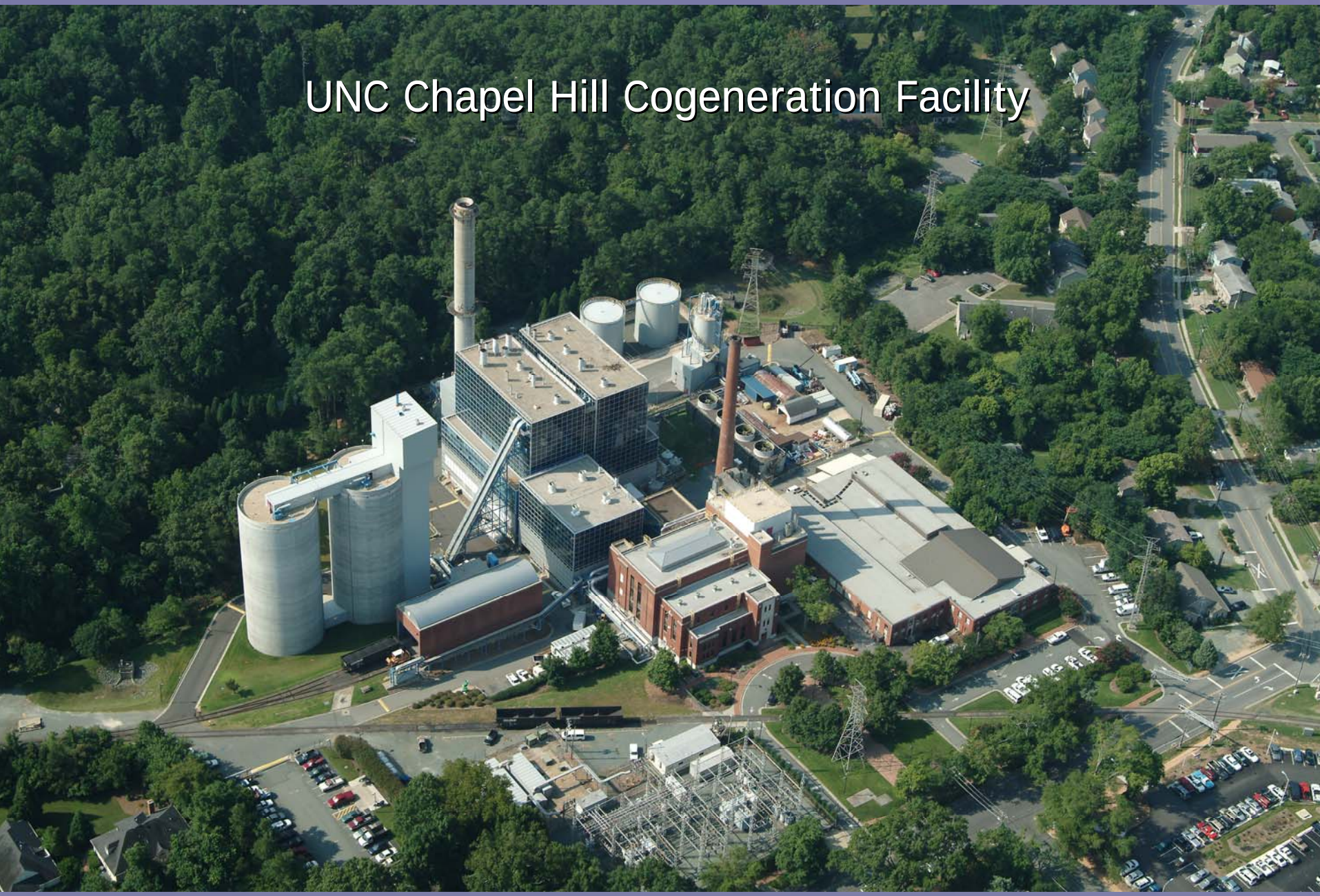
UNC Chapel Hill Cogeneration Concept



UNC Chapel Hill Cogeneration



UNC Chapel Hill Cogeneration Facility

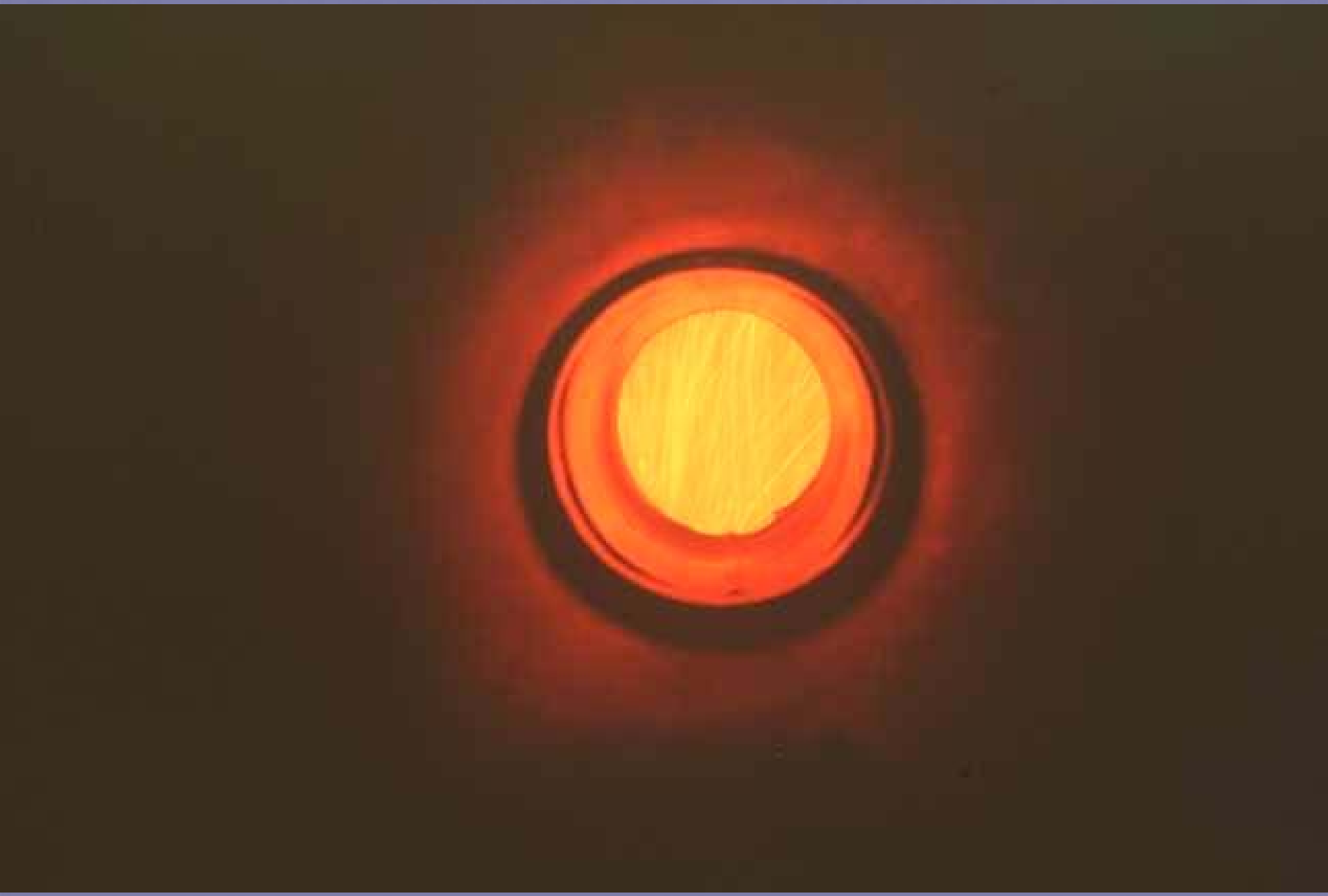


Circulating Fluidized Bed Combustion

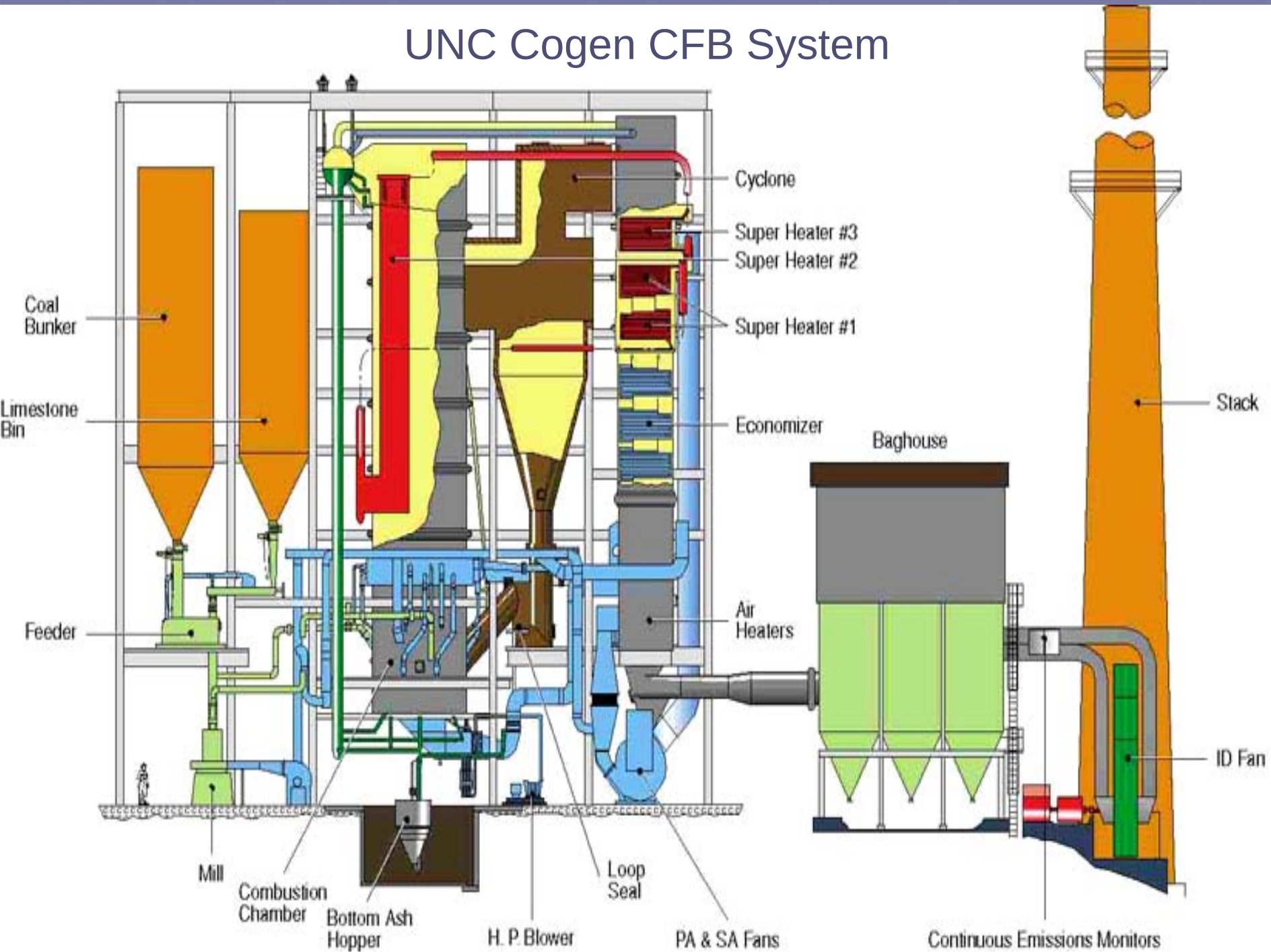
- Nitrous Oxides (NOx) -- furnace temperature
- Sulfur dioxide (SO_2) -- sorbent

NSPS 40CFR60, Subpart Db

- SO_2
  - 90% reduction
  - 1.2 lbs/MMBtu
- NOx
  - 0.6 lbs/MMBtu
- Opacity
  - 20%
- Particulate
  - 0.5 lbs/MMBtu



UNC Cogen CFB System



Chilled Water Systems

- Centralized production of chilled water
- Distribution of chilled water to serve campus needs
- Uses electricity and steam

North Chiller Plant

Thermal Energy Storage

- 40,000 ton-hours capacity
- 4,000,000 gallons of water
- Stratified storage tank 130 feet high x 80 feet diameter
- Completed 2006
- Interconnected to primary distribution lines
- Support plant chillers matched for charging tank

Duke Energy

- Real-time pricing (OPT/HP rate)
- Immediate response to pricing signals
- Steam absorption chillers
- Thermal storage – 10 MW
- Cogeneration of electricity

CHP Performance

- Overall value $6,000,000 per year
- Rate performance $2,000,000 per year

2000 Combined Heat and Power Certificate of Recognition

Presented to

The University of North Carolina at Chapel Hill

by the United States Environmental Protection Agency and Department of Energy in recognition of the superior environmental performance of the central utility plant achieved through the use of pollution preventing combined heat and power.

Awarded on March 21, 2000

Paul M. Stolpman, Director
Office of Atmospheric Programs, EPA

Dan Reicher, Assistant Secretary
Energy Efficiency and Renewable Energy, DOE

2003 ENERGY STAR® Award
Combined Heat and Power

Presented to

The University of North Carolina at Chapel Hill

By the United States Environmental Protection Agency in recognition of the significant fuel savings realized by the central power plant at the Chapel Hill campus through the use of highly efficient combined heat and power technology.

Awarded on 11 February, 2004

Kathleen Hogan, Director
Climate Protection Partnerships Division, U.S. EPA

CHP
EPA COMBINED HEAT AND POWER PARTNERSHIP

CHP Partner Greenhouse Gas Reduction Report

Presented to

University of North Carolina at Chapel Hill

on October 12, 2005

By the United States Environmental Protection Agency Combined Heat and Power Partnership
in recognition of the emission reductions of University of North Carolina at Chapel Hill's CHP Project(s).

Through 2005, the high efficiency of University of North Carolina at Chapel Hill's 1 CHP project(s) produced an estimated 0.2308 million metric tons of carbon equivalents* less than typical separate heat and power, resulting in annual emissions reductions equivalent to:

Planting 16,482 acres of forest

or

Removing the emissions of 10,988 automobiles

*The CHP Partner Greenhouse Gas Reduction Report is an estimate of the overall carbon emission savings of your operational projects based on typical model CHP plant efficiencies and is intended for outreach and educational purposes only.