# Auburn University Basketball Arena:

## How Building Data Analytics Achieved Energy and O&M Savings While Improving Comfort and Sustainability

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# Agenda

- Auburn University & Cimetrics Collaboration
- Auburn Arena Background
- Case Study Findings:
  - Fan speed control
  - Dehumidification control
  - Damper controls
  - Heat exchanger modification
- Ongoing Commissioning Results
- Questions

# Auburn + Cimetrics Collaboration

- University Sustainability Goals
  - American College & University Presidents Climate Commitment (ACUPCC)
  - Carbon neutral by 2050
  - Reduce campus energy intensity 20% by 2020 based on 2006 baseline
- Ongoing commissioning identified ***annual*** savings
  - Energy: $444,276
  - $CO_2$: 4,560 metric tons
  - Electrical: 2,560 MWh
  - HW: 31,000 kgal
  - CHW: 108,000 kgal
  - Steam: 1,150 mlb
  - Natural gas: 1,257 MCF
- ***Cumulative*** savings of $900,000 and 29% reduction in MMBTU/$ft^2$ between 2008 and 2013

# Auburn Basketball Arena

- Built in 2010
- 276,568 $ft^2$, $92.5 million facility
- 9,121 seat main court
- Use: Men's and Women's basketball, Women's gymnastics, music events, camps, commencements
- Additional space: practice courts, locker rooms, weight training, sports medicine, offices, suites & lounges, food prep and service, athletics museum
- Connected to central hot water and chilled water systems

# Issues Identified

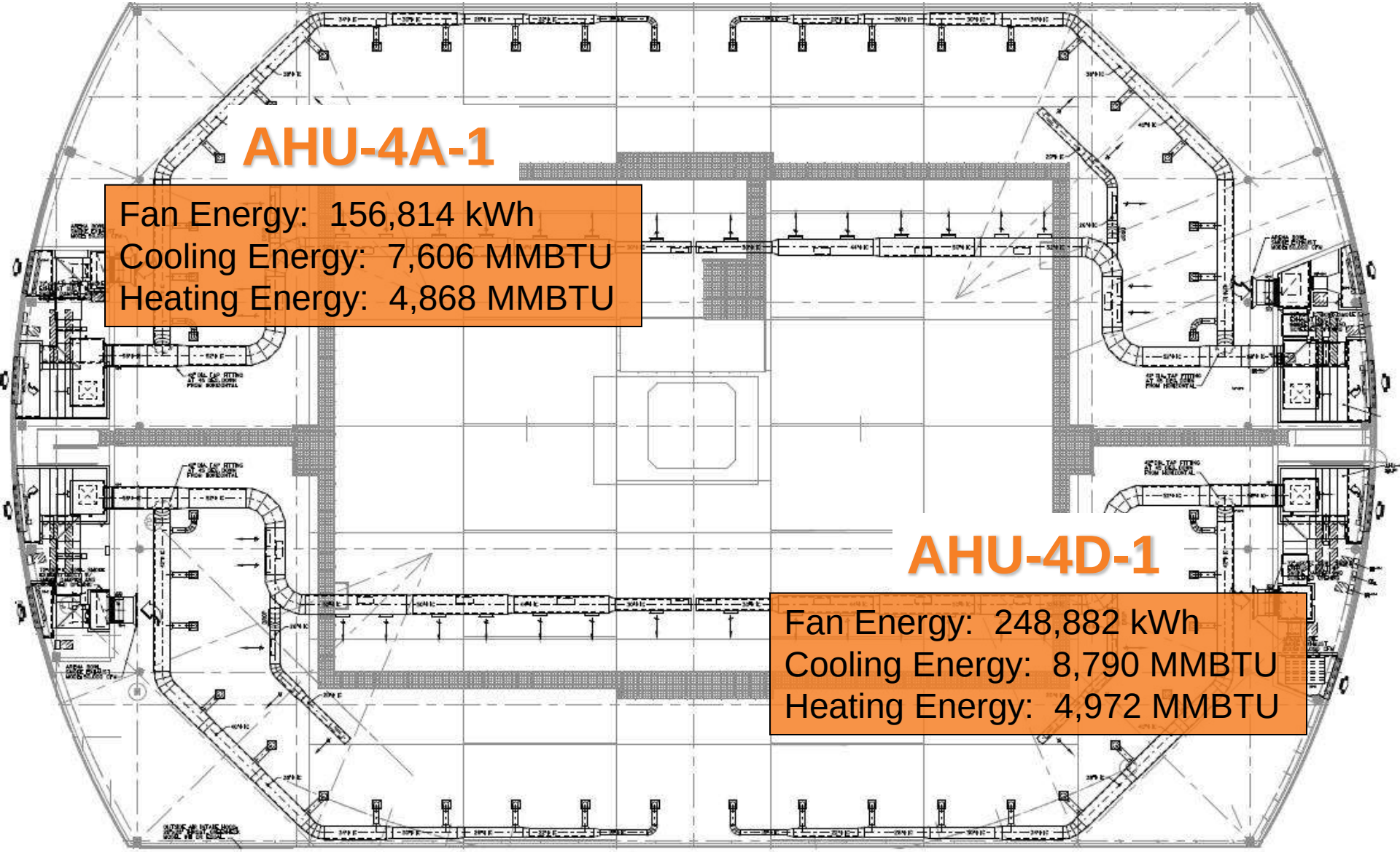
- Main court AHUs:
  - Supply fan VFDs running at constant speeds
  - Cooling valves 100% open in dehumidification mode
  - Economizer optimization
- Building pressurization
- Domestic hot water heat exchanger configuration
- Chilled water pump differential pressure exceeding setpoint
- AHU operation improvements:
  - Occupancy scheduling
  - Static pressure setpoint reset
  - Damper control
  - Temperature control
- VAV operation improvements

# Arena Data Collection & Reporting

- Building automation system (HVAC) data collection, analysis, and reporting by Cimetrics started in Sept. 2011:
  - 2,145 total JCI points polled 24/7/365
  - 15-minute polling frequency
  - 7,798 computed points
  - 200,000+ samples per day
- Equipment monitored and analyzed:
  - 23 air handling units & 19 exhaust fans
  - 5 hot water & chilled water pumps
  - 100 terminal units
  - Multiple system control valves

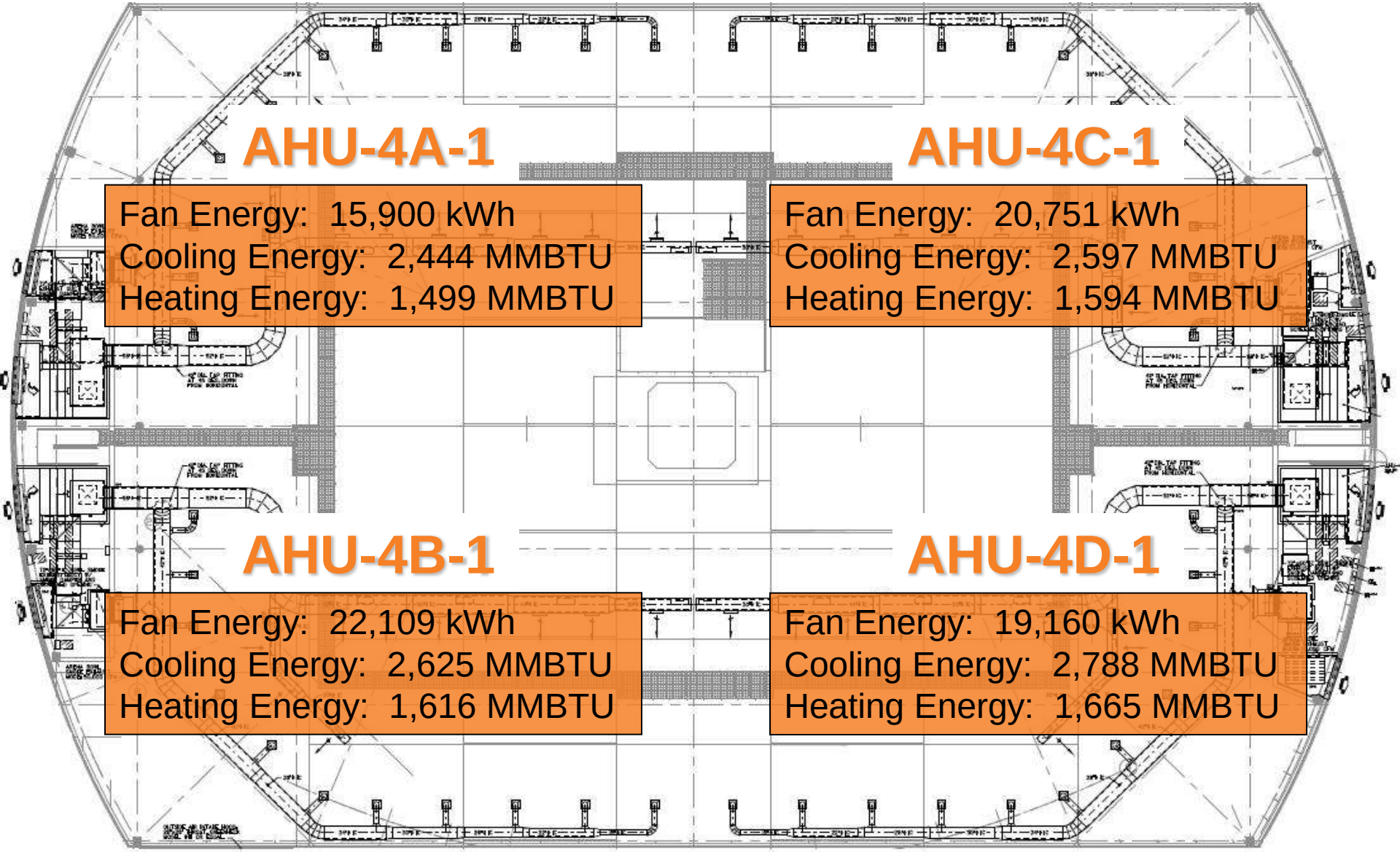
# Main Court Supply Fan Speed Control

## Original Configuration: 2 fans at 100%



# Main Court Supply Fan Speed Control

## Final Configuration: 4 fans variable speeds



### AHU-4A-1

Fan Energy: 15,900 kWh
Cooling Energy: 2,444 MMBTU
Heating Energy: 1,499 MMBTU

### AHU-4C-1

Fan Energy: 20,751 kWh
Cooling Energy: 2,597 MMBTU
Heating Energy: 1,594 MMBTU

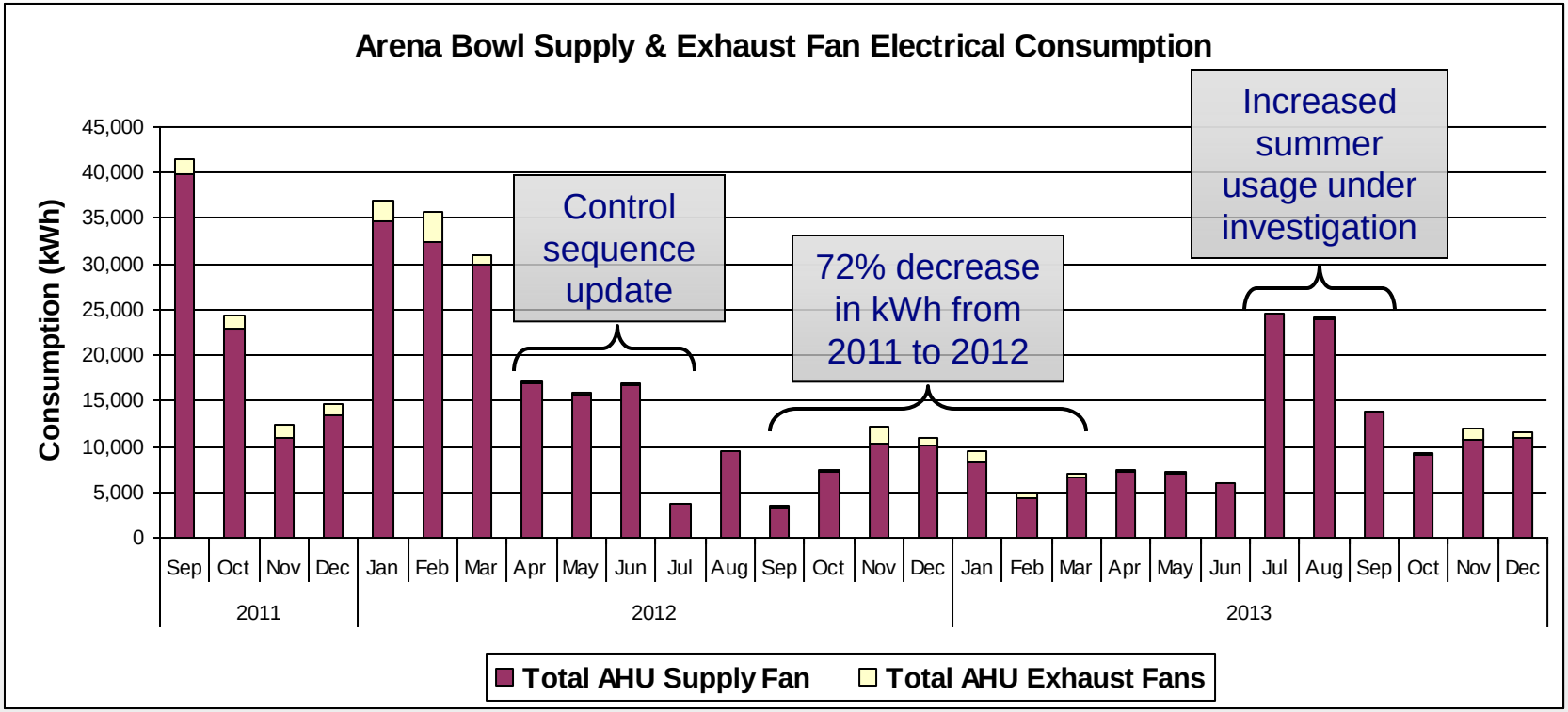
### AHU-4B-1

Fan Energy: 22,109 kWh
Cooling Energy: 2,625 MMBTU
Heating Energy: 1,616 MMBTU

### AHU-4D-1

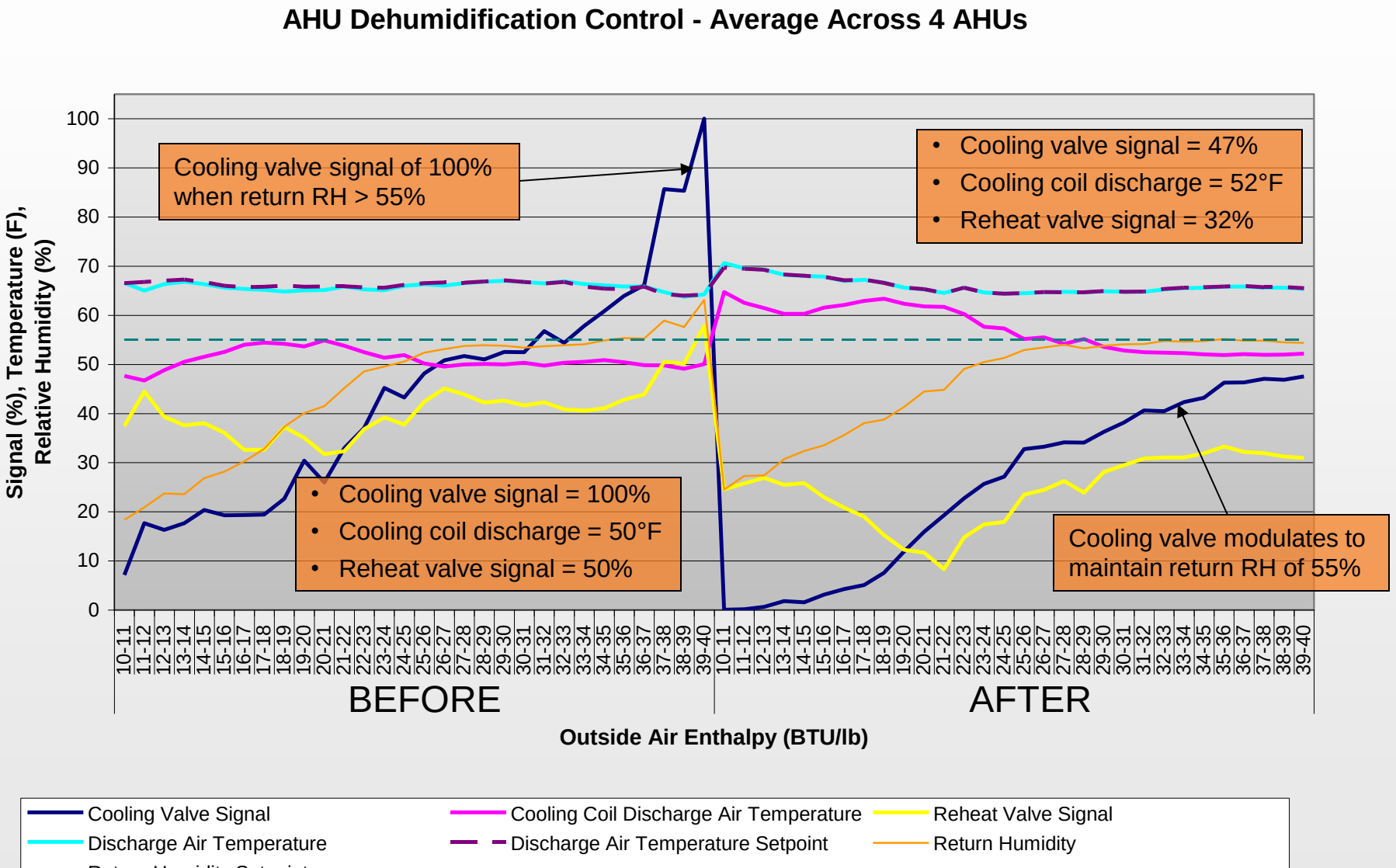
Fan Energy: 19,160 kWh
Cooling Energy: 2,788 MMBTU
Heating Energy: 1,665 MMBTU

# Main Court Fan Speed Control Results

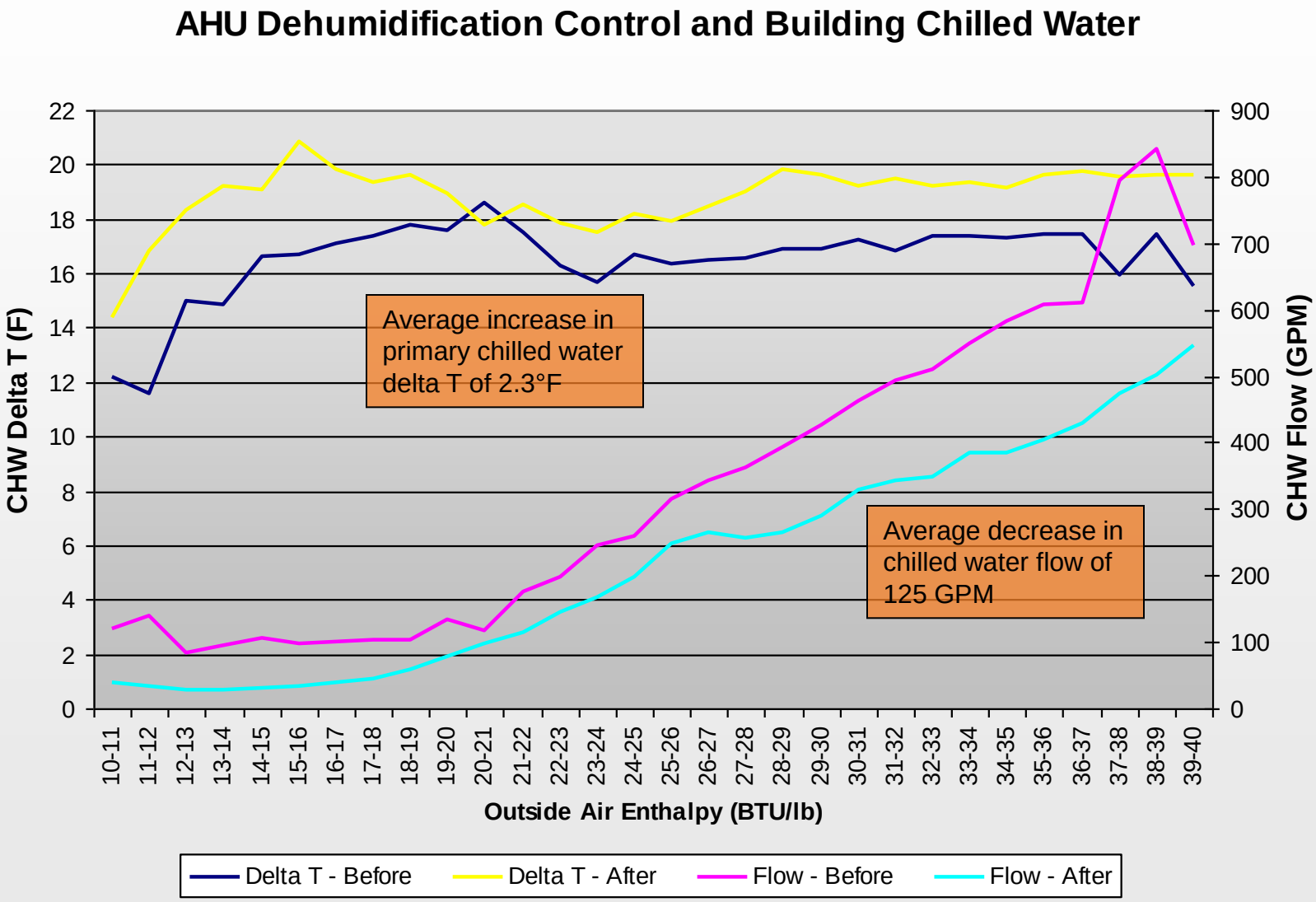



- 184,500 kWh reduction over 7 month period
- $9,200 savings over 7 months
- $15,700 annualized savings
- 72% reduction in electricity consumption

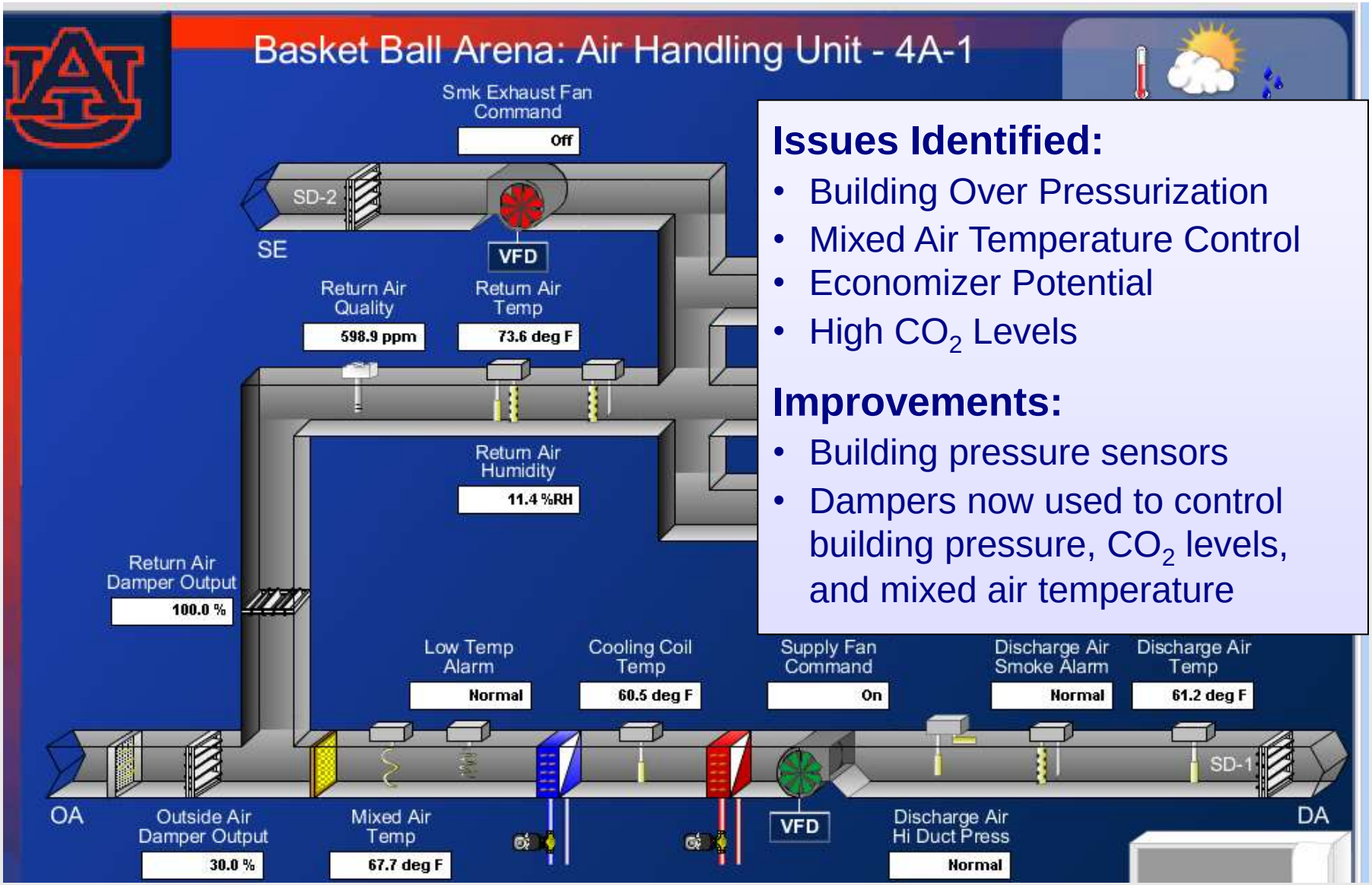
# Main Court Dehumidification Control



# Main Court Dehumidification Control



# Main Court AHU Damper Control




**Issues Identified:**

- Building Over Pressurization
- Mixed Air Temperature Control
- Economizer Potential
- High $CO_2$ Levels

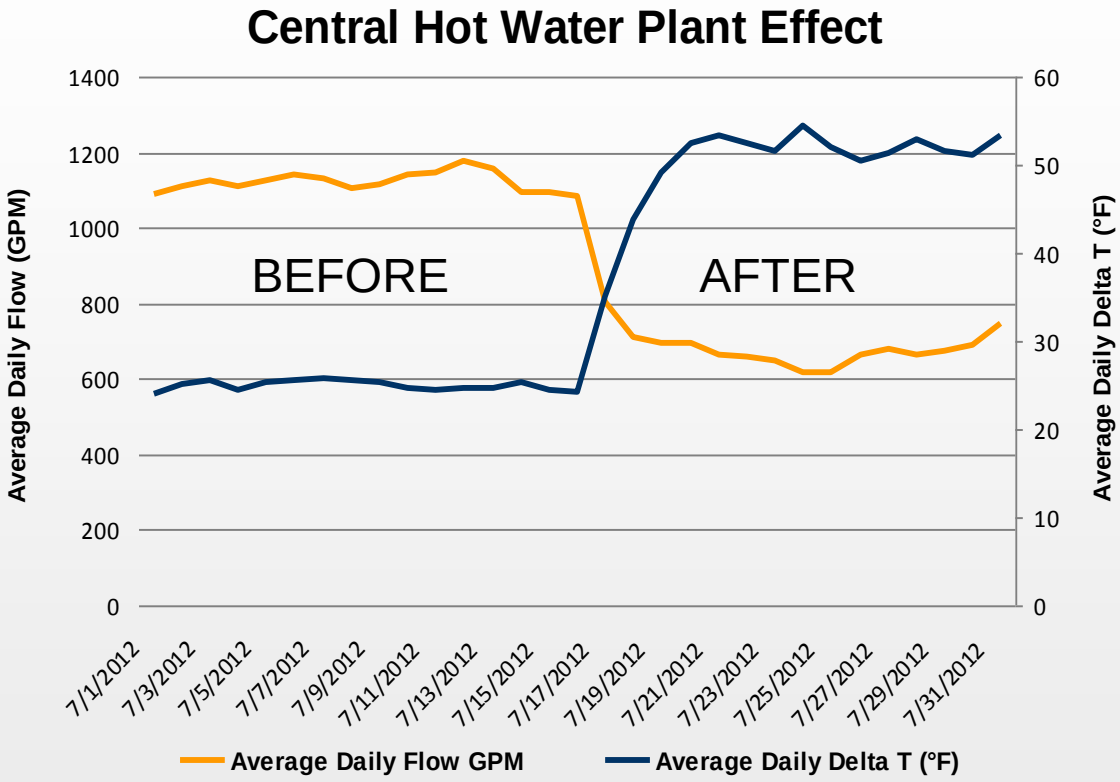
**Improvements:**

- Building pressure sensors
- Dampers now used to control building pressure, $CO_2$ levels, and mixed air temperature

# Heat Exchanger Modification

## Issue Identified:

- Instantaneous domestic hot water heaters had three-way valves on primary side.




## Estimated Annual Savings:

- Central Plant - $10,000

# Energy & Environmental Results

- Estimated results based on Cimetrics recommendations and Auburn University implementation
  - Annual savings: $114,000
  - Annual carbon savings: 1,800 metric-tons $CO_2$
- Energy intensity based on actual utility data
  - 2010: 188,476 BTU/$ft^2$
  - 2011: 165,950 BTU/$ft^2$
  - 2012: 150,447 BTU/$ft^2$
  - 2013: 151,290 BTU/$ft^2$

# Special thanks to:

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- Mary Ellen Cantabene – Chief Operating Officer, Cimetrics
- Dean Taylor – Manager of Analytics, Cimetrics

# Questions?

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