Arts and Letters MBCx

San Diego State University

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Outline

- Introduction
- Project/Building Summary
- Energy Conservation Measures
- Implementation Process
- Energy Baseline and Savings
- Challenges
- Project Takeaways

Project Summary

Equipment	Description	
1. Year of construction	2006	
2. Gross area (gross square footage)	114,413 sq. ft.	
3. Number of stories	6 stories above grade, no basement level	
4. Building use	Offices, Classrooms, Lecture Halls	
5. Weekly hours of occupancy by major space type	Offices	0630-2000 M-F 0830-1330 Sat 0730-1630 Sun
	Classrooms	
	Lecture Halls	
6. Type of lighting equipment installed (e.g., T12, T8, HID)	T8 Fluorescent fixtures w/ electronic ballasts	
7. Brief renovation history	N/A	
8. Brief description of building improvements planned	N/A	

Project Summary

Equipment	Description
1. Type of Cooling System (i.e. district cooling, package A/C)	District Cooling
2. HVAC distribution system (i.e. constant volume, variable volume, dual duct, multi-zone)	Variable volume AHUs with VAV reheat, Single zone fan coils (cooling only)
3. Age of primary cooling system	8 Years
4. Heating system type	District heating with steam-hot water heat exchanger
5. Miscellaneous Equipment	HHW Pumps: P-1, P-2 CHW Pumps: P-1, P-2
6. HVAC control system type (i.e. pneumatic, DDC)	All major equipment is controlled/monitored through DDC. Zone control is DDC

Energy Conservation Measures

- ECM 1 – AHU Schedule Optimization
- ECM 2 – Fan Coil Schedule Optimization
- ECM 4 – Supply Air Temperature Reset
- ECM 5 – Static Pressure Reset
- ECM 7 – Optimize Economizer Operation
- ECM 8 – Demand Control Ventilation for AHU-4, 5

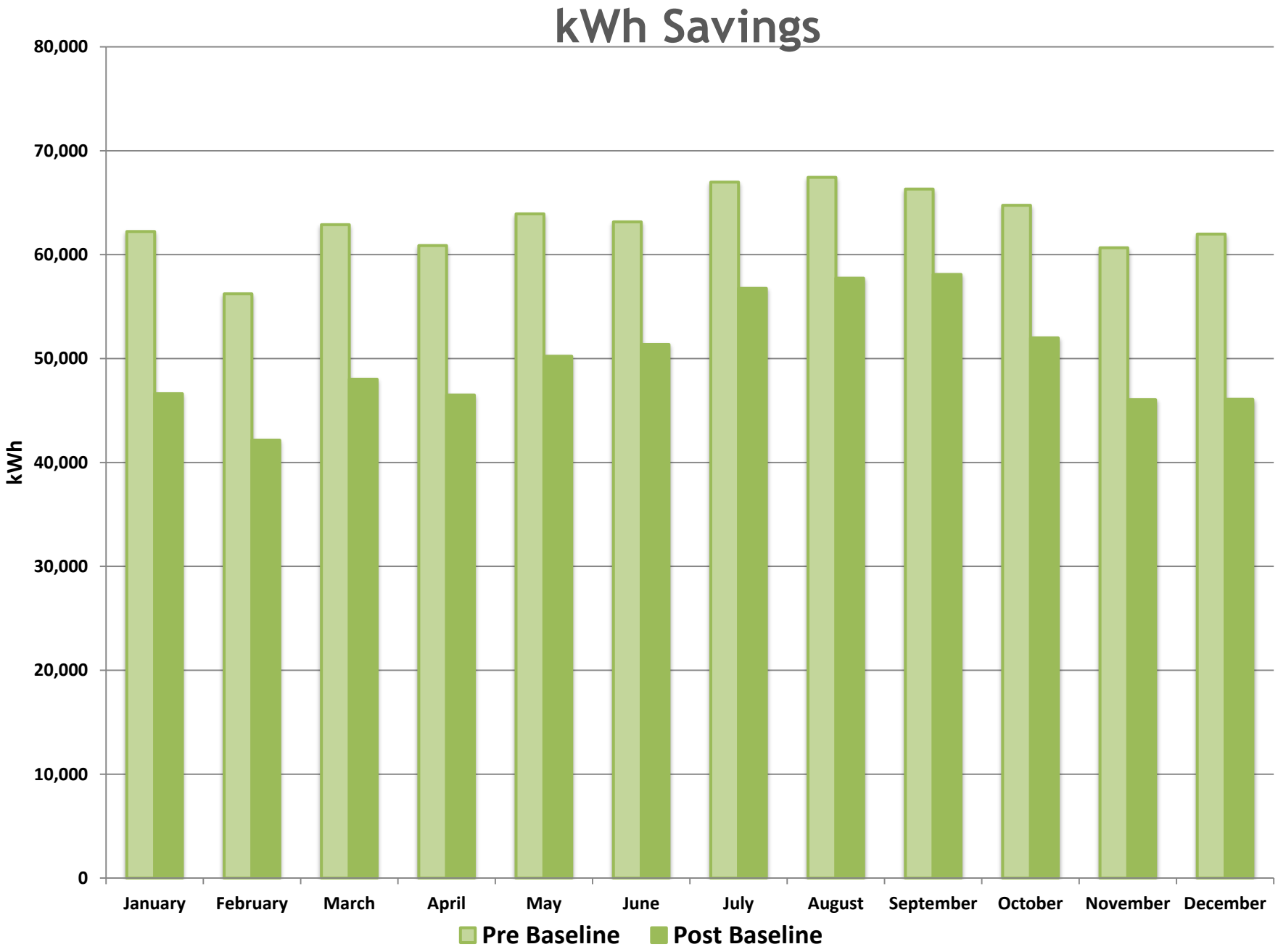
Implementation Process

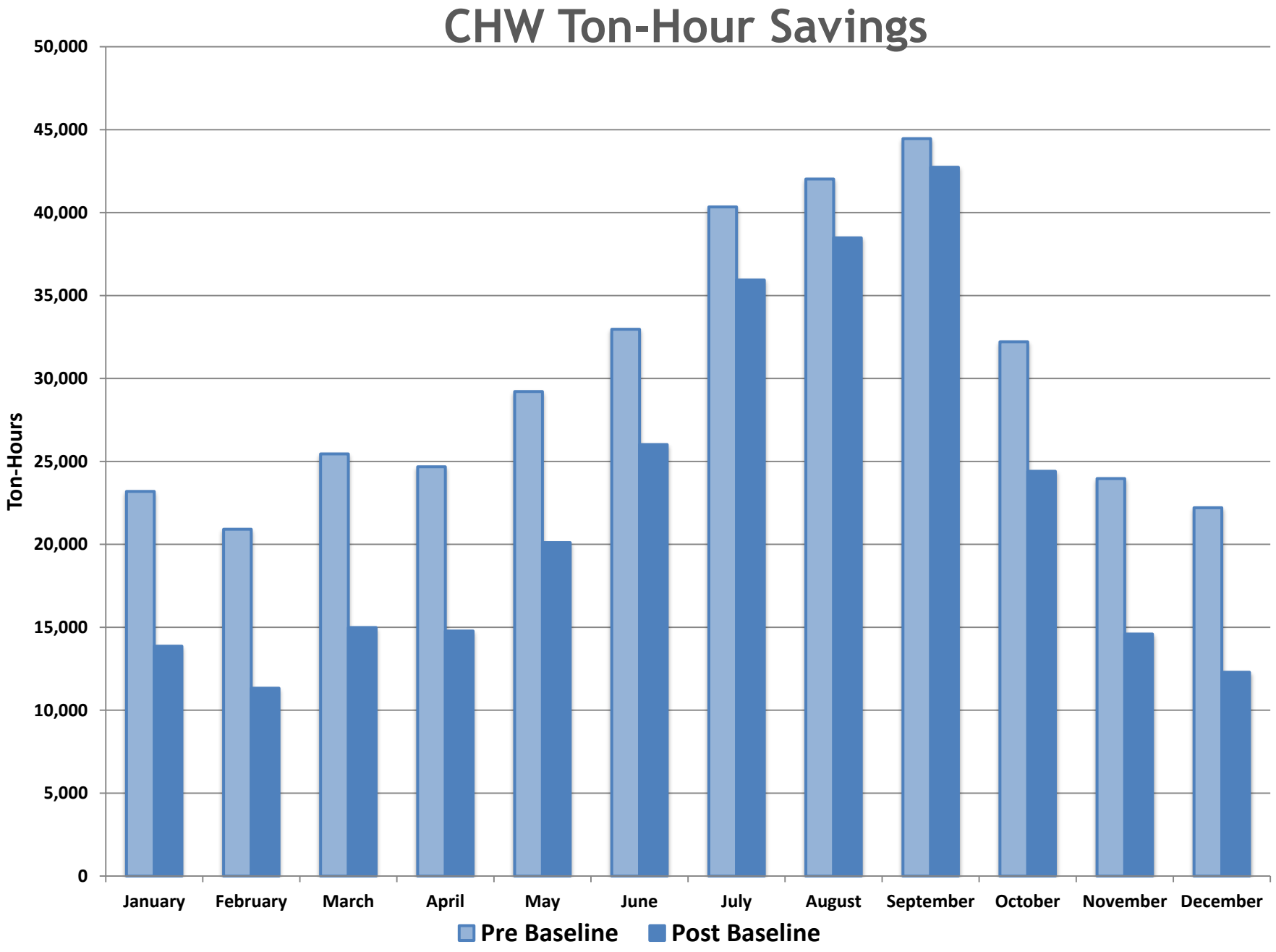
- Campus preferred controls contractor
  - contracted directly to engineer
- Sensors purchased by campus directly
  - Installed by facilities staff and controls contractor

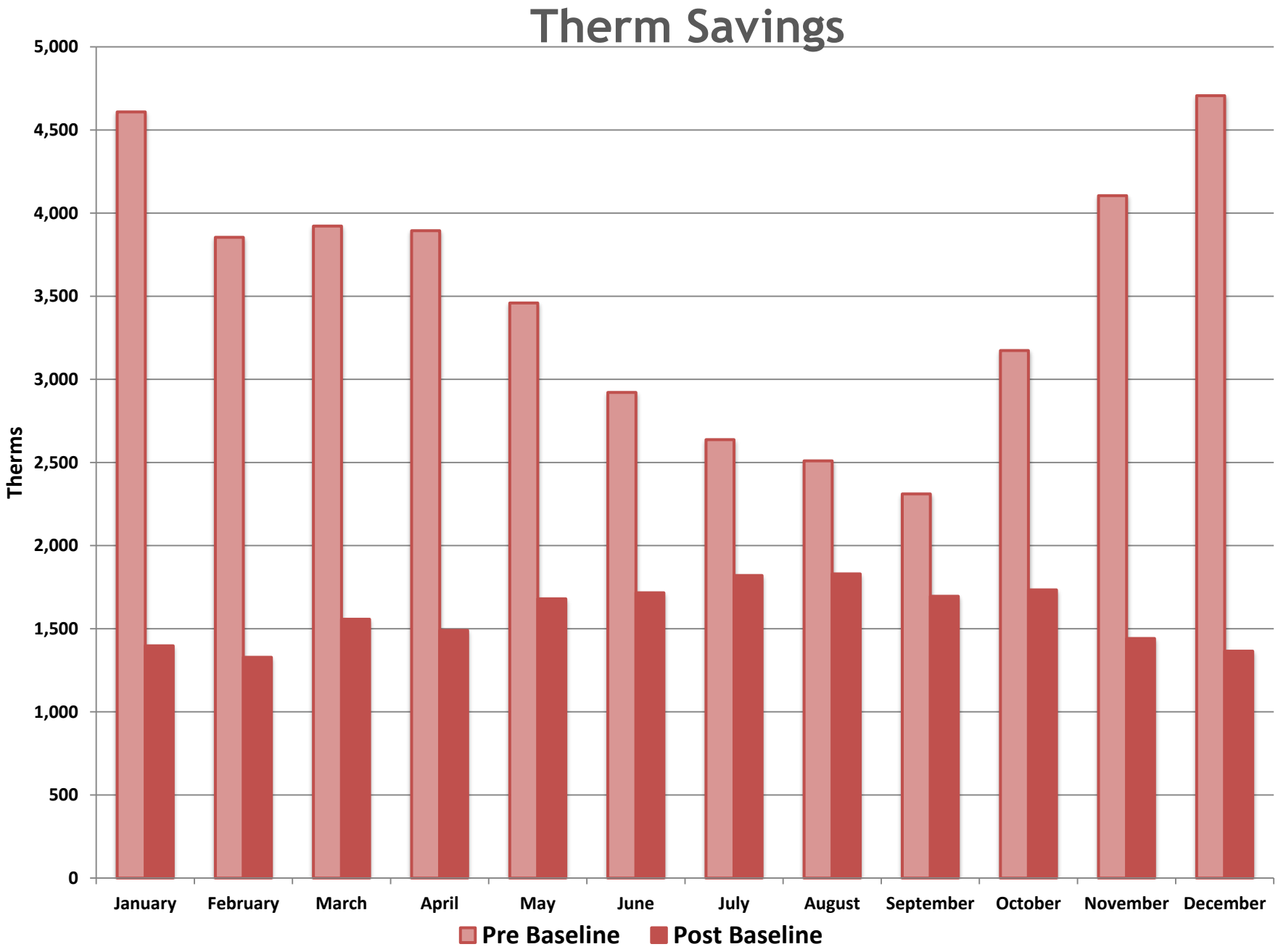
Original Energy Baseline

	Annual Energy Estimates
Electrical	757,407 kWh/year
Peak Electrical Demand	126 kW
Chilled Water Usage	289,299 kWh/year (361,624 Ton-Hours)
Hot Water Usage	52,628 Therms/year

Category	EUI (kBtu/SF_Yr)
Electrical	**22.6**
Chilled Water	**37.9**
Steam	**46.0**
Total	**106.5**
Power Density	
1.10 W/SF	


kWh Savings
80,000
70,000
60,000
50,000
40,000
30,000
20,000
10,000
0
kWh
January
February
March
April
May
June
July
August
September
October
November
December
Pre Baseline
Post Baseline


CHW Ton-Hour Savings
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
Ton-Hours
January
February
March
April
May
June
July
August
September
October
November
December
Pre Baseline
Post Baseline

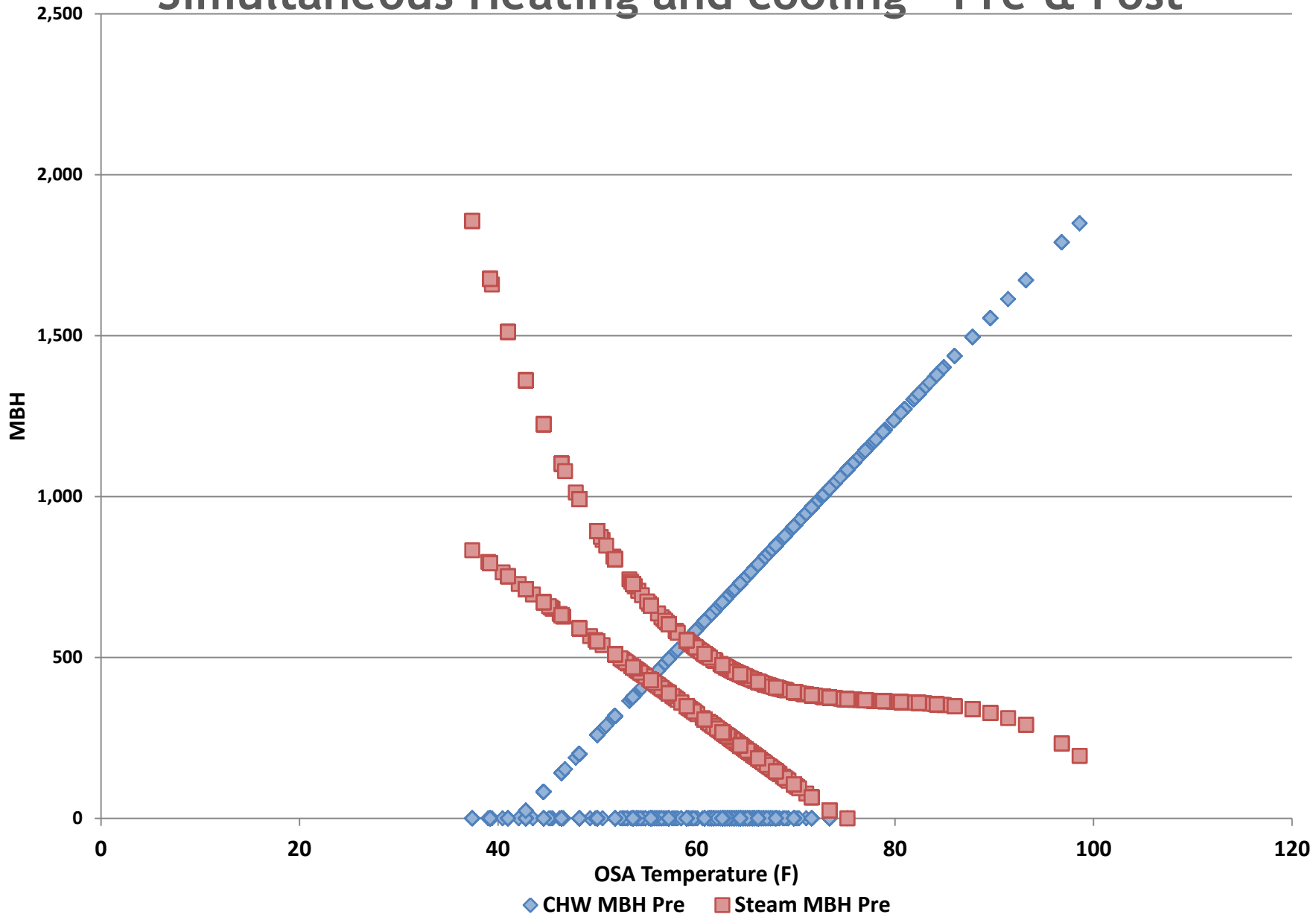

Therm Savings
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Therms
January
February
March
April
May
June
July
August
September
October
November
December
Pre Baseline
Post Baseline

Post Energy Baseline (Form D)

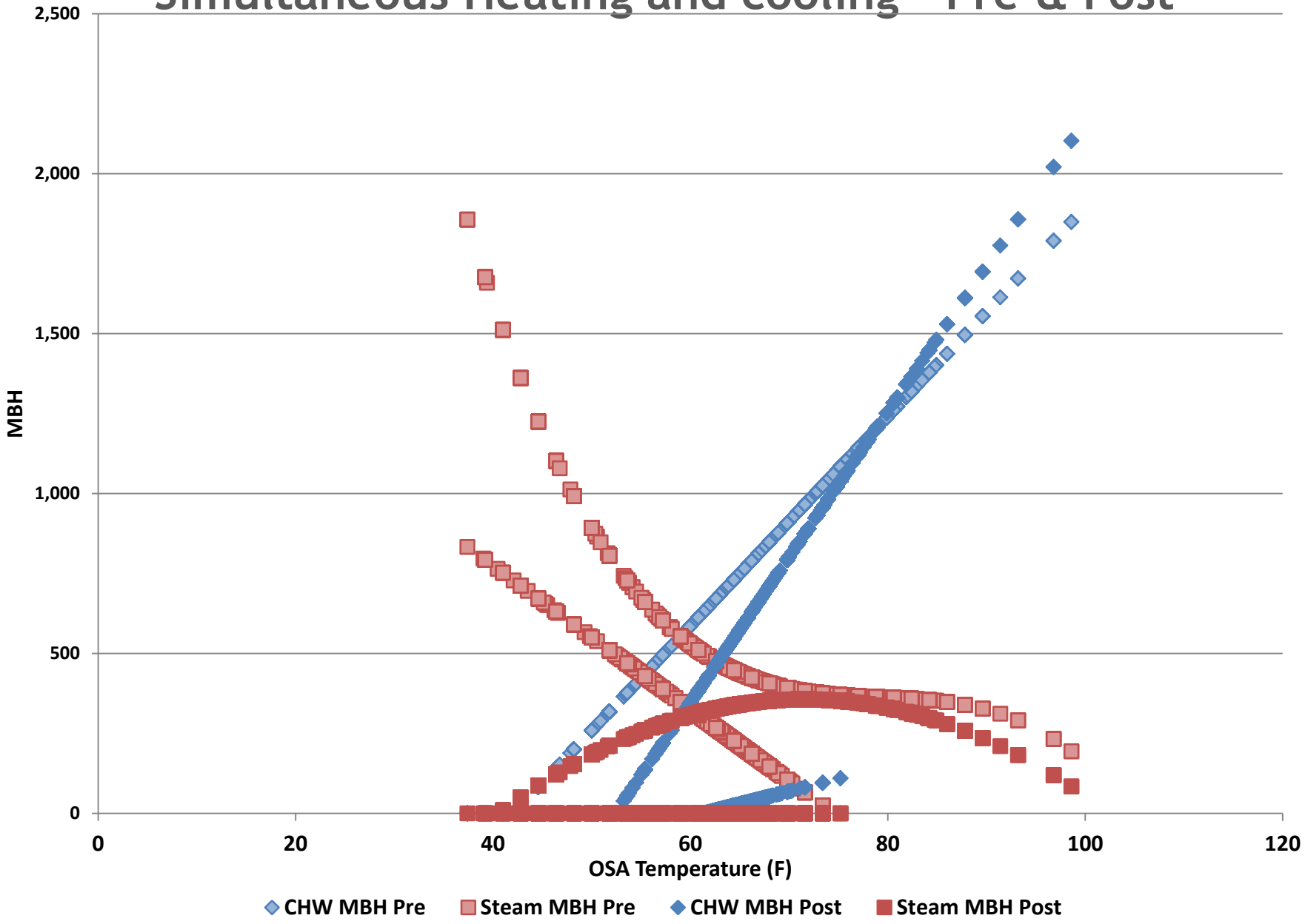
	Annual Energy Estimates
Electrical	601,569 kWh/year (-21%)
Peak Electrical Demand	132 kW (+5%)
Chilled Water Usage	215,621 kWh/year (269,526 Ton-Hours) (-25%)
Hot Water Usage	23,816 Therms/year (-55%)

Category	EUI (kBtu/SF_Yr)
Electrical	**17.9**
Chilled Water	**28.3**
Steam	**20.8**
Total	**67.0**
Power Density	
1.15 W/SF	

Simultaneous Heating and cooling - Pre & Post



Simultaneous Heating and cooling - Pre & Post



Energy Savings

- Savings
  - 155,838 kWh
  - 73,678 CHW Ton-Hours
  - 28,812 Therms
- $39,000 Annual Operating Savings
- $219,000 Total Project Cost
  - Includes internal labor, investigation, implementation support
- $100,000 Chancellor's Office Special Repairs Funding
- $86,000 Estimated Incentive*
  - Likely reduced to $40,000 due to Distributed Generation limitations
- Simple Payback 2 Years

Challenges

- Overcome departmental cultural history and divisions
- Expand comfort zone of comfort settings
- Limitations of existing building envelope
  - Uninsulated metal panels in several areas
- Complete lingering items and hold attention after savings targets met (and exceeded) and the MBCx engineer has left
  - Shift back from proactivity to reactivity due to limited staff
- Utility incentives shifting due to reinterpretation of CPUC distributed generation rules
  - Cogeneration plant responsible for most of campus usage

Key Takeaways

- DDC vs Pneumatic
  - Can still save energy in DDC buildings, need to focus on sequences interactions between different systems
  - Ongoing process to continuously fine-tune the building to find optimum efficiency points

Key Takeaways

- Simplicity vs Complexity
  - 5 + 5 = 2 + 2 + 2 + 2 + 2
  - Can't just focus on big items; need to dive down deep into the building operation if you want the maximum efficiency (and greatest savings)
  - However, need to make sure we balance complex resets with ease of operation
  - Important to educate operators on how the changes and how the sequences work

Project Team

- SDSU Facilities Services Core Team
  - Steve Quinn
  - Chris Sprofera
  - Larry Tilton
- External
  - David Klug, P2S, MBCx engineer
  - Robert Lastinger, controls implementation
- Additional SDSU Support
  - Tom Abram
  - Bill Lekas

Contact info and references

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Q & A