Designing and Implementing an Ultra Efficient Chilled Water System at Wake Forest University

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Agenda

WAKE FOREST UNIVERSITY

- Campus and Chilled Water System Overview
- Design Process and Efficient Equipment Selection
- Future Growth Planning
- Path to Optimization
- Project Results
- Project Challenges
- Future of CHW System

Campus Overview

WAKE FOREST UNIVERSITY

Wake Forest University

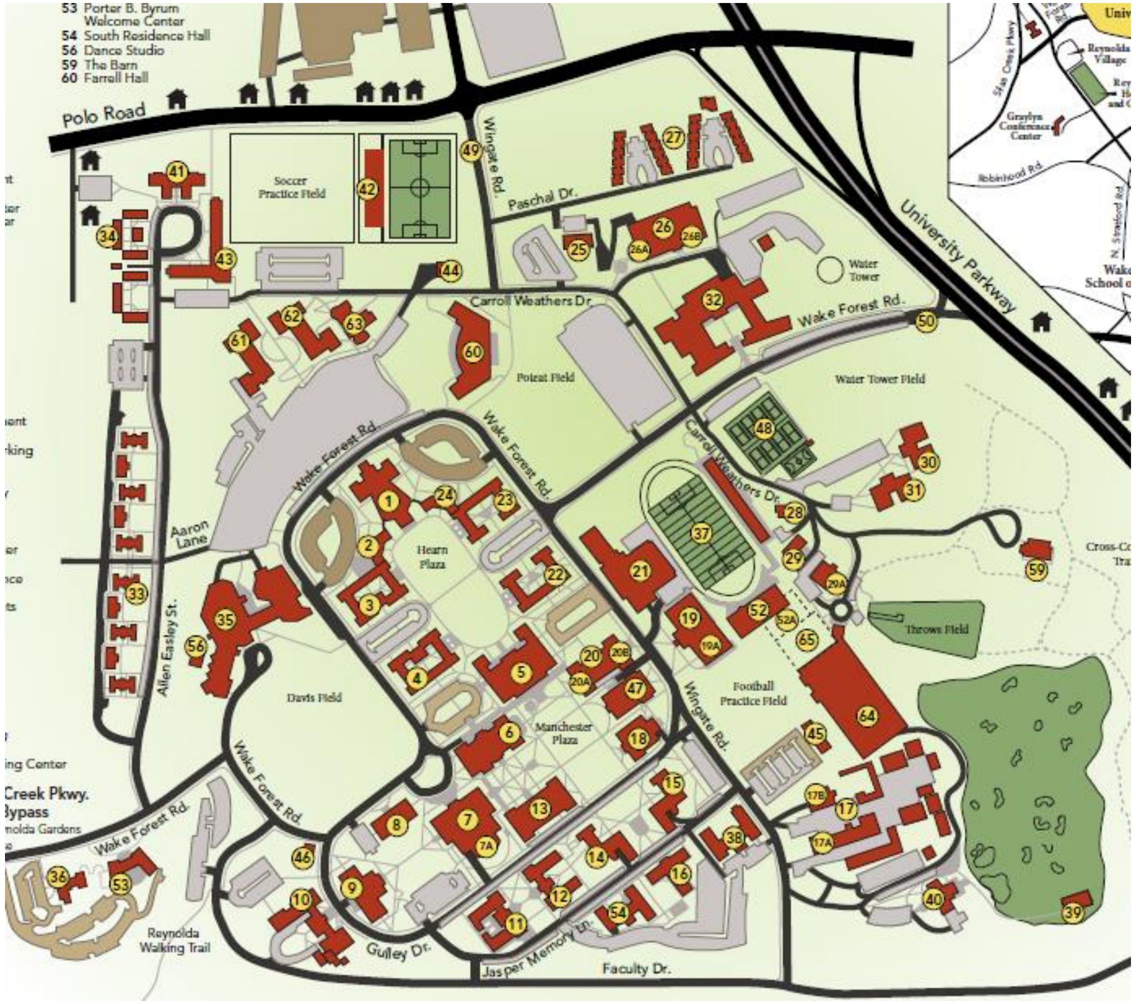
- Private School and Member of the ACC
- Located in Winston-Salem, North Carolina
- 5,225 undergrads, Over 8,400 total students
- Main Campus - 3.5 million Sq. Ft.
- Carbon Footprint - 5.2 million Sq. Ft.

District Utilities for Main Campus

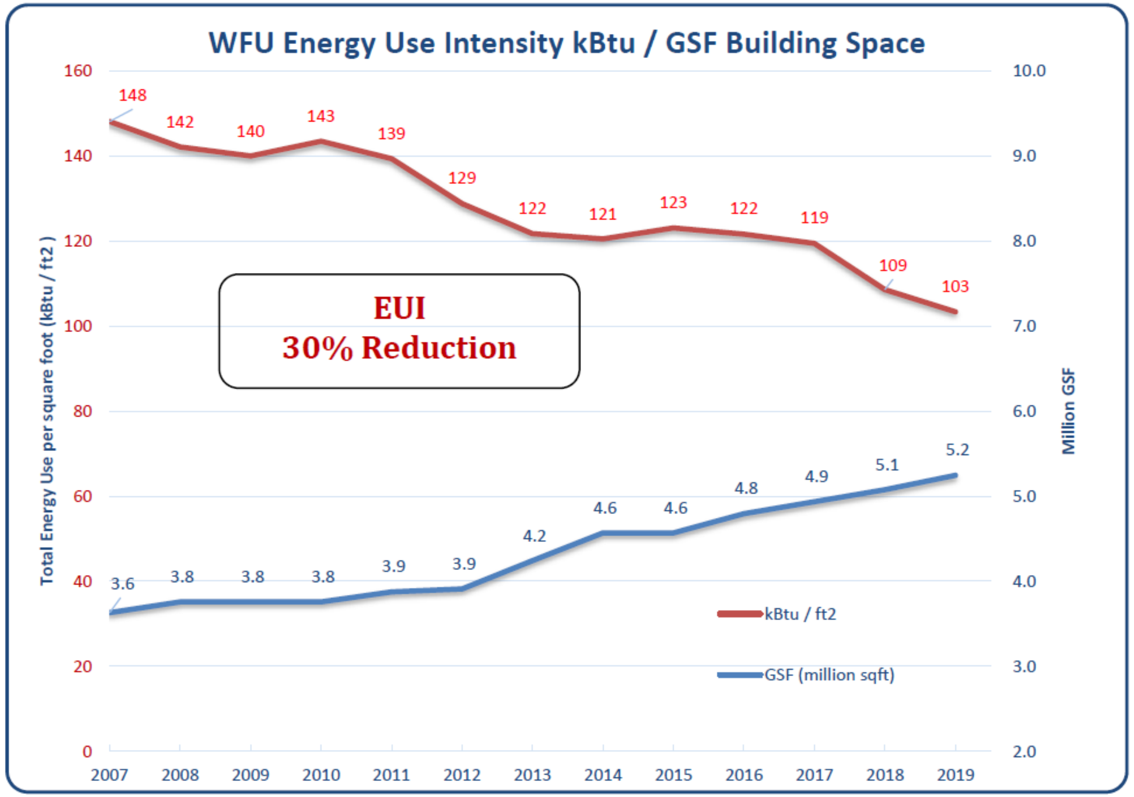
- Steam and Chilled Water Generation
- Distribution includes Electrical & Water/Sewer

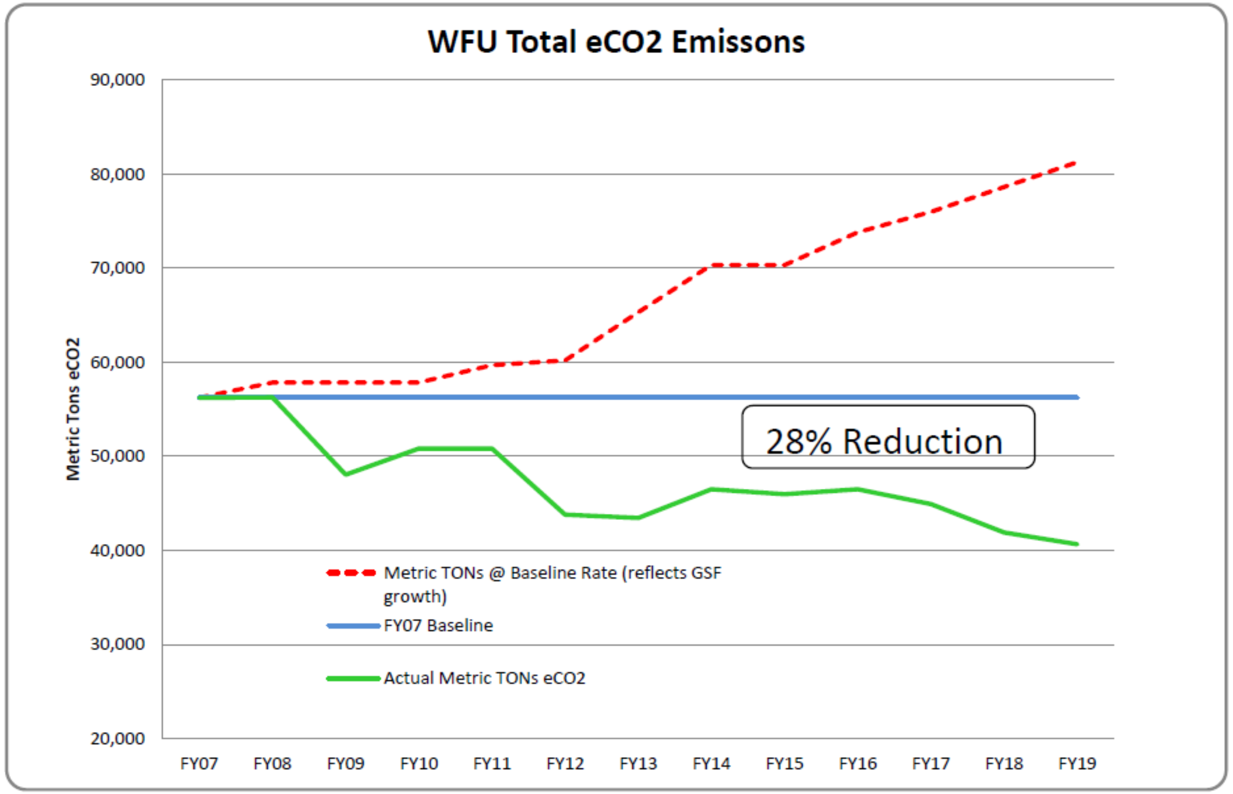
Growth of connected Chilled Water

- 10 year growth from 2.5 to 3.2 million Sq. Ft.



Campus Overview – Energy Use and Emissions





Energy Use per Sq. Foot decreases have helped to offset energy use from added space

Gross Carbon Emissions continue to decrease

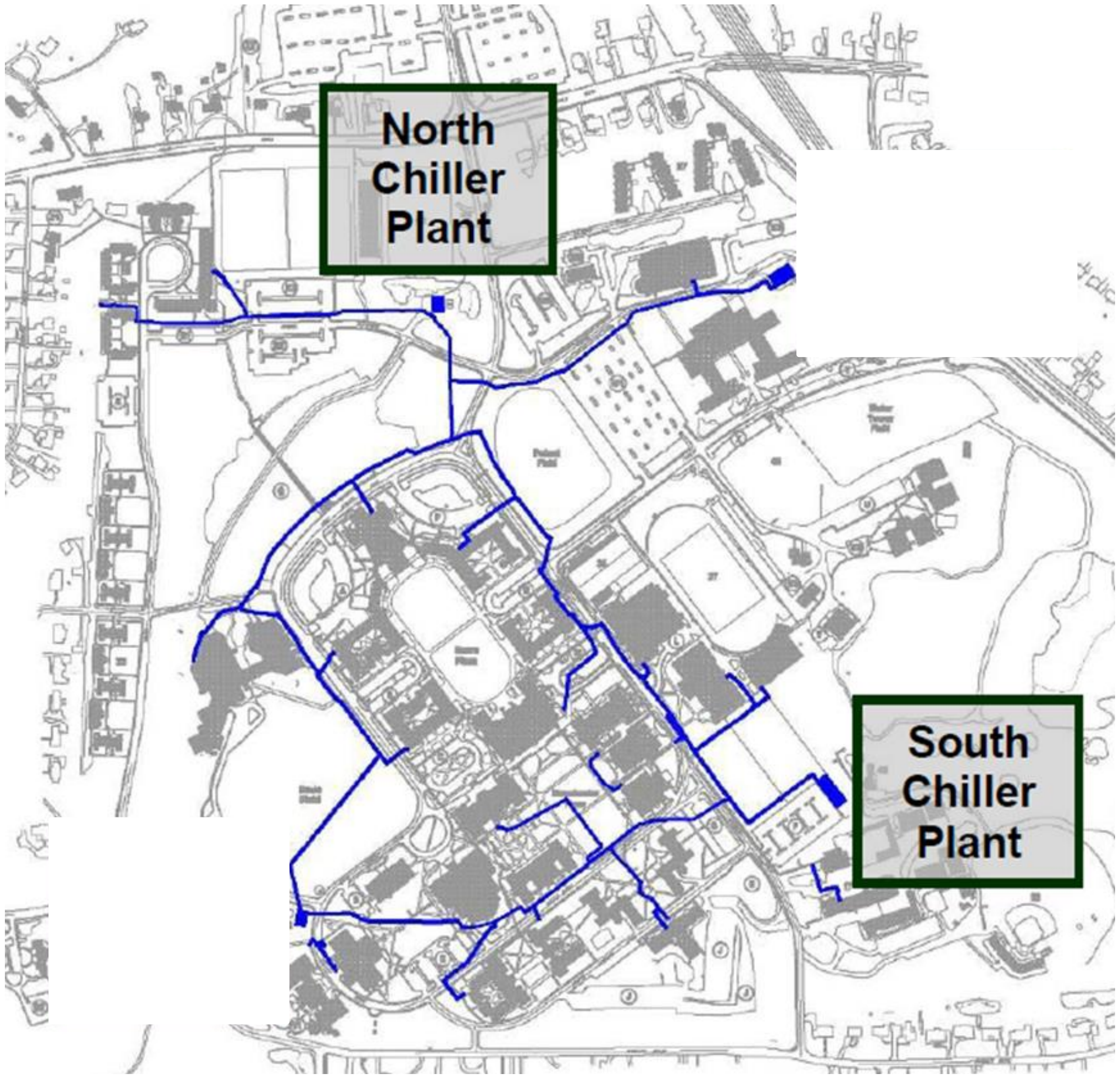
Chilled Water System Overview

2015 Chilled Water System (Baseline)

- 4 Plants, 10 Chillers, 6700 Tons
- 40 Buildings Totaling 3.1M ft^2
- Aging Equipment
- R-11 Refrigerant
- 0.78 kW/Ton Campus CHW Efficiency

Shift System Priorities To Sell Objectives

- Focus on Maintenance/Modernization
- Decommission Old Plants
- Upgrade South Plant
- Replace/Expand North Plant
- Optimize During Upgrades



Design Process – Project Goals

South Chiller Plant (2017)

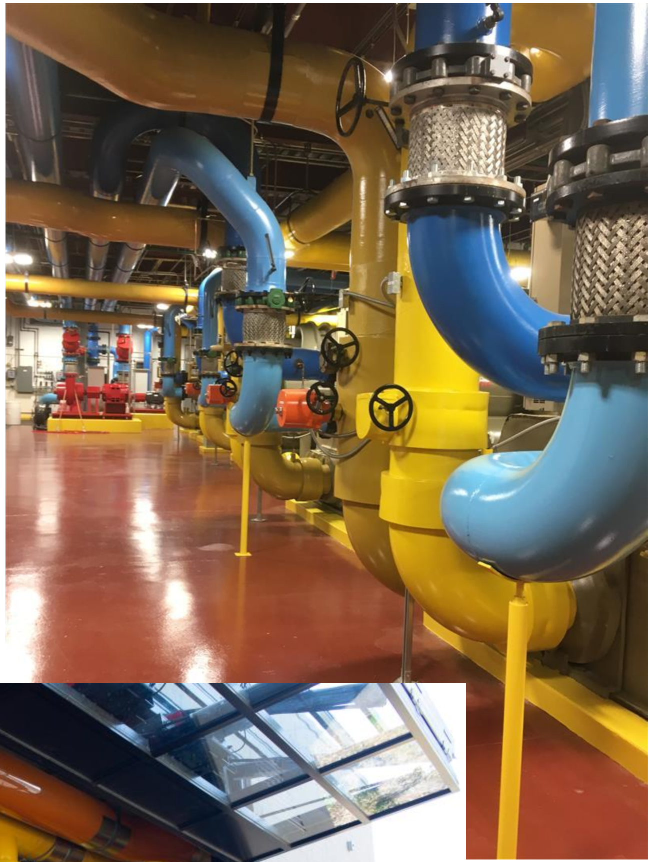
- Variable Primary CHW Conversion
- Variable CDW Pumps

North Chiller Plant (2018)

- Double Capacity from 1200 to 2400 Tons
- VFD Chillers
- Variable Primary CHW
- Headered Variable CDW Pumping

Campus Chilled Water System

- Optimized CHW Generation and Distribution



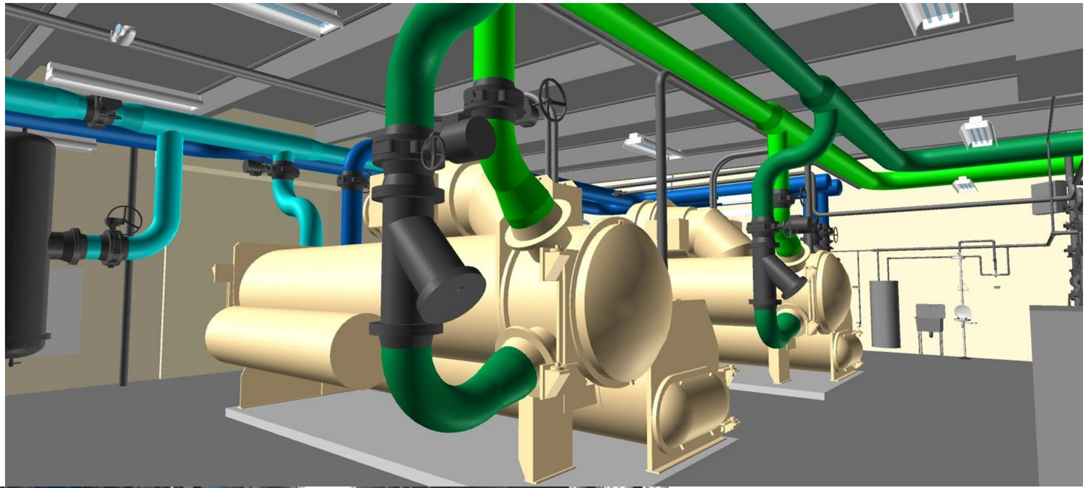
Design Process – Setting A New Standard

Energy Efficient Equipment

- Headered CDW and CHW
- Variable Volume Pumping
- Variable Speed Chillers

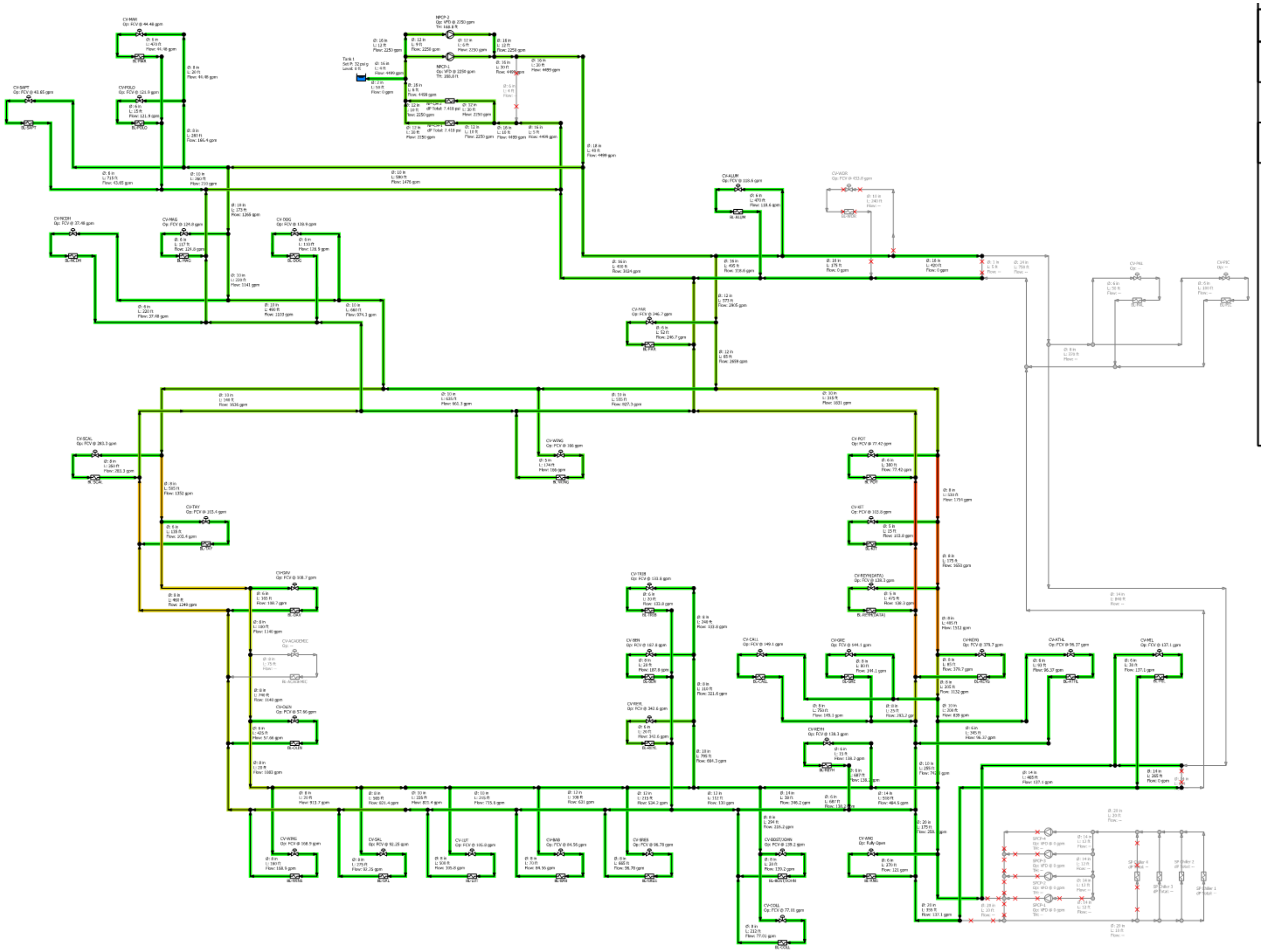
Team Effort

- Collaboration between owner and engineering
- Transparency in design and modeling



Design Process – Hydraulic and Distribution Analysis

- Hydraulic limitations on load hours
- Validating Future Projects
- Establish Working Model

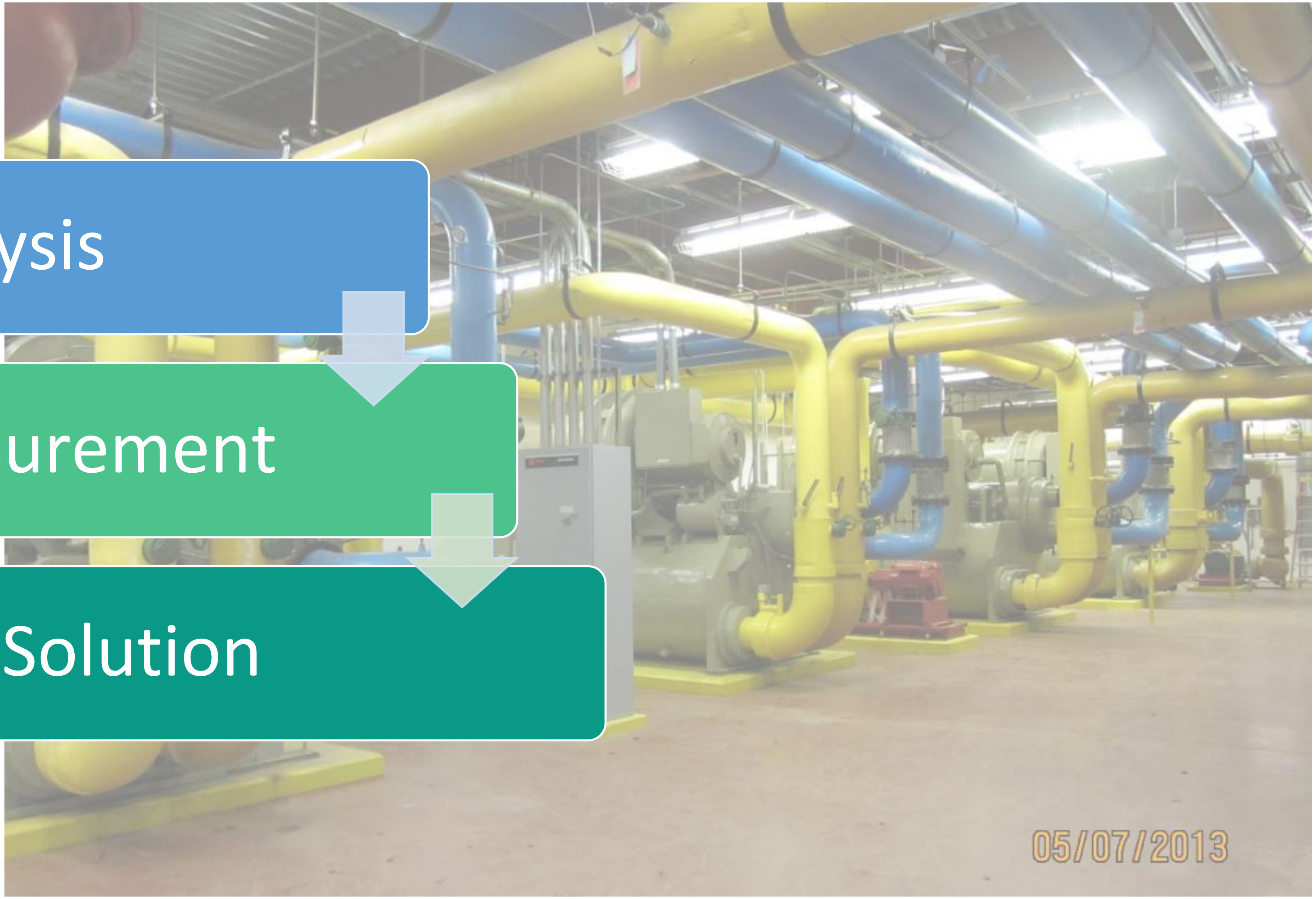


Implementation of Optimization

Engineering Analysis

Baseline Measurement

Implement Solution

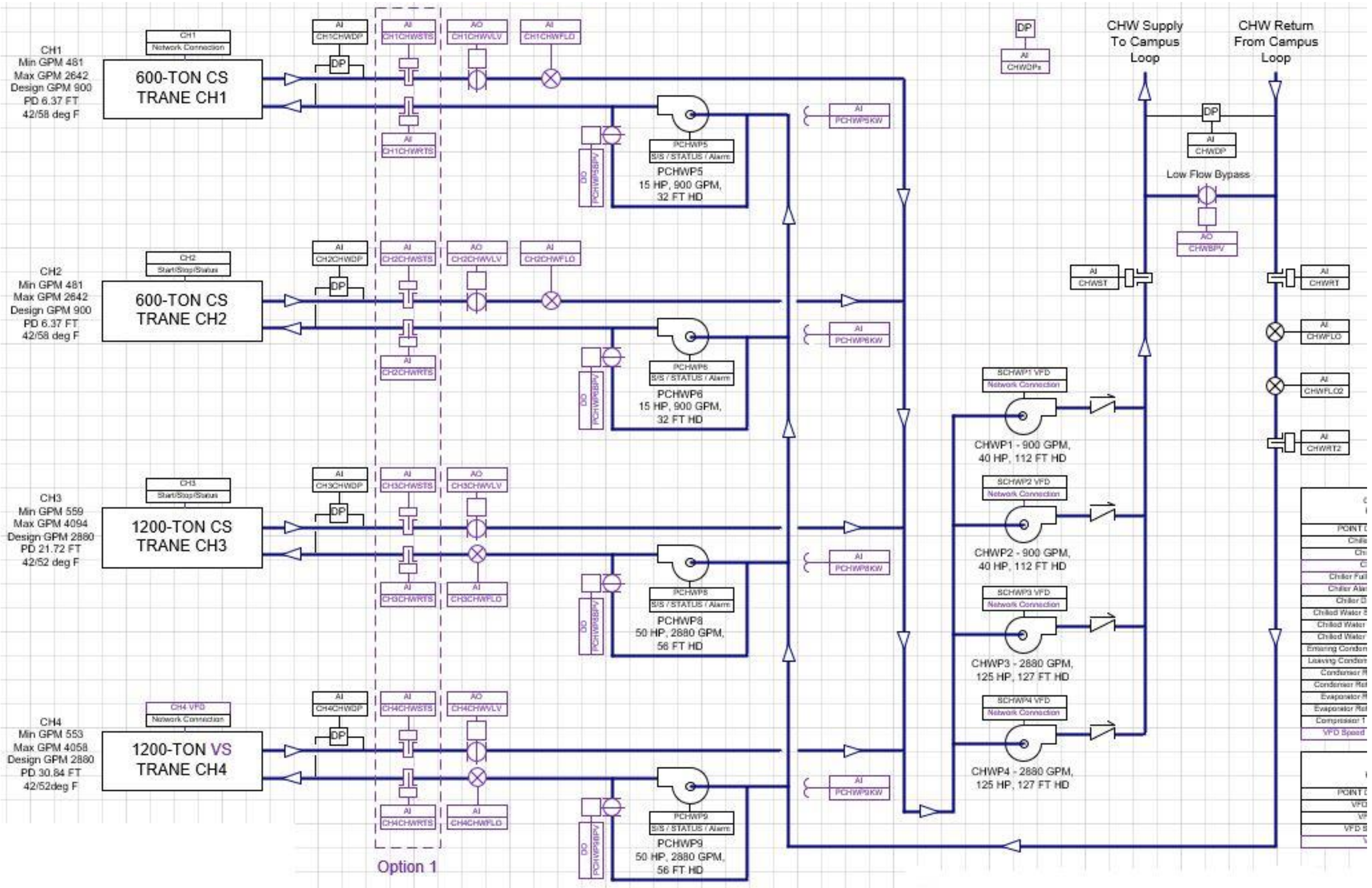


Engineering Analysis

Develop project scope of work

Model baseline and projected energy

Implement within design strategy

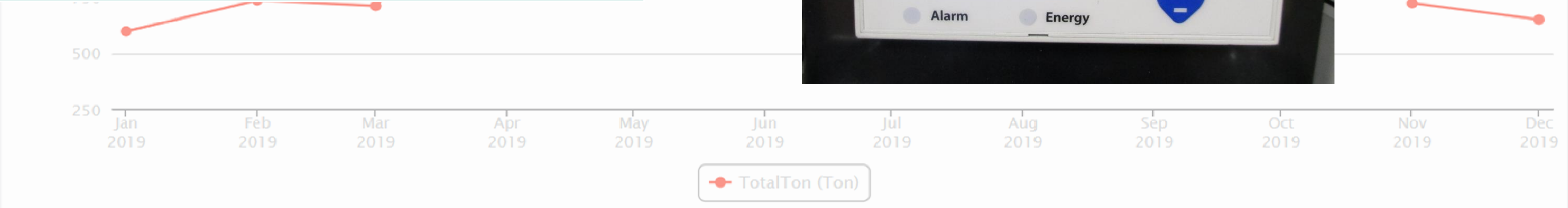


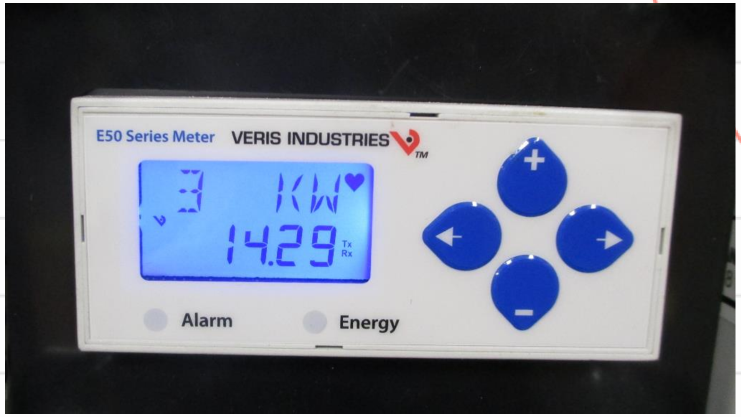
Baseline Measurement

Determine parameters for measurement

Integrate metering devices with BAS

Install Optimization appliance and trend data





Implementation of Optimization Solution

Project Implementation and Commissioning

Custom Optimization programming and deployment

On site testing and continued remote support

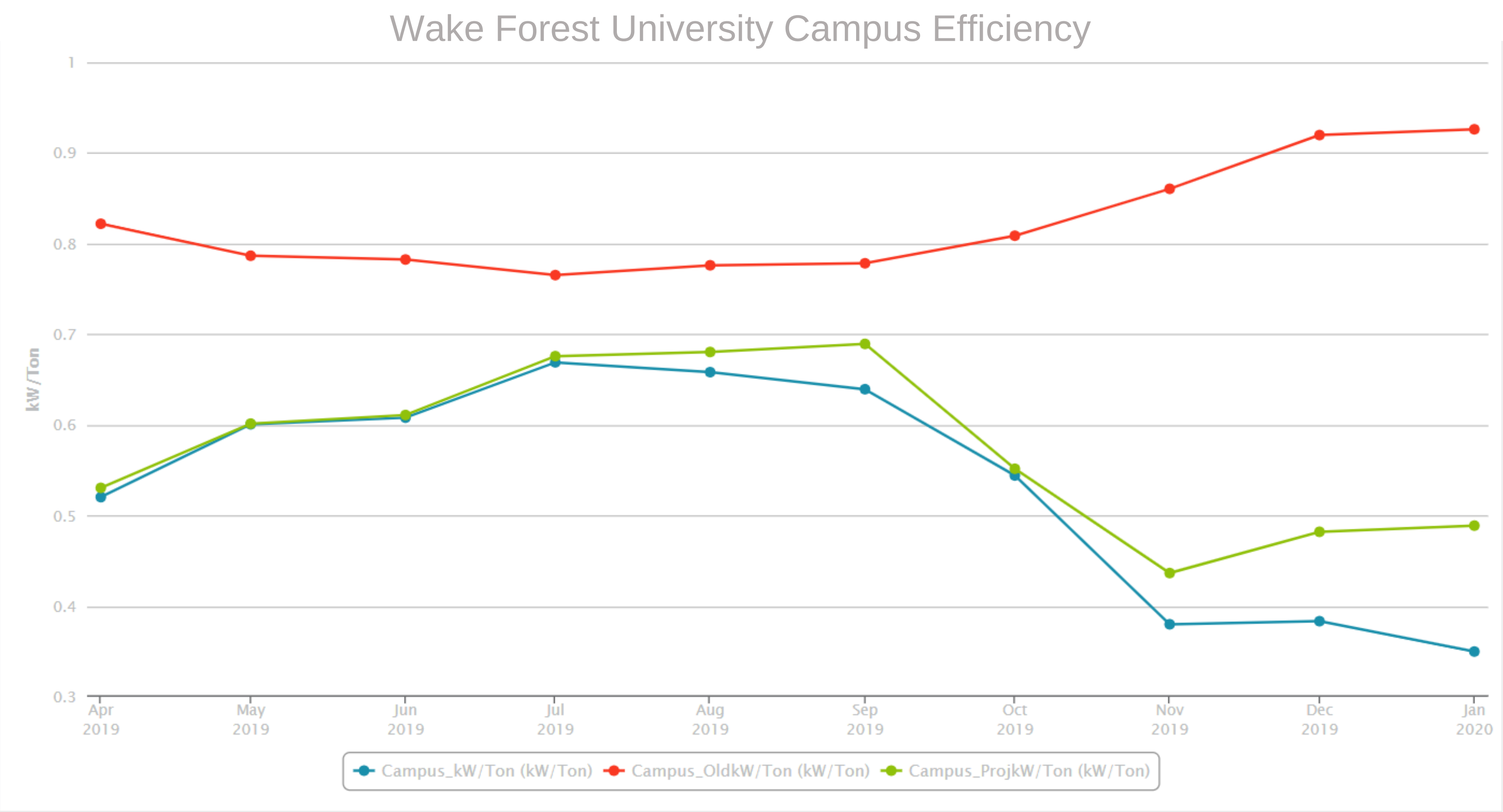
Project Results

0.78 kW/Ton Baseline

0.56 kW/Ton Projected

0.54 kW/Ton Actual

$ 220,000 / year saved



Project Challenges

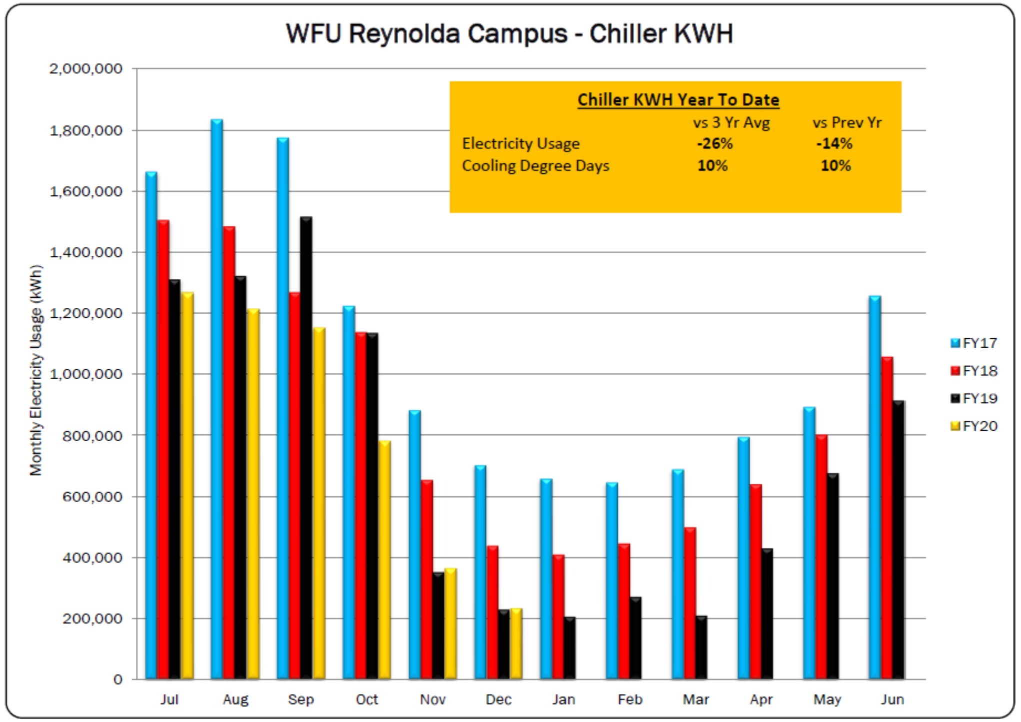
- Confidence in data, historical and projections
- Staff Adoption
- Funding
- Seasonality
- Future Needs

Flow X Delta T

Sensor Accuracy

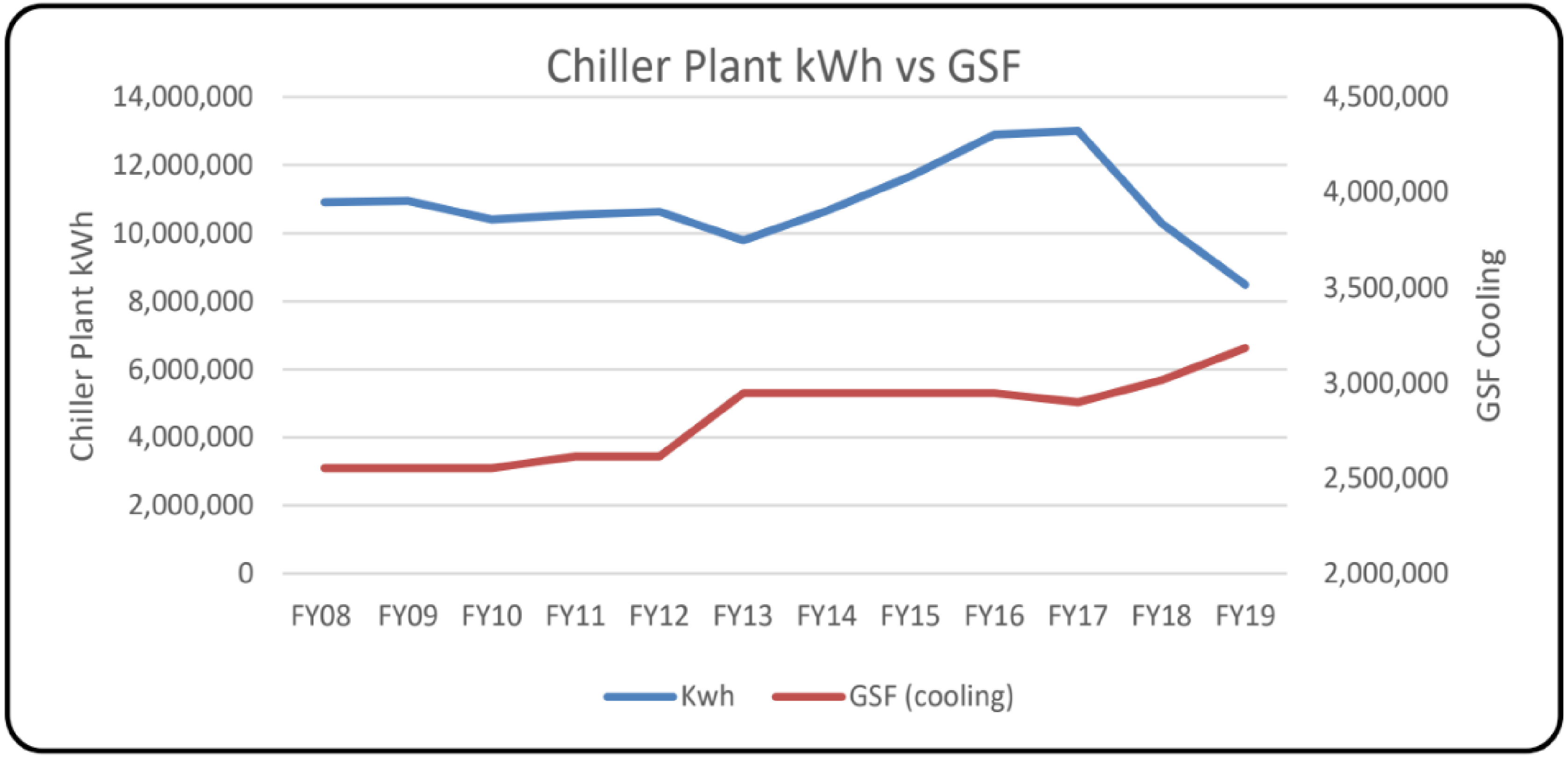
Calibration

System Efficiencies



Future of CHW System – Continued Improvement

Continued Efficiency Improvement as CHW Needs Increase

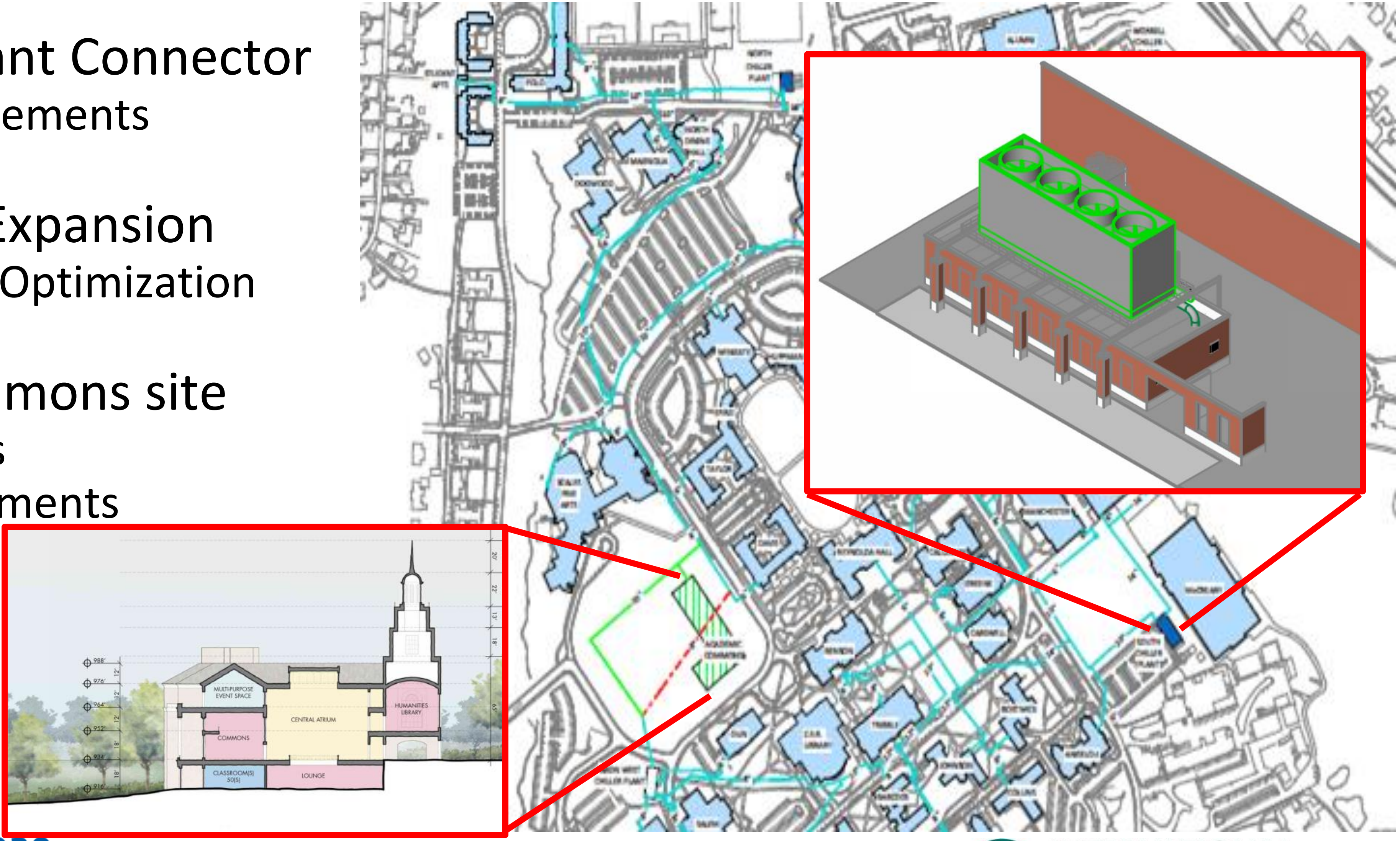


Future of CHW System - Expansion

North and South Plant Connector
- Distribution Improvements

South Chiller Plant Expansion
- Renewal, Capacity, Optimization

New Academic Commons site
- Building Efficiencies
- Site Utility Improvements



Questions?

Thank you!

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