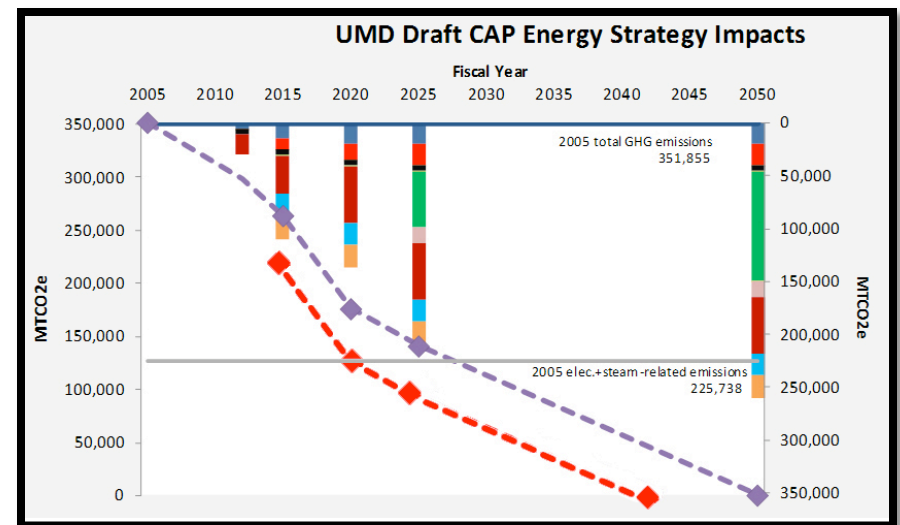


GEMSTONE Thesis Proposal Defense

**TEAM COGEN**

# Introduction

- Justification for energy research
  - Desperate need to reduce carbon emissions
  - Presidents' Climate Commitment
  - Current energy systems are inefficient
- Why CHP?
  - Immediate practicality
    - Economic efficiency
    - Technological availability
  - Intermediate tool



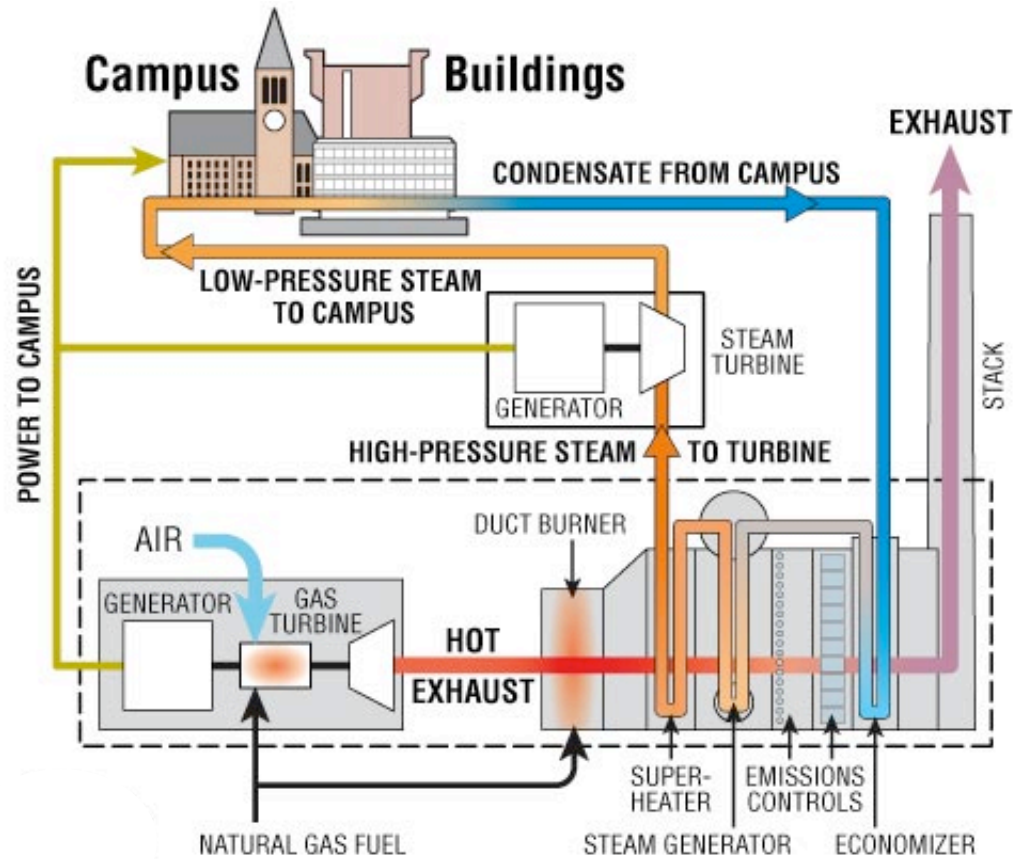
# Research Questions

- How can Combined Heat and Power minimize carbon emissions at a large university campus?
- What CHP system is best suited for the University of Maryland?

# What is CHP?

- Simultaneous or sequential generation of multiple forms of useful energy (usually electrical and thermal) in a single, integrated system.
- Benefits
  - High overall thermal efficiency
  - Simultaneous production of thermal & electrical energy
  - Minimal transmission & distribution losses

# CHP Diagram



**Combustion Turbine with Heat Recovery Steam Generator**

# Potential for Improvement

- Turbine selection
  - Solar Mercury 50
- Plant operating procedures
- Supplemental components
  - Intercooling
  - Reheat + second stage turbine
  - Regeneration
- Better performance in smaller machines

# Project Overview

Chapter 1

Chapter 2

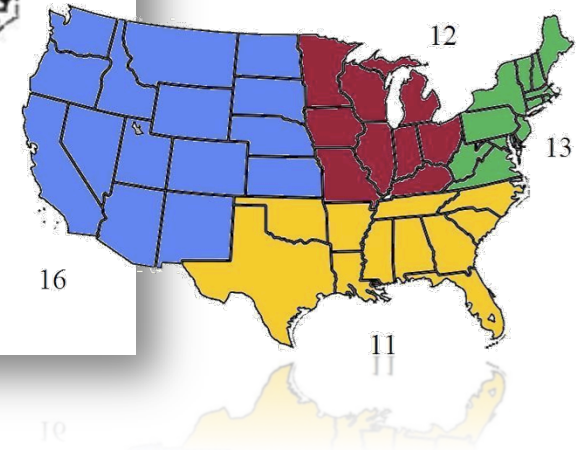
# Chapter 1

Determine the best efficiency among current university CHP plants and demonstrate achievable performance increases.

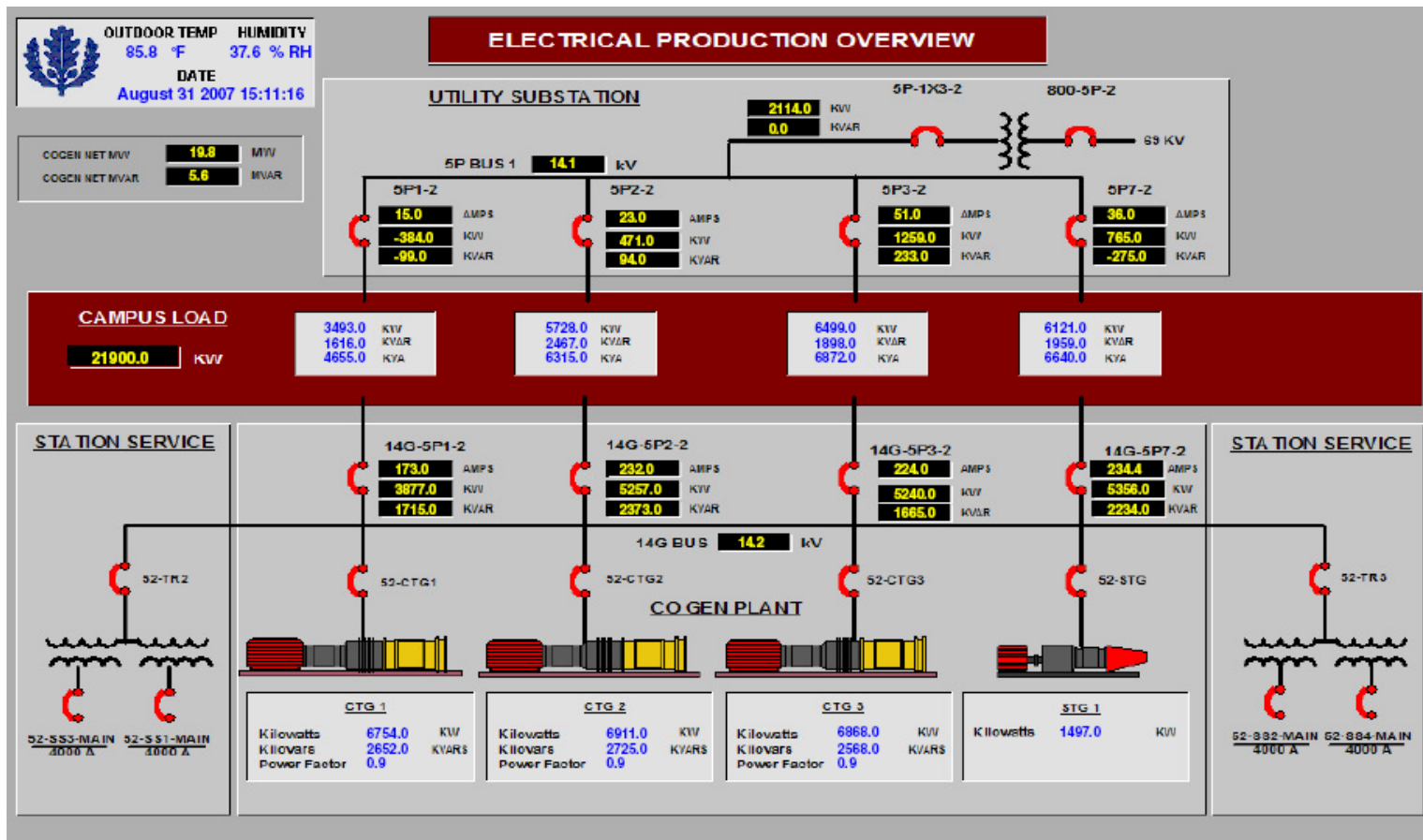


# Surveying

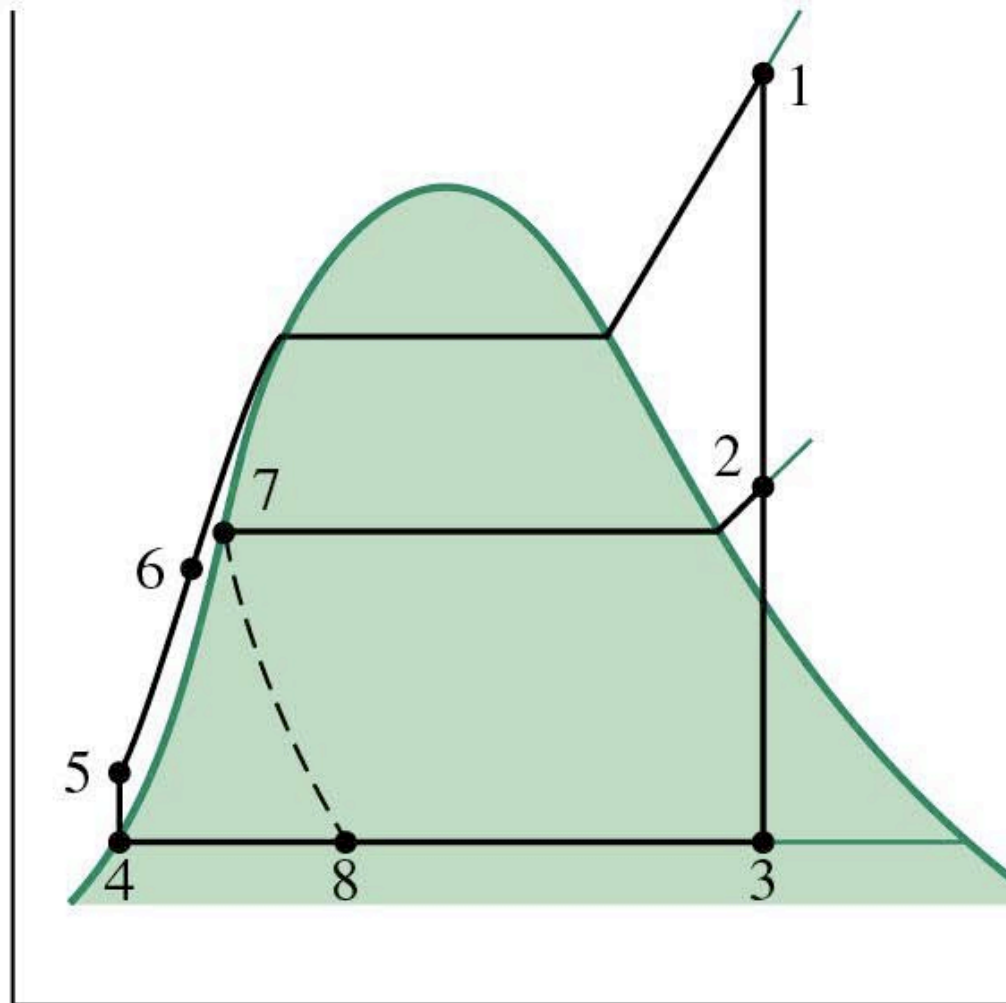
- Survey universities nationwide to gather and evaluate CHP performance data



# Analyzing University CHP Systems



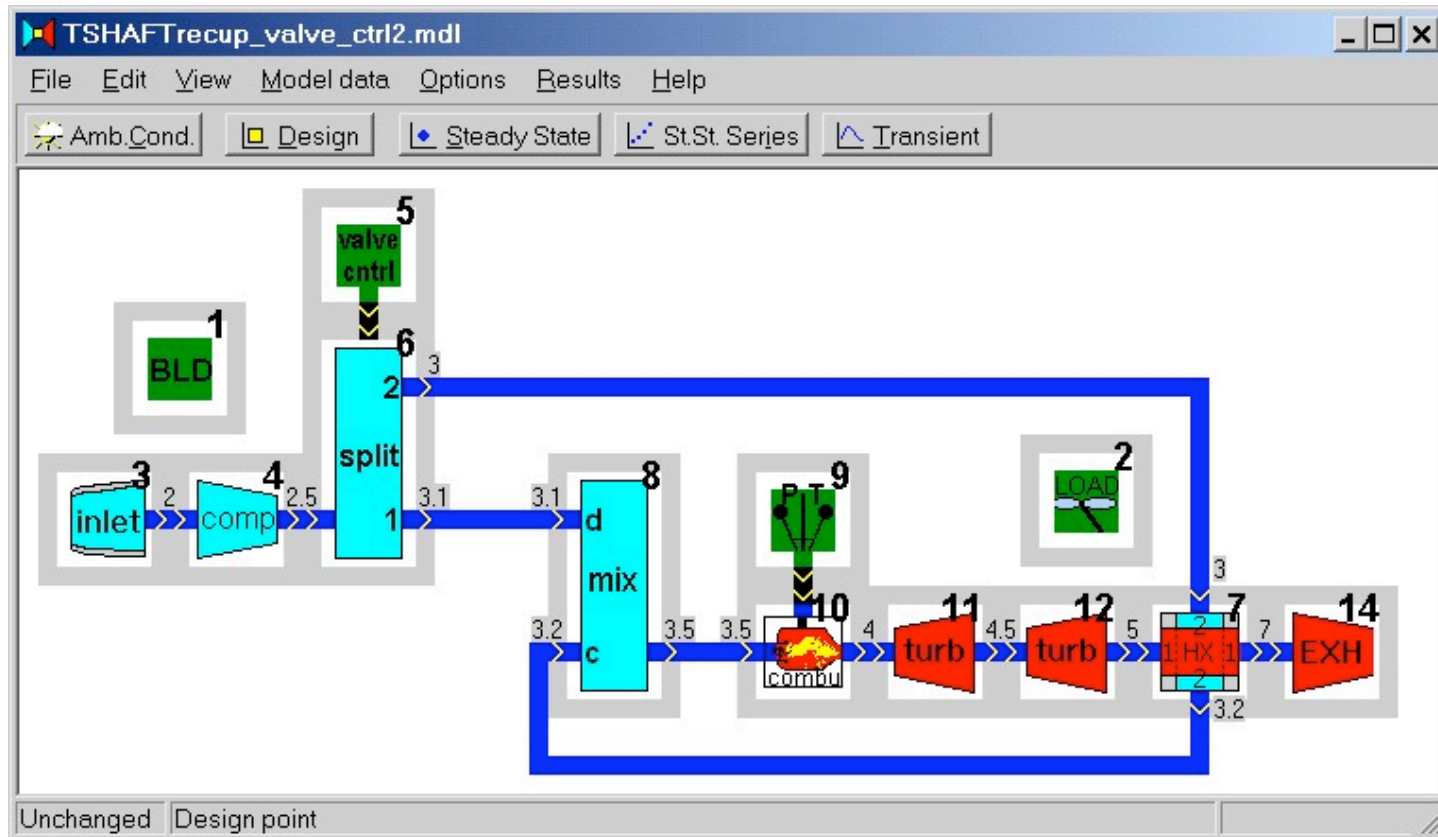
# Analyzing University CHP Systems



<https://netfiles.uiuc.edu/asandler/www/Regen/Regen2.jpg>

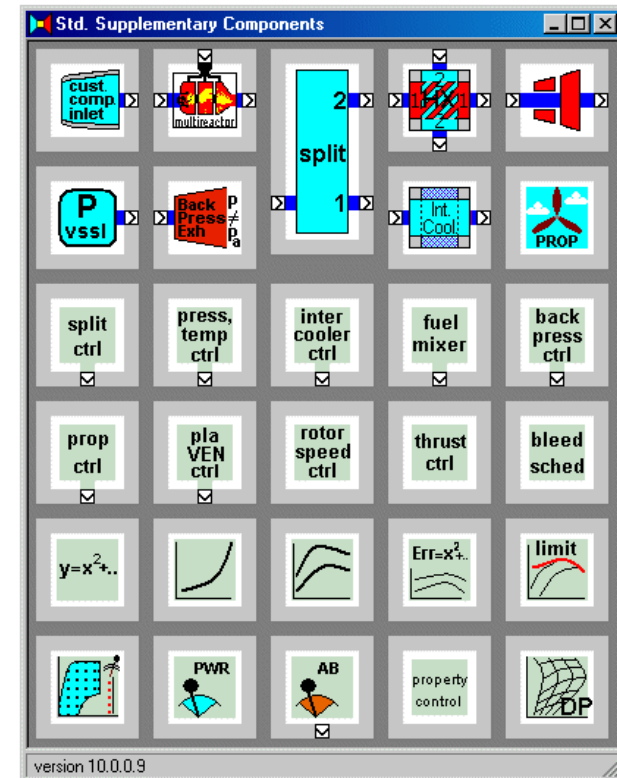
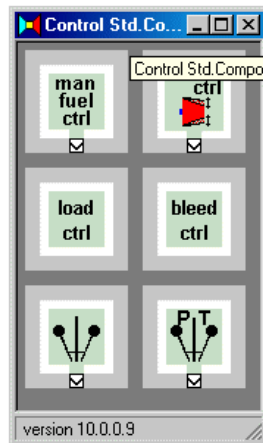
# Modeling

- Design a CHP system / simulate performance



# Modeling

- Tweak simulation to improve realism
- Simulate concept system and compare to best current performance achieved



# Chapter 2

Make specific recommendations to the University of Maryland regarding improvements in efficiency of its energy generation system.

# Improving UMD's Energy Infrastructure

- Evaluate best technology available on today's market
- Conceive a technologically and economically achievable CHP plant
- Assess performance gains under two scenarios
  - Current plant is replaced with a more efficient one
  - A new plant is constructed to supplement the first

# Economic Analysis


- Current economic considerations
  - Costs of purchasing electricity from PEPCO
  - Fuel price and availability
- Estimate costs for potential CHP system
- Cost-benefit analysis
  - Establish payback period



# Policy

- The Public Utilities Regulatory Policies Act (PURPA) of 1978
- 2005 Energy Policy Act
- UMD Climate Action Plan
- Greenhouse Gas Emissions Reduction Act of 2009
- UMD's relationship to PEPCO

# Looking Forward

- 
- Finish university surveys
  - Establish best operating achievements of current systems
  - Continue / wrap up basic background research
  - Design and model ideal CHP system

**Questions / Suggestions**