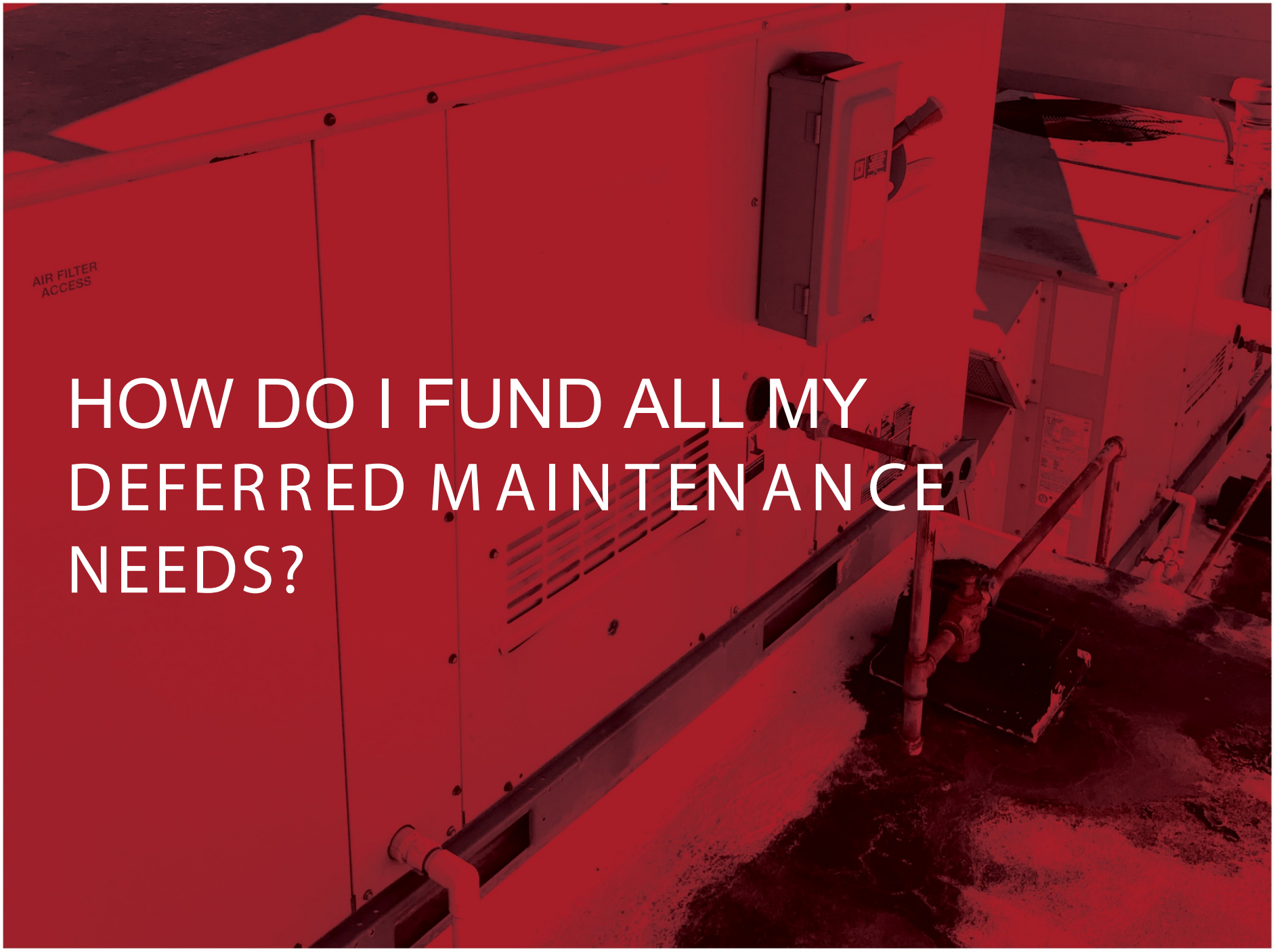
HEAPY

Providing High Performance Building Solutions

BUTLER UNIVERSITY

CENTRAL PLANT EXPANSION & UPGRADE

CampusEnergy2020
THE POWER TO CHANGE
FEBRUARY 10-14 ▲ SHERATON DENVER DOWNTOWN ▲ DENVER, CO



HOW DO I FUND ALL MY DEFERRED MAINTENANCE NEEDS?

HOW DO WESERVE NEW CAPITAL PROJECTS WITH EXISTING INFRASTRUCTURE ISSUES?


HOW DO WE MAKE THE MOST OF AVAILABLE FUNDS WHILE PLANNING FOR THE FUTURE?

THE PROJECT

BUTLER UNIVERSITY CHILLED WATER PLAN

AMANDA DOENGES, PE
Client Strategies Leader
HEAPY

RYAN O'CONNELL, PE
Senior Mechanical Engineer
HEAPY

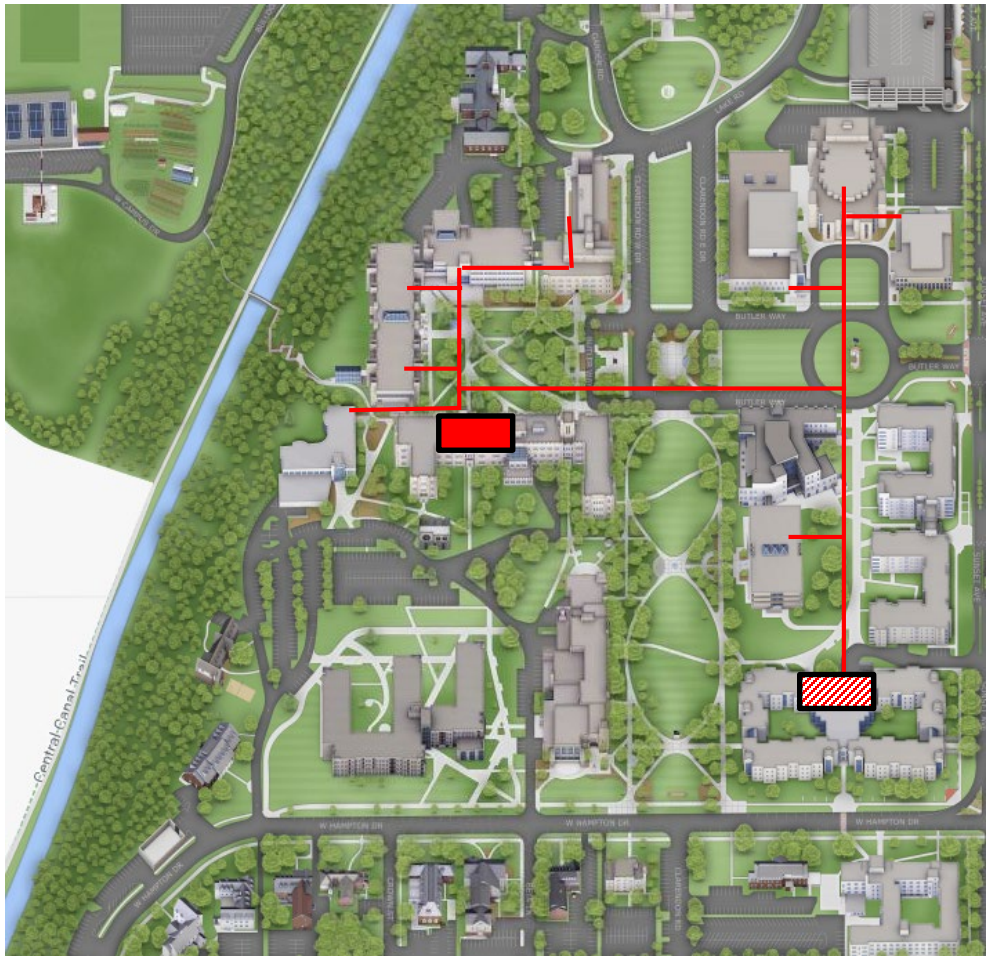
TAYLOR SMITH
Campus Engineer
Butler University

ABOUT BUTLER UNIVERSITY

- Private Institution – Indianapolis, IN
- Founded in 1855
- Current campus since 1928
- 6 colleges
- 300 acres
- 3.1M+ square feet

THE EXISTING PLANT

- Existing plant:
  - 1800 tons, 3 water cooled chillers in Jordan Hall
  - 700 tons, 2 air cooled chillers in ResCo
- 10 buildings, 1.045Msf served



EXISTING CHALLENGES

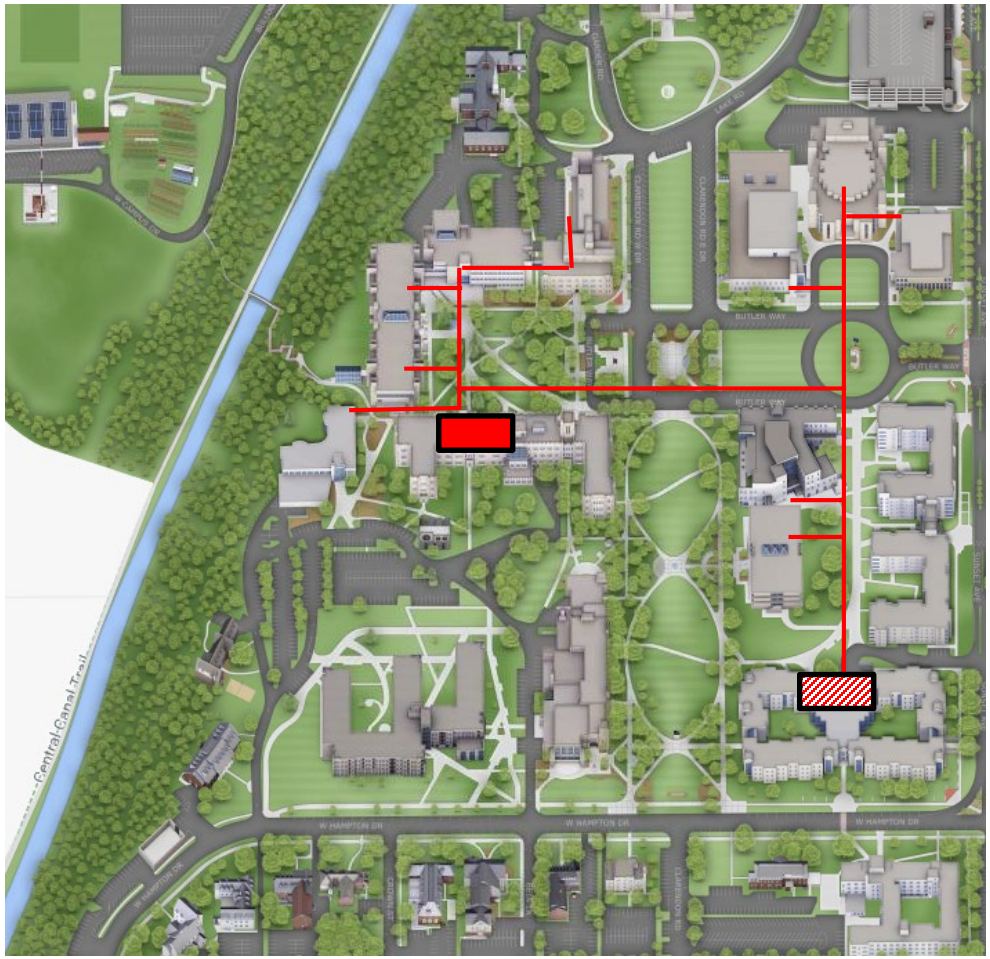
- “Not enough capacity to cool buildings”
- Chilled water flow issues
- No year-round cooling capability
- Equipment past median expected service life

PROJECT DEVELOPMENT

- 2 new capital projects
- Existing cooling capacity
- Existing plant operational issues
- Challenges in hiring maintenance staff
- Pressure to reduce operational costs
- Campus cooling needs during construction
- Central plant location
  - Existing building
  - Heart of campus

PROJECT STUDY- FINDINGS

- Central plant vs. stand alone
- Central plant more cost effective
- Project funding
  - Capital projects
  - Deferred maintenance



PROJECT DETAILS

Project Budget & Team

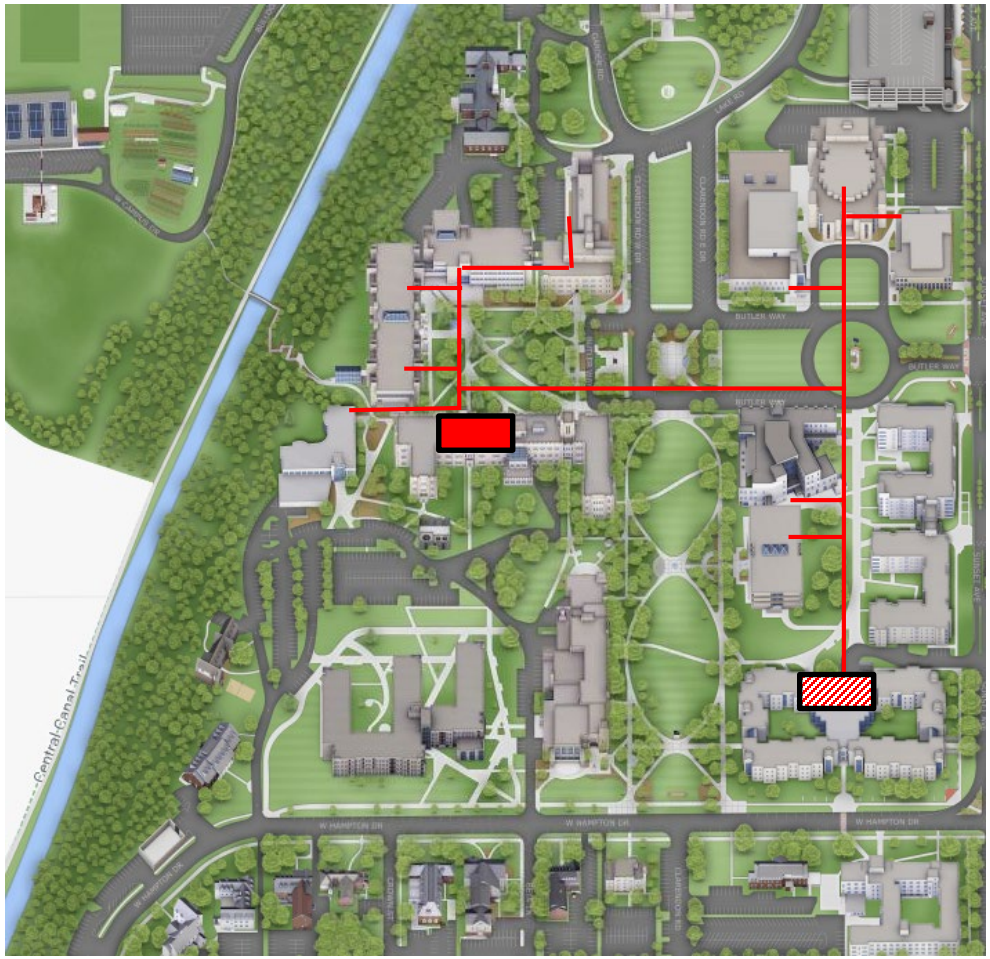
- $6.6M total project cost
- Aggressive Construction Schedule
- Heapy Engineering – MEP Design
- Pepper Construction – CM
- Browning Day Mullins Dierdorf – Architecture
- CE Solutions – Structure

Unique Project Components

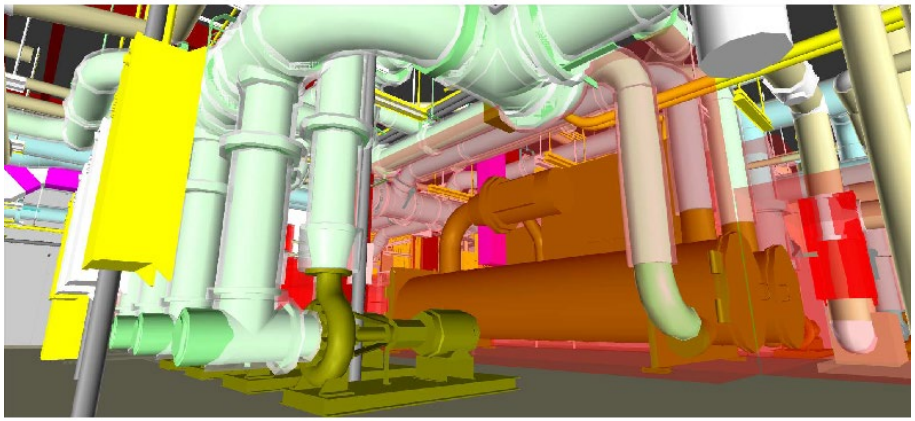
- Technology
  - 3D point cloud survey, Revit
  - BIM Modeling and Navisworks coordination
  - AR Construction Assistance
  - BIM/CMMS Integration
- Operational Considerations
  - Delta T control issues
  - Switch to open controls platform
  - Automated plant operation control
  - Schedule
  - Cooling tower wall
- Chiller selection
  - Pre purchase bid package

PROJECT DETAILS

- New plant:
  - 2700 tons, 3 water cooled chillers in Jordan Hall
  - 700 tons, 2 air cooled chillers in ResCo
- 11 buildings, 1.2Msf served



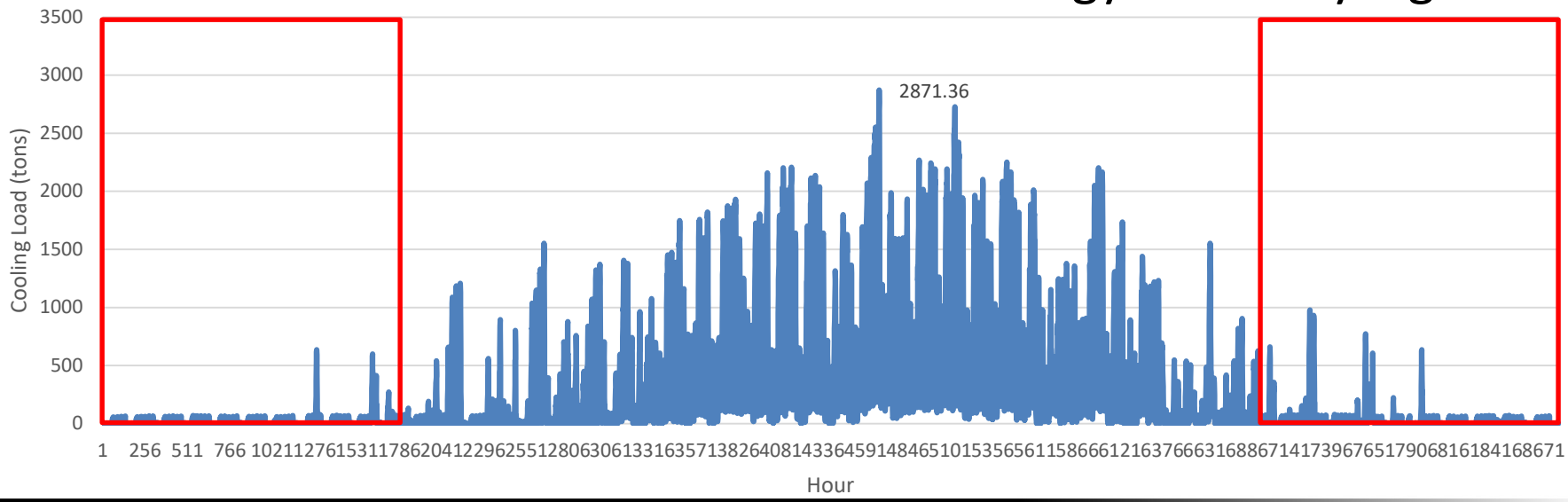
TECHNOLOGY - CONSTRUCTION



TECHNOLOGY - CONSTRUCTION

EXISTING PLANT ISSUES

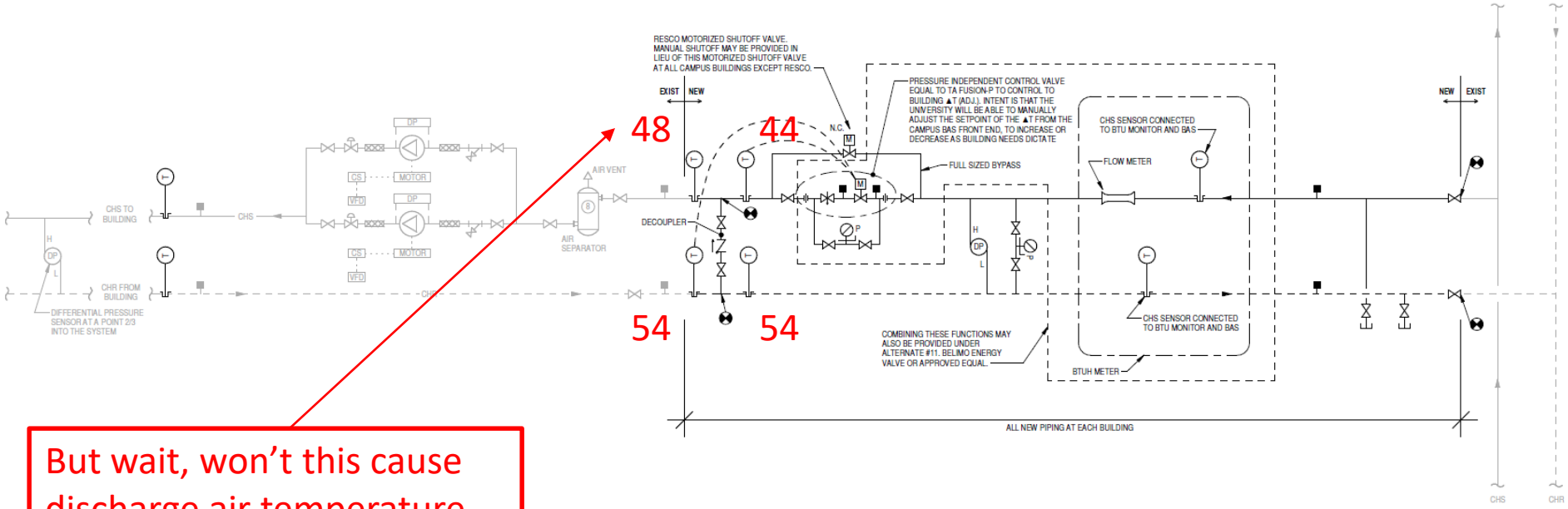
- Issues Identified:
  - Majority of plant controlled in hand
  - Low deltaT issues (often as low as 3-4°F)
  - No year-round operational capabilities
  - Noise concerns
  - Energy Efficiency a goal



DESIGN – ▲T FLOW CONTROL

- Low ▲T issues can be cause by numerous sources:
  - Aging cooling coils or improperly selected coils
  - Three-way valves (bypassing water)
  - Control valve issues (over-flowing coils)
- Low ▲T causes increased pump energy usage due to increased flow required
- ▲T degradation over time is inevitable in large CHW plants and must be addressed over time

DESIGN – ▲T FLOW CONTROL



But wait, won't this cause discharge air temperature issues leading to space temp loss, humidity issues, etc.?

DESIGN – ▲T FLOW CONTROL

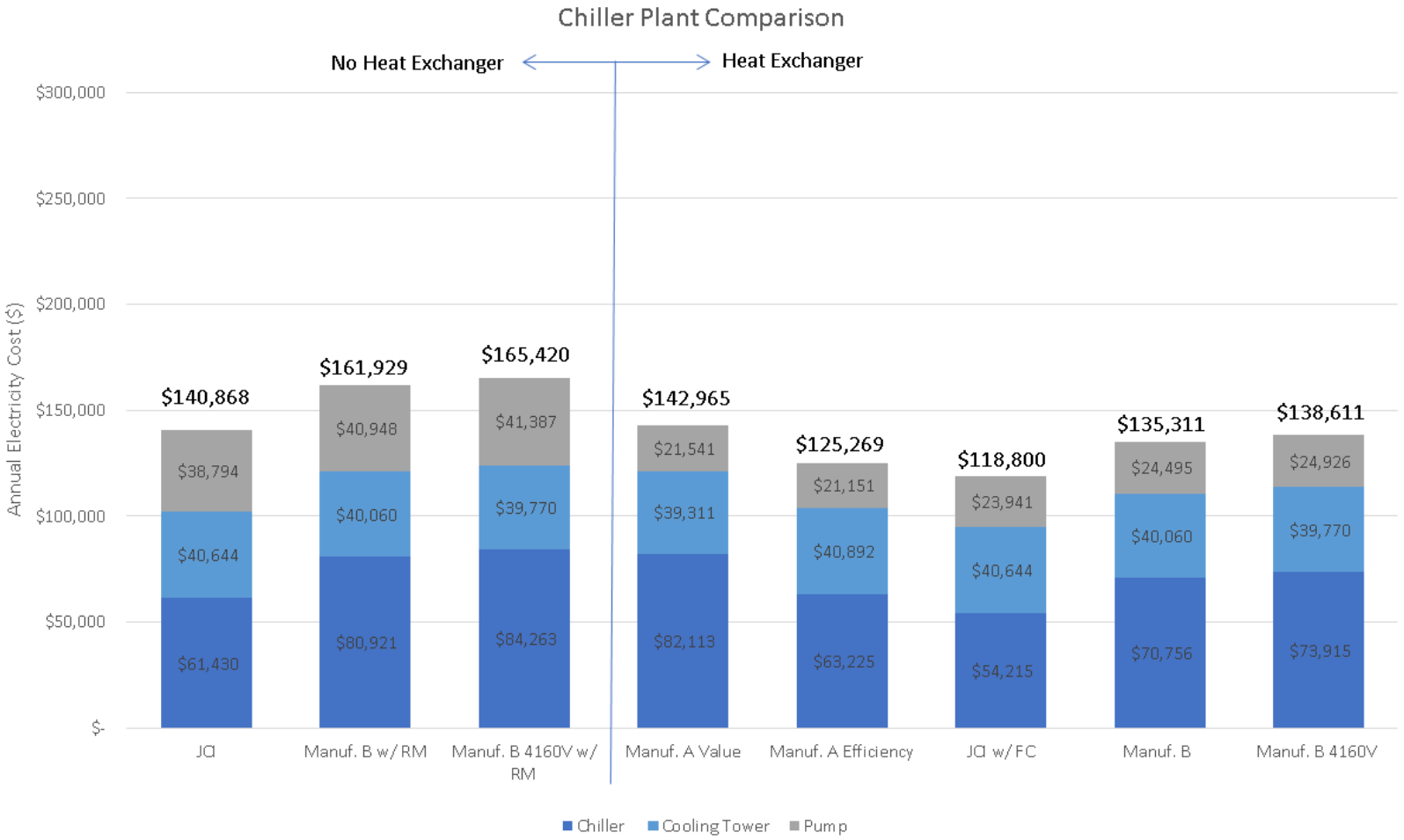
▲T Benefits:

- Decouples buildings
  - Isolates issues
  - Gives operator control over “problem” buildings which negatively affect the plant, thus the whole campus
- Identifies “Problem” Buildings
  - Helps owner identify which buildings are good candidates for AHU replacements, pump/flow building studies, etc.

PRE-PURCHASE BID PACKAGE

- Chillers
  - Lead times for chillers impacted project schedule
  - Multiple manufacturers' selections evaluated
  - Manufacturers were given flexibility to bid their best options
- Controls
  - "Parts and Smarts"
  - Chiller Plant Optimizer "CPO10" by JCI was purchased

CHILLER BID EVALUATION



CHILLER BID EVALUATION

Alternatives by Electricity Cost						
Option No.	**Alternative Name**	**HX**	**Refrigerant Migration**	**Description**	**Plant Capacity (tons)**	**Total Electricity Cost ($)**
3	JCI			3 x 900 ton chillers	2700	$ 140,868
4	JCI w/ FC	X		3 x 900 ton chillers	2700	$ 118,800
2	Manuf. A Efficiency	X		5 x 520 ton chillers	2600	$ 125,269
5	Manuf. B w/ RM		X	2 x 1000 ton chillers, 1 x 600 ton chiller	2600	$ 161,929
6	Manuf. B	X		2 x 1000 ton chillers, 1 x 600 ton chiller	2600	$ 135,311
1	Manuf. A Value	X		4 x 650 ton chillers	2600	$ 142,965
8	Manuf. B 4160V	X		2 x 1000 ton chillers, 1 x 600 ton chiller	2600	$ 138,611
7	Manuf. B 4160V w/ RM		X	2 x 1000 ton chillers, 1 x 600 ton chiller	2600	$ 165,420

CHILLER BID EVALUATION

Alternatives by Electricity Cost								
Option No.	HX	Alternative Name	First Cost Bid ($)	Yearly Electricity Cost ($)	Additional Electrical Cost From Baseline ($/year)	30-year Lifetime Additional Cost ($)	First Cost Savings vs. Baseline Bid ($)	Simple Payback vs. Baseline (years)
3		JCI	$ 822,024	$ 140,868	$ 22,068	$ 662,039	$ 179,000	8.1
4	X	JCI w/ FC	$ 1,001,024	$ 118,800	$ -	$ -	$ -	-
2	X	Manuf. A Efficiency	$ 996,500	$ 125,269	$ 6,468	$ 194,051	$ 4,524	0.7
1	X	Manuf. A Value	$ 866,500	$ 142,965	$ 24,165	$ 724,938	$ 134,524	5.6
5		Manuf. B w/ RM	$ 824,000	$ 161,929	$ 43,129	$ 1,293,859	$ 177,024	4.1
6	X	Manuf. B	$ 929,000	$ 135,311	$ 16,510	$ 495,314	$ 72,024	4.4
8	X	Manuf. B 4160V	$ 919,000	$ 138,611	$ 19,811	$ 594,339	$ 82,024	4.1
7		Manuf. B 4160V w/ RM	$ 814,000	$ 165,420	$ 46,620	$ 1,398,608	$ 187,024	4.0

		Baseline
		Simple payback for installing waterside economizer HX
		Lowest First Cost (Contractor selected option in competitive bid environment)

CHILLER BID EVALUATION

- Worked with Heapy and Pepper
  - Up front cost
  - Energy savings
  - Noise
  - Maintenance
- Site visits with maintenance staff
- HX – unclear of available funds up early on. Added later

DESIGN – CONSIDERATIONS

- This was the best plant ***for Butler***
- Use evaluation tools/considerations to design the best plant for you
  - Prioritize
- Work with your design/construction team to push the envelope – biggest bang for your buck

CONSTRUCTION – OWNER'S PERSPECTIVE

- Engineer involvement throughout construction = critical
- What are your priorities?
  - Maintaining workforce
  - Pressures for operational budget reductions
  - Energy reduction goals
  - Addressing deferred maintenance/operational issues?
- PLAN PLAN PLAN!
  - Significant reduction in change orders
  - Schedule
  - Budget

QUESTIONS?

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THANK YOU!