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Nebraska’s comprehensive approach to campus energy management

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- 14.6 million GSF
- 148 major buildings
- Over 650 acres
- 11.0 miles of chilled water distribution
- 10.7 miles of steam distribution
- 18.7 miles of electrical distribution
Operational Silos

• Previous organization
  • Utilities and Energy Management groups in separate units
• Cross-departmental interaction as needed
Integrating energy services

• Current organization
  • AEM group bridges gap between maintenance and utilities
  • Added technical capabilities
    • Utility Engineering
    • Building Recommissioning
  • Consolidated building energy-related facilities services
    • Fluid interaction with both BSM and Utilities
Energy management at every stage

- Building recommissioning
- Plant operational efficiency
- Addressing low chilled water delta-T
- Thermal energy storage
Building Recommissioning

Deliverables:
• Full HVAC recalibration and commissioning
• Calculate new design loads based on space changes and academic program needs
• Energy audit of rooms and equipment
• List of project recommendations

Quilt House Recommissioning
Original Building
37,851 GSF
10,615 MMBtu/year
With Addition
51,551 GSF (36% increase)
7,930 MMBtu/year (25% reduction)
EUI decreased by 45.1%
Continuous tube cleaning

With online cleaning, 77°F ECWT

Without online cleaning, 77°F ECWT

May (64 hours)  September (67 hours)

May (70 hours)  September (70 hours)

Efficiency [kW/ton]

% Load

50% 75% 100%
Case Study: Addressing Low Delta-T

- Backflushed coils
- Temp setpoint no lower than design
- Removed 3-way valves
- Building pressure control for reduced humidity
Case Study: Increased Delta-T benefits

• Effect seen at chillers
• Flow reduction at peak nearly at design flow of 1500 ton chiller
• New, better problem
  • chillers designed for 12° ΔT

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- Flow Savings [GPM] 2,866
- Pumping Savings [kW] 95
- Demand Savings [$/year] $13,723

City Campus ΔT, Average Summer Day

[Graph showing ΔT comparison between 2015 and 2019]
Case Study: Thermal Energy Storage

- City Campus 2017: Demand charges accounted for 66% of electric bill
- Excess ratchet charges of $273K
- Electricity for cooling accounted for 33% of total campus demand
- No onsite non-emergency generation
  - Combination of high capital cost and inexpensive energy portion of electric bill so no payback

![City Campus Peak Day 2017 Graph](chart.png)
Case Study: Thermal Energy Storage

• Flatten load profile
• Eliminate excess ratchet charges
• Offset new chiller additions
• East Campus TES built in 2013
• City Campus TES built in 2018
• Total Demand Reduction of 8 MW, over $1.5MM annual savings
Campus Energy Reduction

UNL Energy Use vs Research Expenditures

FY04 FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18 FY19

$0 $50 $100 $150 $200 $250 $300 $350

Total Research Expenditures (M$)

EUI, Energy Use Index (kBtu/sf/yr)

Research $ EUI

BSM UTL AEM
Campus Energy Reduction

UNL Energy Use vs Student Enrollment

EUI, Energy Use Index (kBtu/sf/yr)

Enrollment

Student Enrollment

FY04 FY05 FY06 FY07 FY08 FY09 FY10 FY11 FY12 FY13 FY14 FY15 FY16 FY17 FY18 FY19

BSM UTL AEM
Campus Energy Reduction

UNL Energy Costs since FY04

Elec + Gas Costs ($MM/year)

- Actual (FY19 price)
- Projected, at FY04 EUI

FY04 - FY19
Campus Energy Reduction

UNL Energy Savings since FY04

Cumulative Savings ($MM) since FY04

- FY04: $0
- FY05: $0
- FY06: $0
- FY07: $0
- FY08: $0
- FY09: $5
- FY10: $10
- FY11: $15
- FY12: $20
- FY13: $25
- FY14: $30
- FY15: $35
- FY16: $40
- FY17: $45
- FY18: $50
- FY19: $90

NEBRASKA
Thank you!

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