# CampusEnergy2021

## BRIDGE TO THE FUTURE

**Feb. 16-18 | CONNECTING VIRTUALLY**

**WORKSHOPS** | Thermal Distribution: March 2 | Microgrid: March 16

# Campus Energy Planning

Jeff Urlaub, MEP Associates, a Salas O'Brien Company
Dano Weisbord, Smith College
Doug Hammerle, MEP Associates, a Salas O'Brien Company, formerly Miami University

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MEP A SALAS O'BRIEN COMPANY

INTERNATIONAL DISTRICT ENERGY ASSOCIATION

# Q&A Will Not Be Answered Live

**Please submit questions in the Q&A box.**
**The presenters will respond to questions off-line.**

# CAMPUS ENERGY PLANNING

**Presented by**


**Jeff Urlaub,**
MEP Associates,
A Salas O'Brien Company

**Dano Weisbord,**
Smith College

**Doug Hammerle**
Miami University

# Growth outpacing energy performance.

Over its history, an average US college can double the square footage of its campus every 25 years, outpacing the optimal performance of its energy systems.

# 1880–
# 1930

- Coal
- Steam
- Steam storage
- Distribution pipes in concrete ducts

# 1930-1980

- Combined heat & power coal/oil
- Pressurized hot water
- Heat storage
- Pipes in concrete ducts
- Large substations built on site

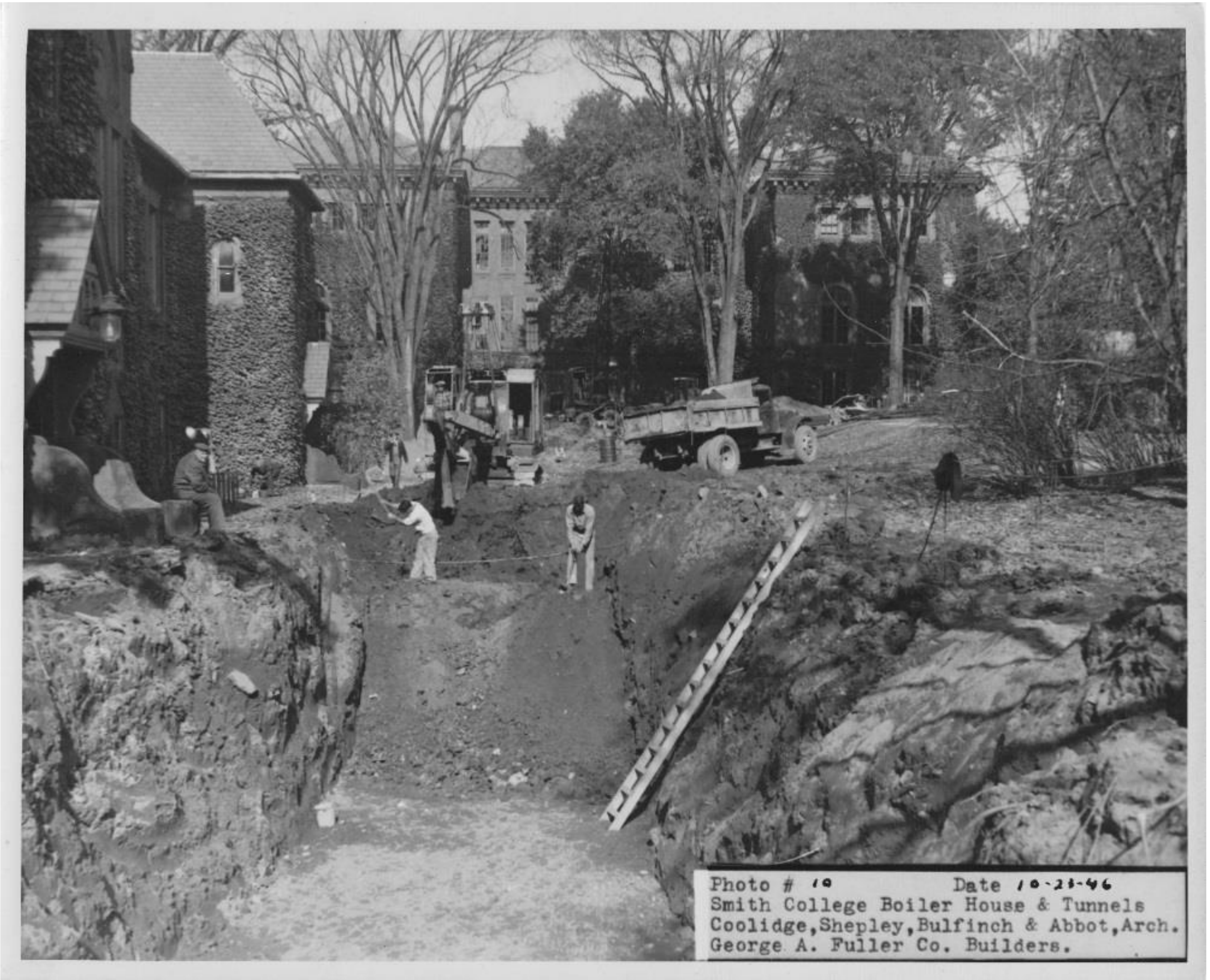
# 1980-2020

- CHP coal/oil, large scale solar, biomass
- Pressurized hot water
- Heat storage
- Pre-insulated pipes
- Pre-fabricated compact substations
- Metering & Monitoring

# 2020-

- Electricity, large scale solar, wind, geothermal heat exchange, biomass conversion, CHP biomass, CHP waste incineration, two-way district heating
- Low temperature hot water
- Heat storage, cold storage, seasonal heat storage
- Pre-insulated pipes
- Pre-fabricated compact substations
- Smart energy
- Low-energy buildings

# Smith College District Energy Master Plan



# About Smith College

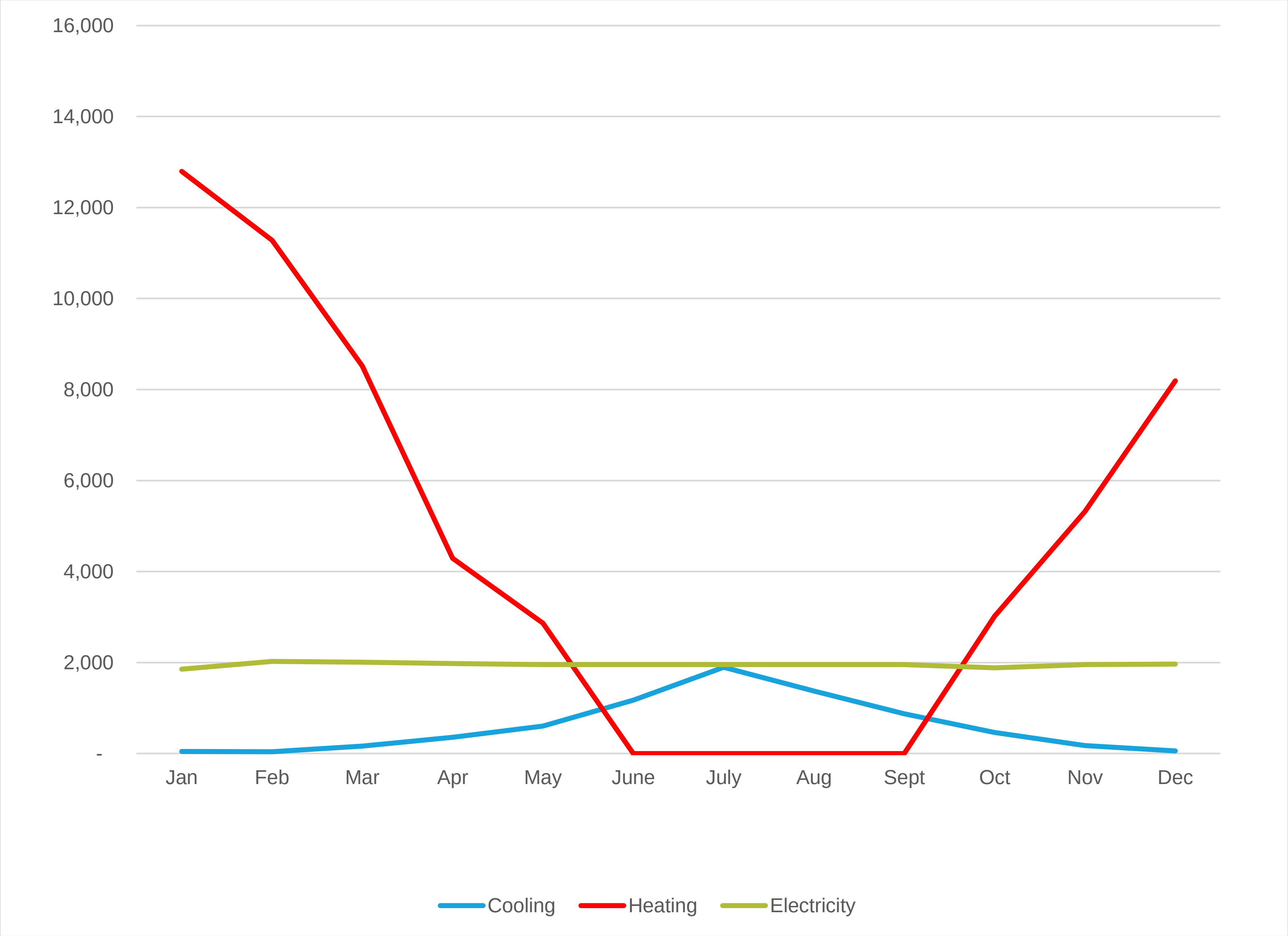
## 2,500 undergraduate women

- 40% STEM majors
- 500 graduate students

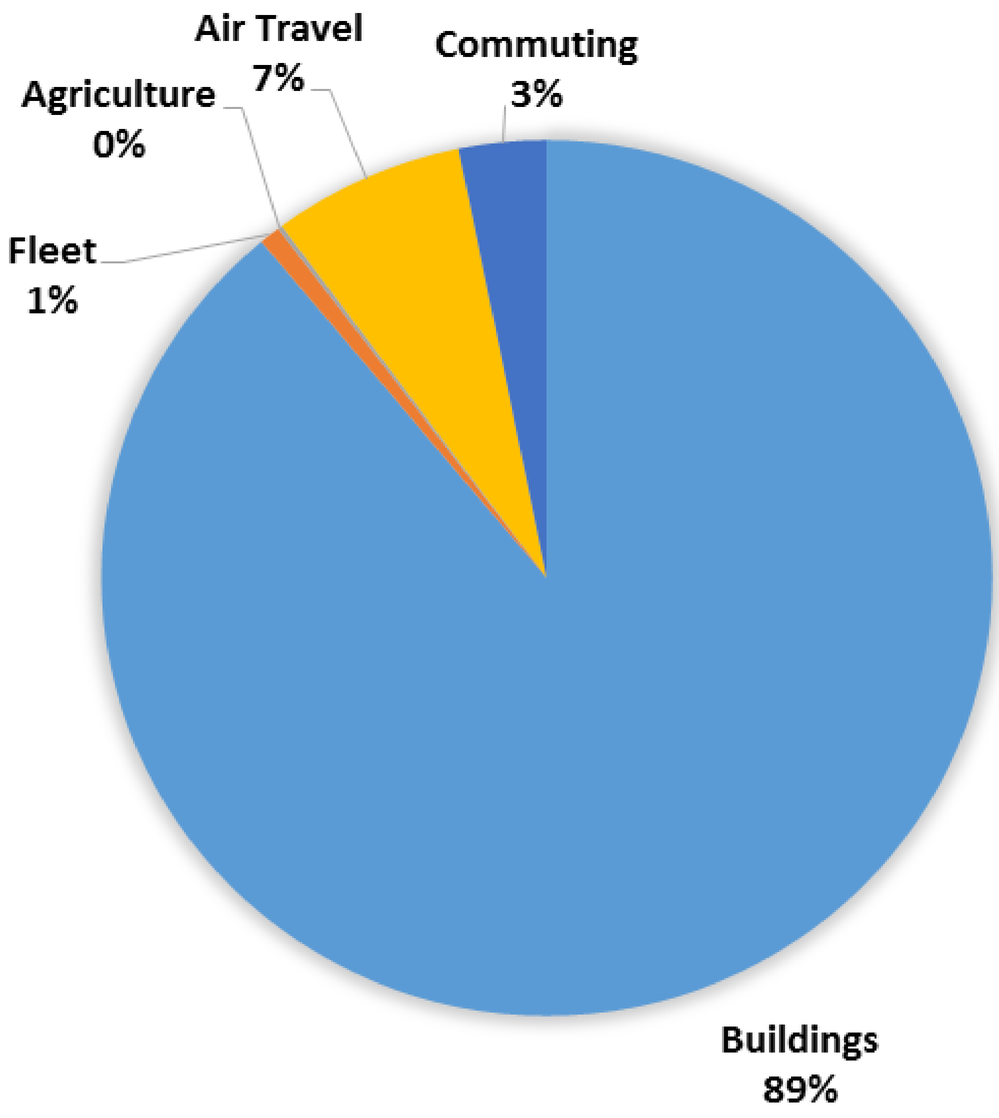
## District System

- 114 buildings
- 3 million GSF
- 1947 steam distribution
- 2007 co-generation
  - 3.5 MW turbine w/HRSG
  - 3 peaking boilers
  - Gas, #6 fuel oil

# Energy & Electricity Demand (MWh)



# College Greenhouse Gas Emissions FY2016



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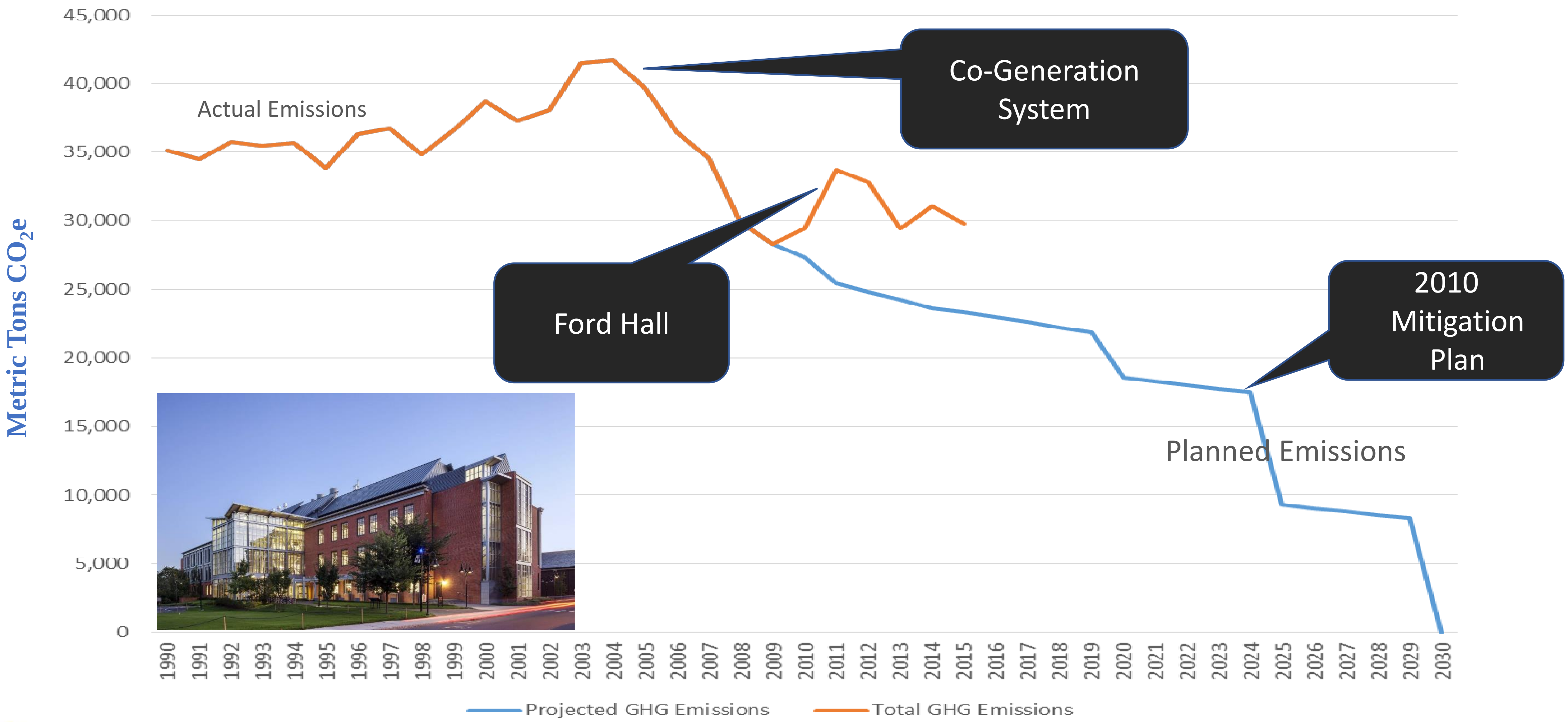


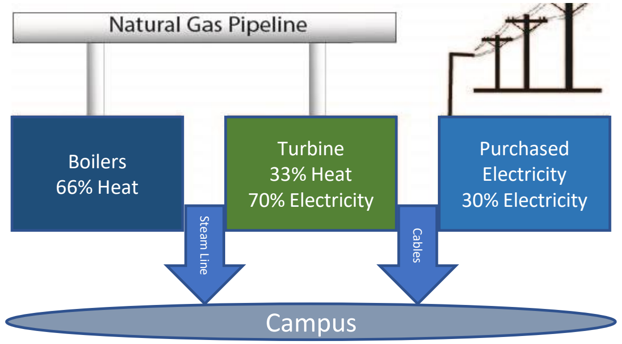
# Our Initial Model

Centralized

Switch Fuels

Decentralize

100% Electric, super-Insulated Buildings




# Master Plan Model

## Move toward electrification

- Centralized
- Strong business case
- Flexible approach

## Distribution

- From steam (~360F.⁰) to hot water (~130F.⁰)

## Buildings

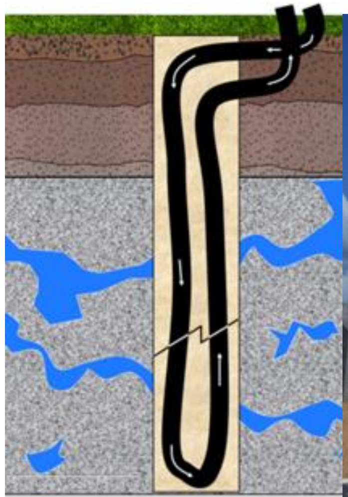
- From steam/ 160F.⁰ water to 130F.⁰ water

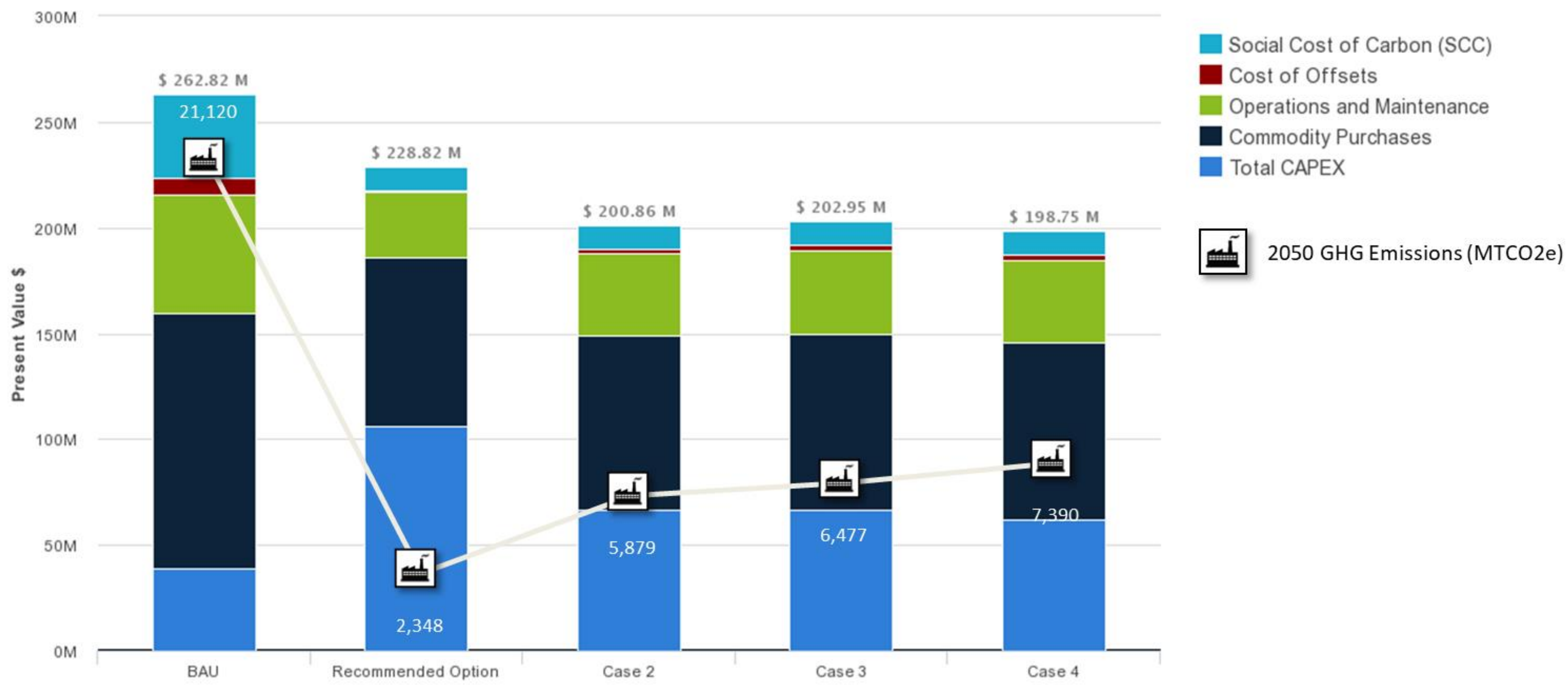
## Source

- From combustion to electricity (heat pumps)
- 4 Cases

# Case Descriptions

- **Business as usual** - Maintain combined heat and power / chiller plants
- **Case 1** – Ground source primary. Includes simultaneous, sewage and storage
- **Case 2** – Sewage source primary. Includes simultaneous, and storage
- **Case 3** – Air source primary. Includes simultaneous and storage
- **Case 4** – Simultaneous primary. Includes storage.





300M
250M
200M
150M
100M
50M
0M
Present Value $
$ 262.82 M
21,120
$ 228.82 M
2,348
$ 200.86 M
5,879
$ 202.95 M
6,477
$ 198.75 M
7,390
BAU
Recommended Option
Case 2
Case 3
Case 4
Social Cost of Carbon (SCC)
Cost of Offsets
Operations and Maintenance
Commodity Purchases
Total CAPEX
2050 GHG Emissions (MTCO2e)



# Campus Energy Master Plan and Steam to Hot Water Conversion Implementation

## Miami University

> When you can take energy bills down from $12 million in 2009 to a projected $5 million in 2020, while adding 28% in campus square footage, you are doing something right.

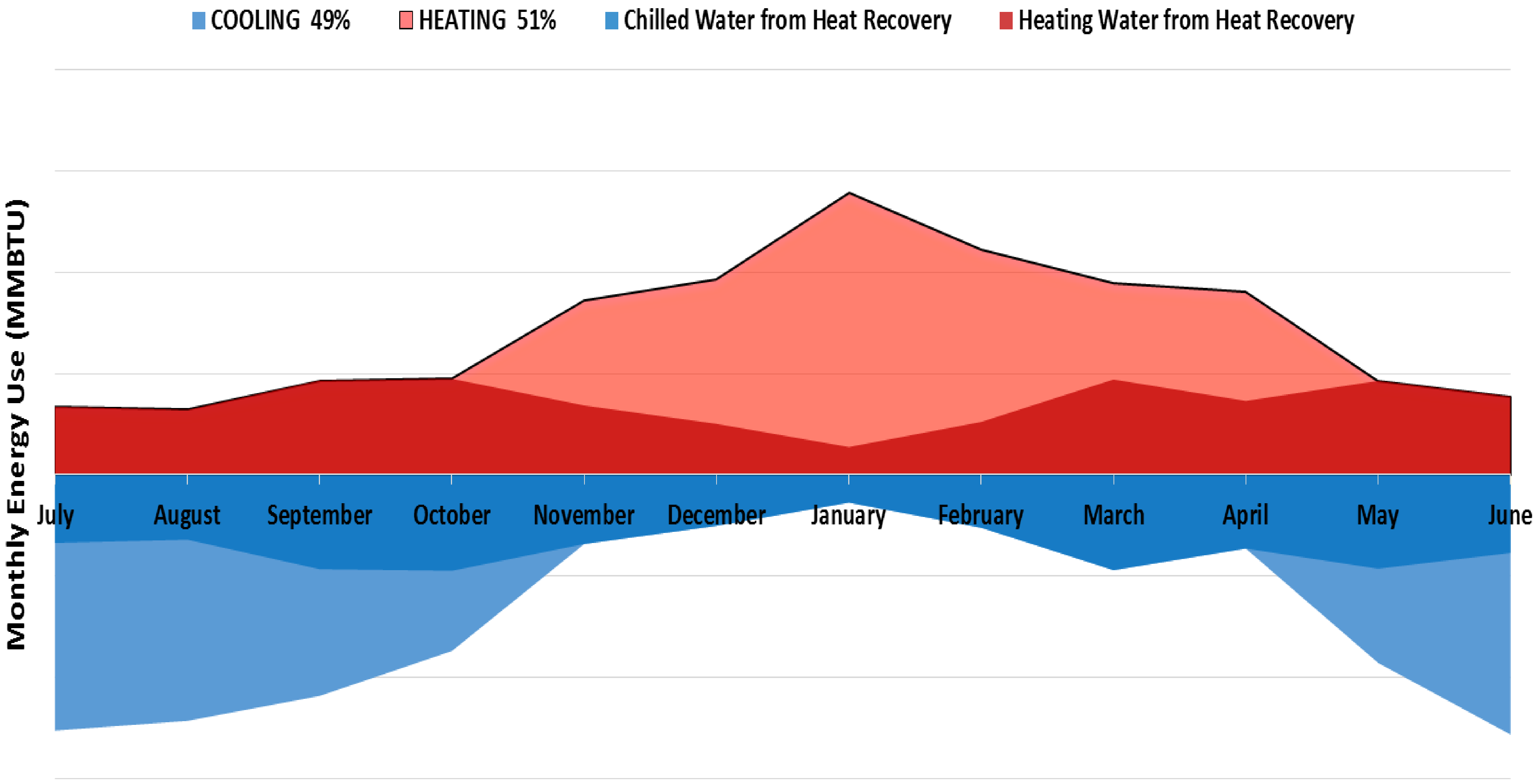
**Cody Powell**
Associate Vice President, Facilities Planning and Operation
Miami University

# New System Optimization

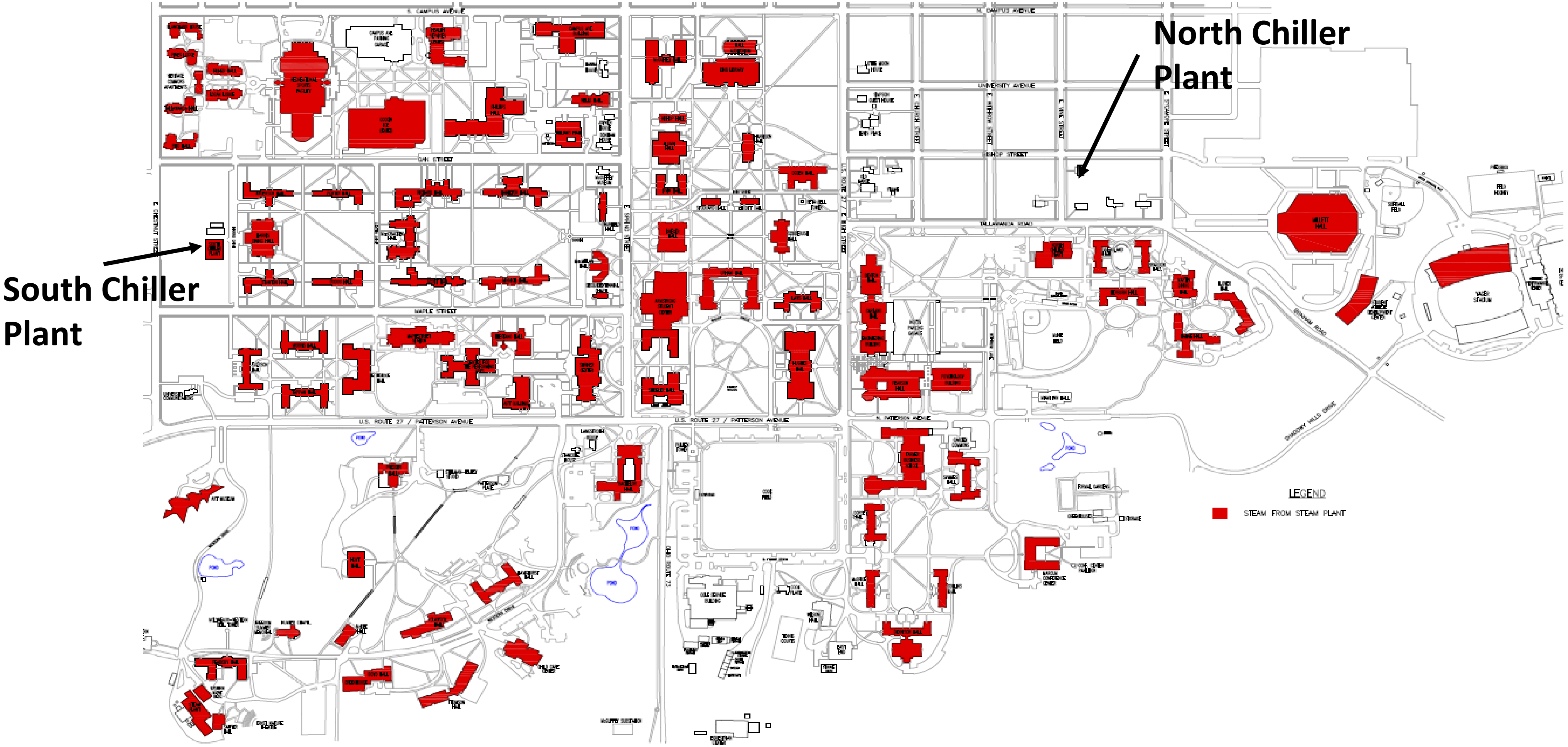
## Energy & Sustainability Goals adopted in 2010:

- Committed to 20% reduction in energy density consumption by 2014 based on 2004 baseline
- Pledged to eliminate burning coal by 2025
- Reduce carbon emissions by 20% by 2020 based on 2008 baseline and 50% by 2030.

# FY 2018 Load Profile for Geothermal Plant

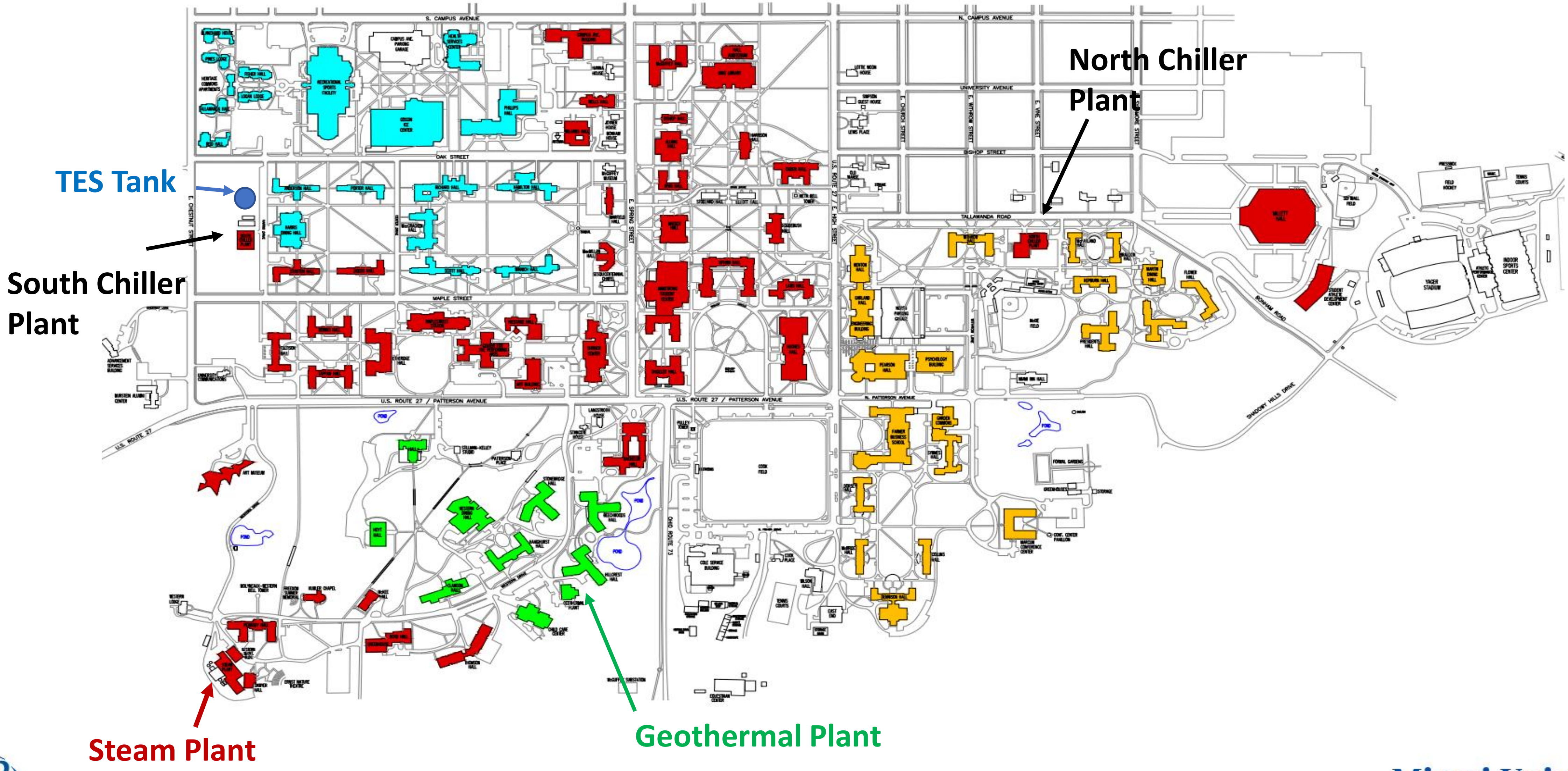


# 2010 BAU Steam Heated Buildings




**Steam Plant**

# 2020 BAU Steam and Heating Hot Water Buildings

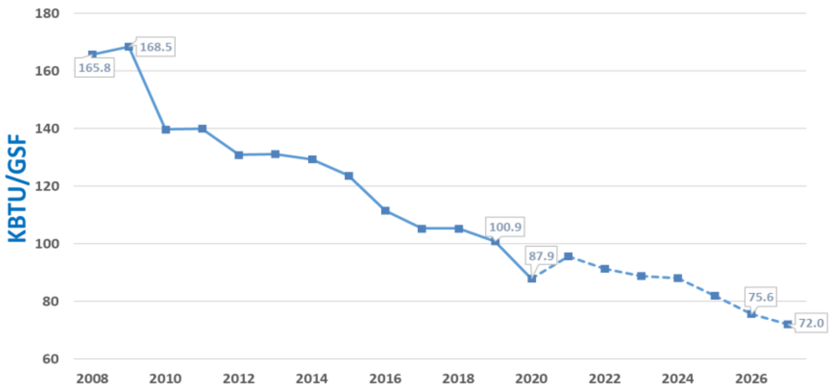


# Miami University - Oxford Campus

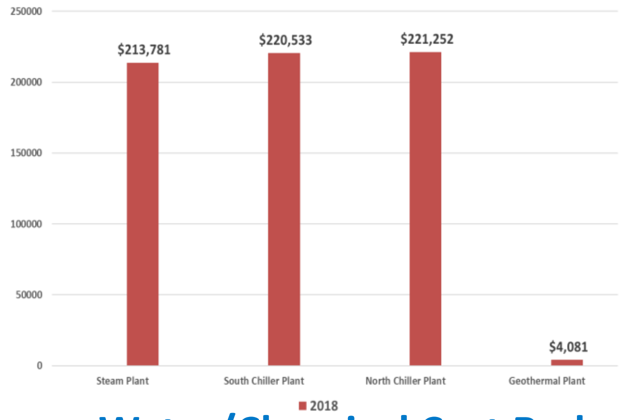
## Environmental Impact of Geothermal/LTHW Conversion

## Campus Historic Data:

- 56% carbon reduction since 2008
- 52% EUI reduction in the last 10 years
- $8.9 million annual utility cost savings in 2019
- $200,000 in water/chemical savings

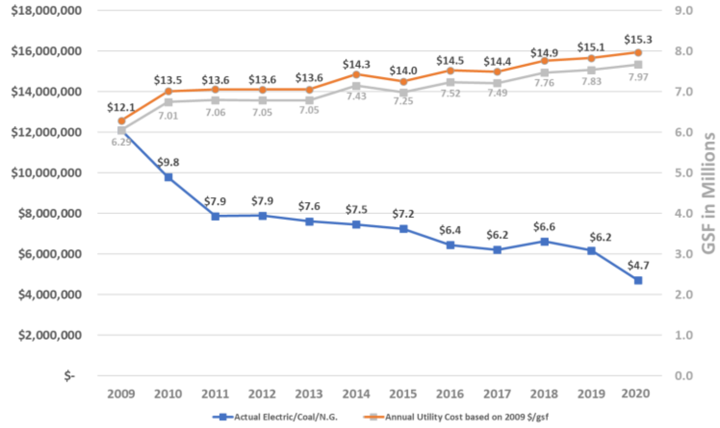



EUI Reduction




Water/Chemical Cost Reduction


Carbon Reduction




Utility Cost Savings