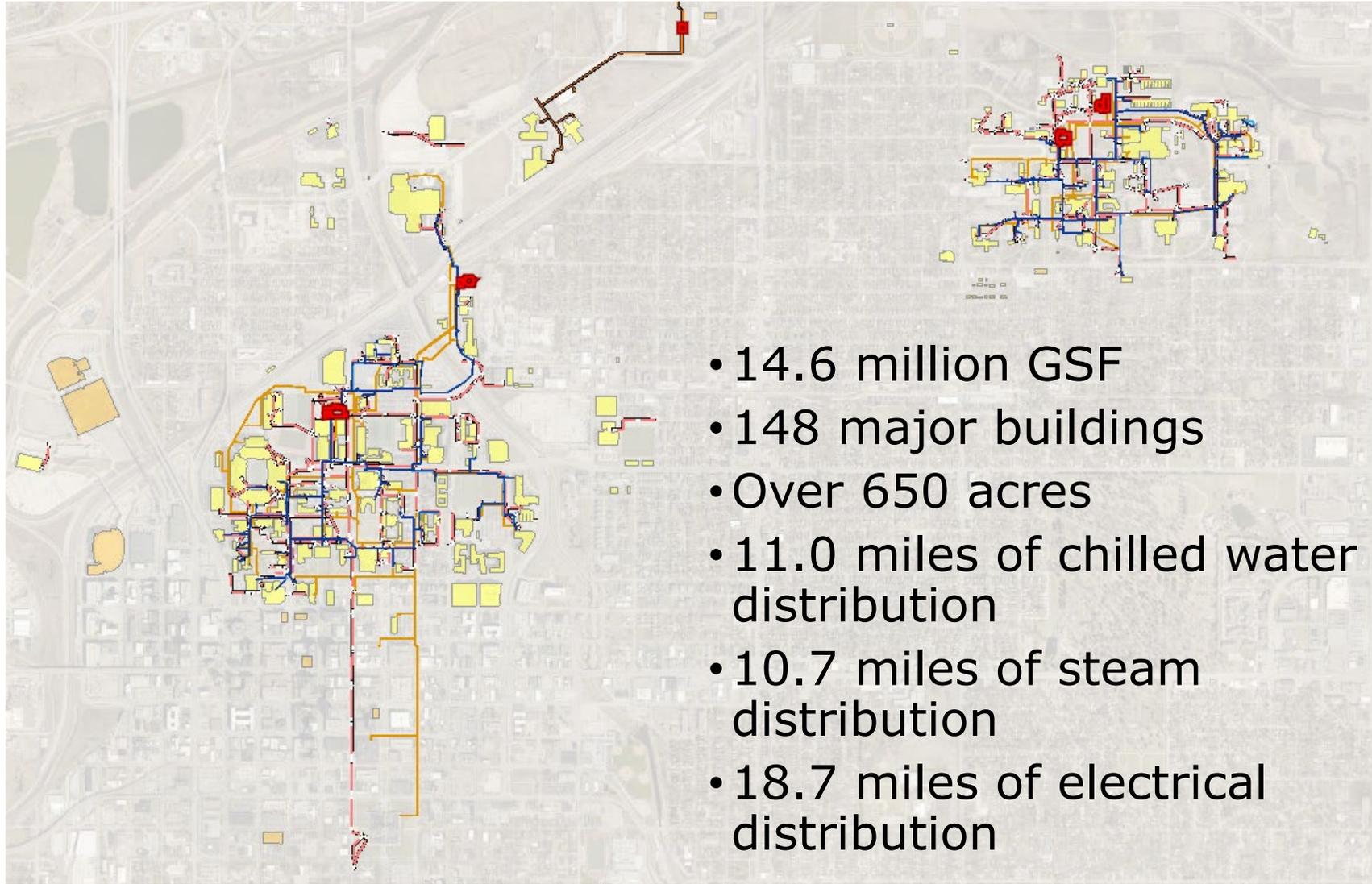


Site to Source

Nebraska's comprehensive approach
to campus energy management

Aaron Evans, PE
Utility Services Engineering Supervisor
University of Nebraska-Lincoln

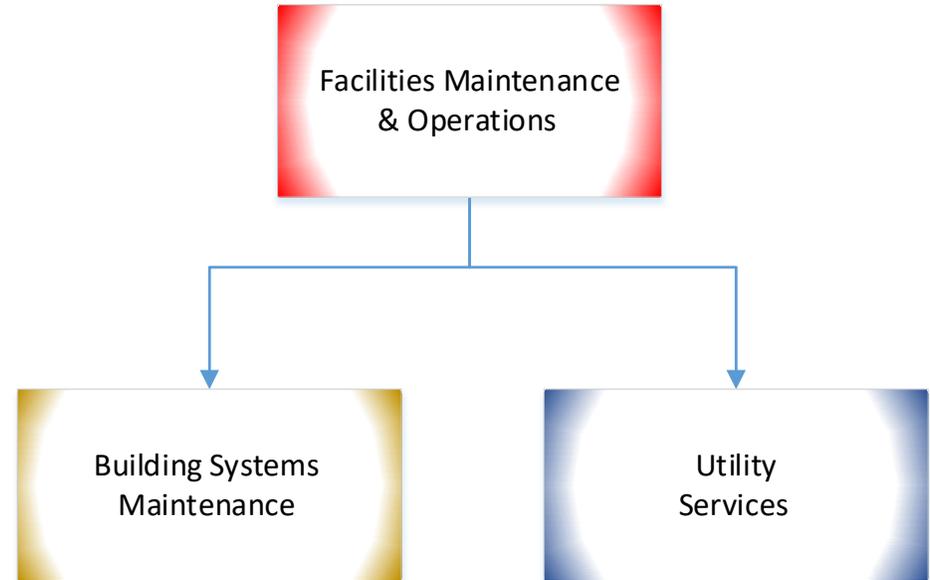
UNL Utility Services & Energy Management



- 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

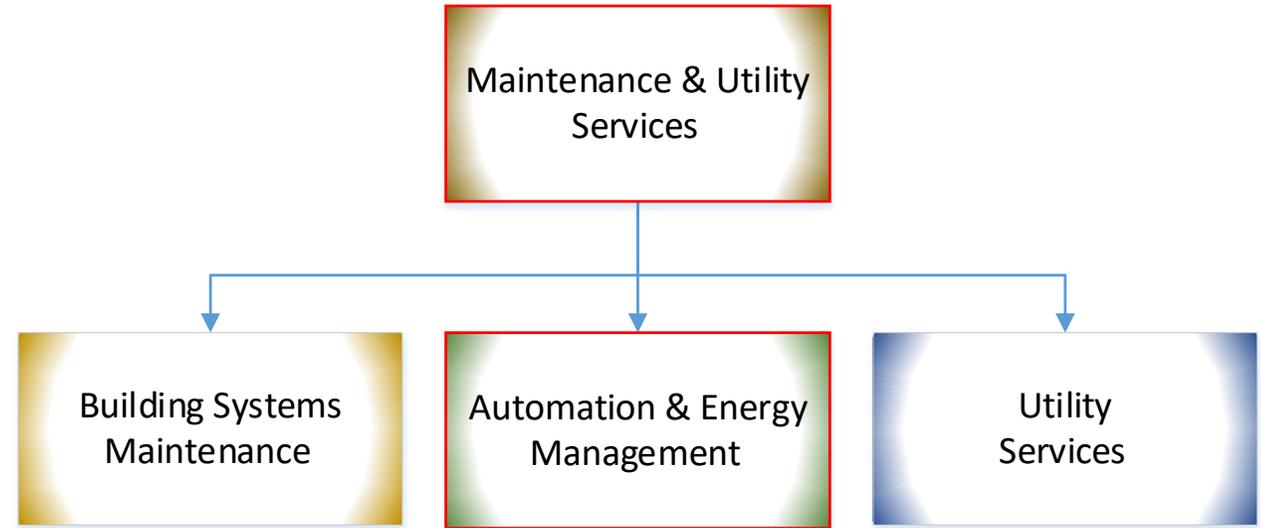
Operational Silos

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



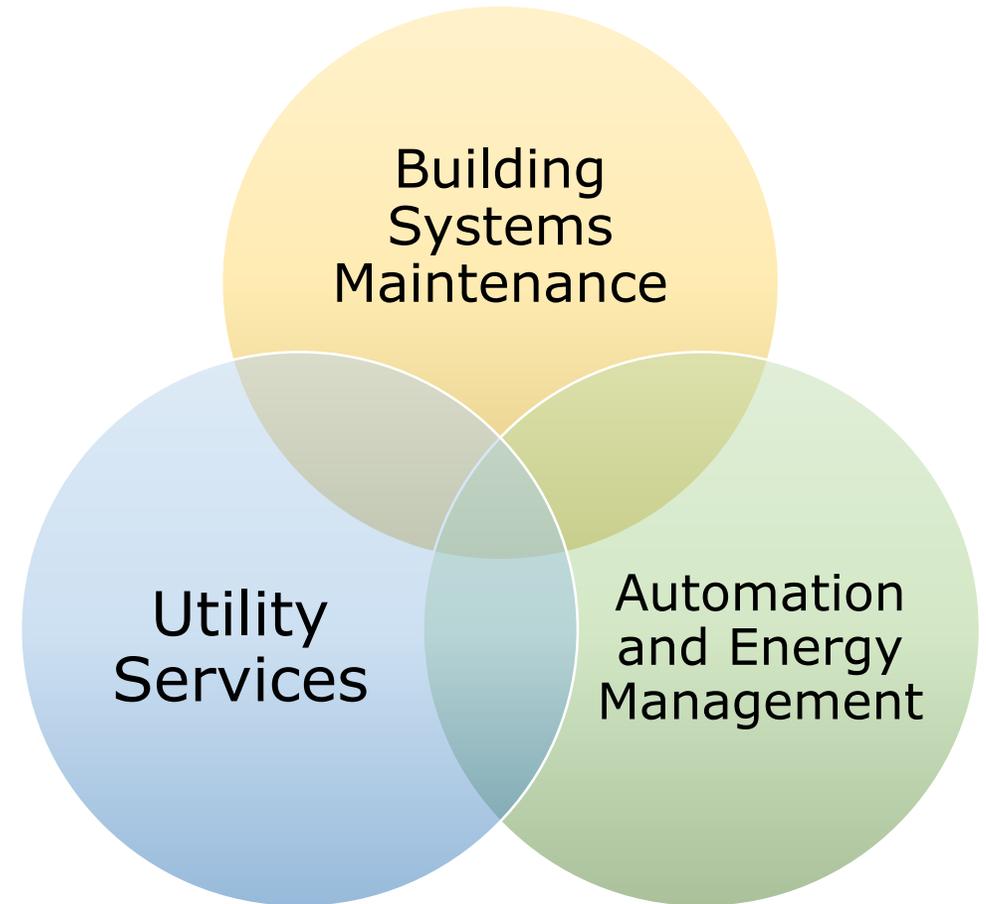
Integrating energy services

- 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

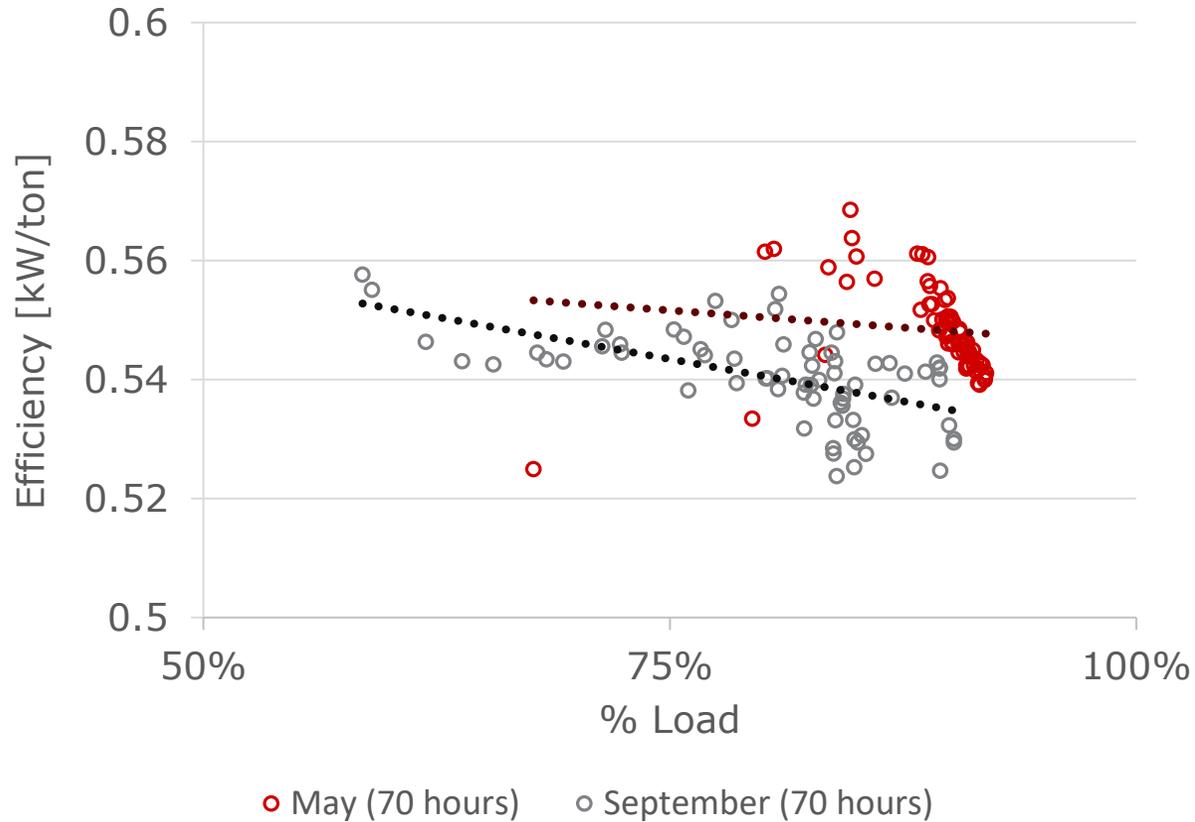
51,551 GSF (36% increase)

7,930 MMBtu/year (25%
reduction)

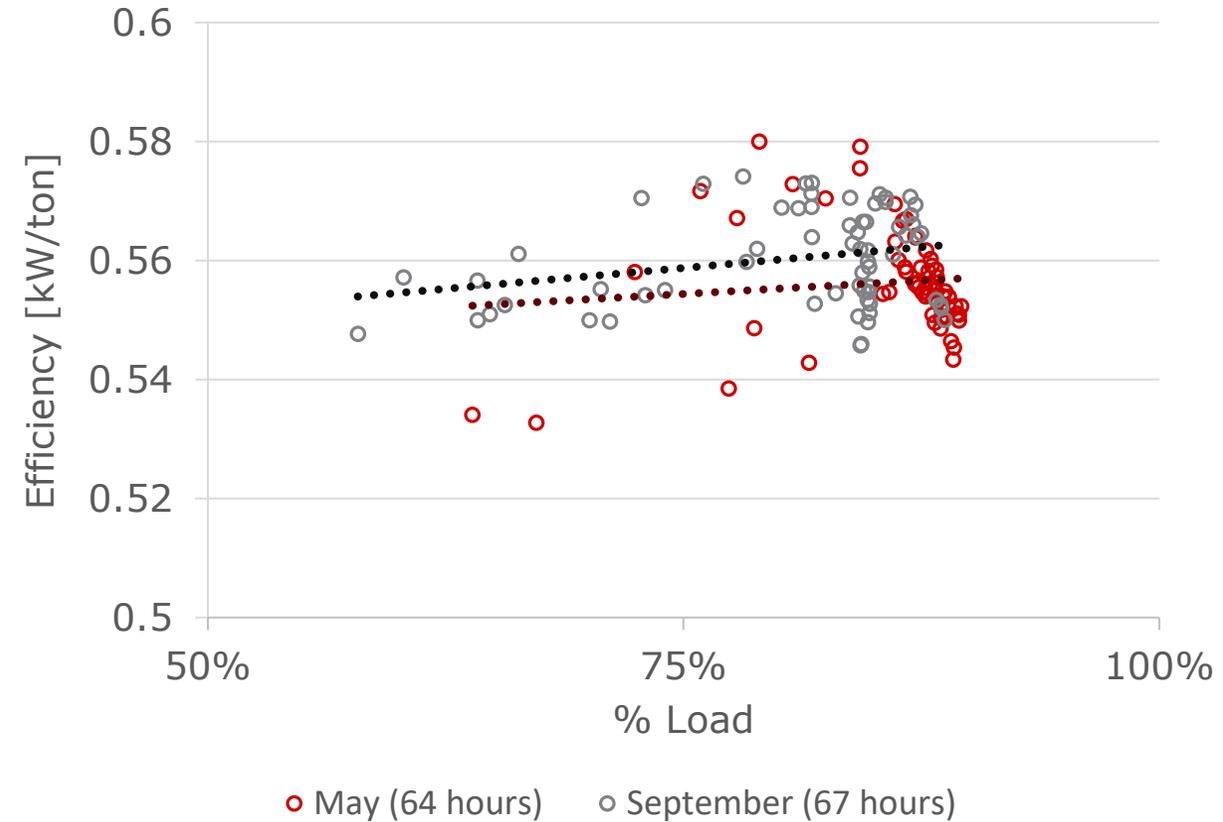
EUI decreased by 45.1%

Continuous tube cleaning

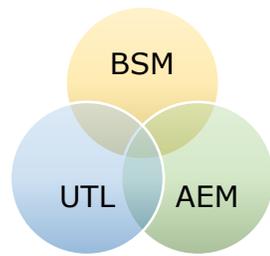
With online cleaning, 77°F ECWT



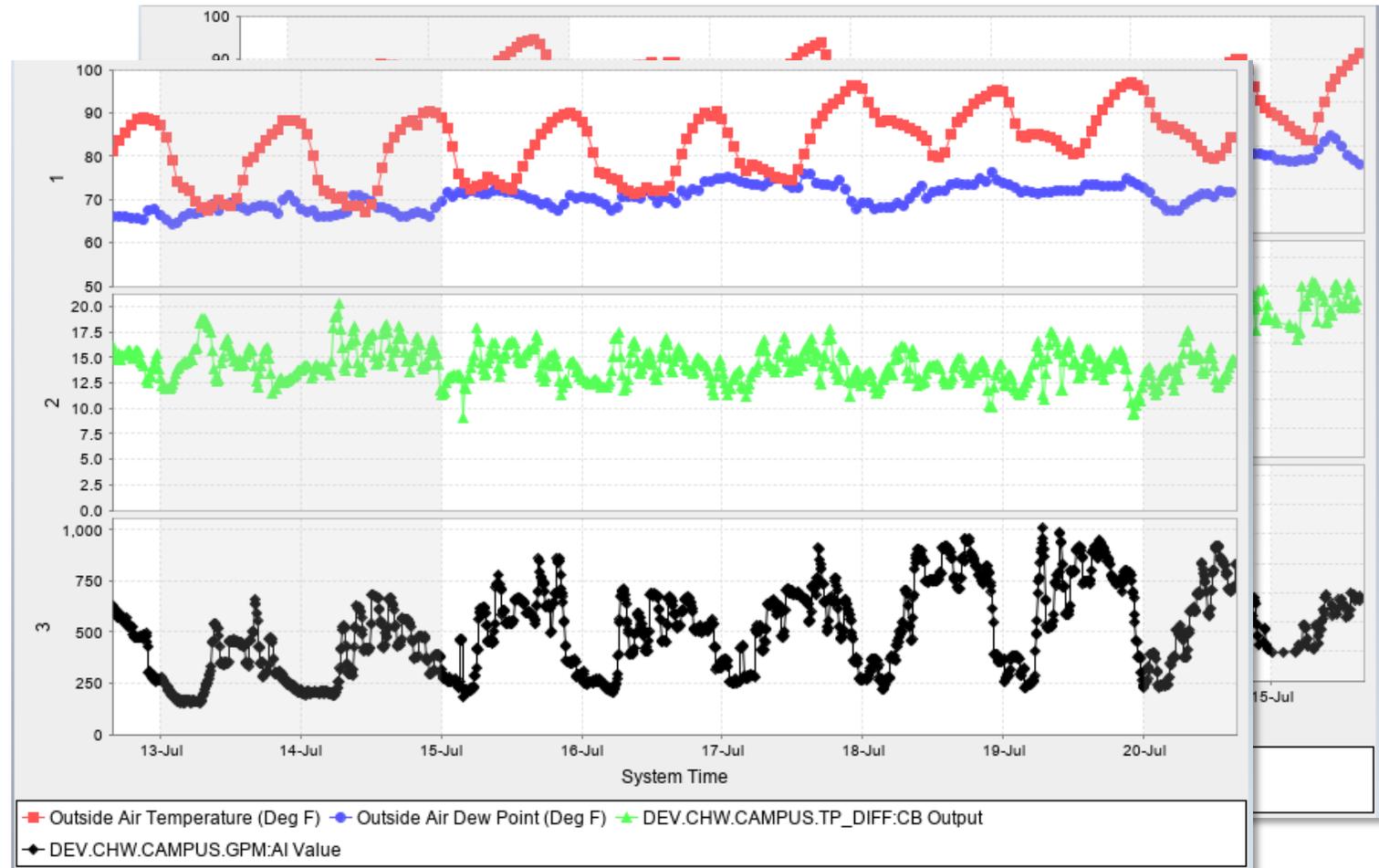
Without online cleaning, 77°F ECWT



Case Study: Addressing Low Delta-T

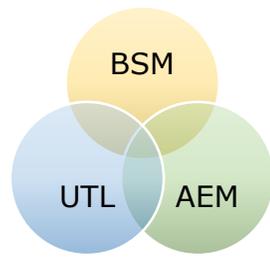


- Backflushed coils
- Temp setpoint no lower than design
- Removed 3-way valves
- Building pressure control for reduced humidity



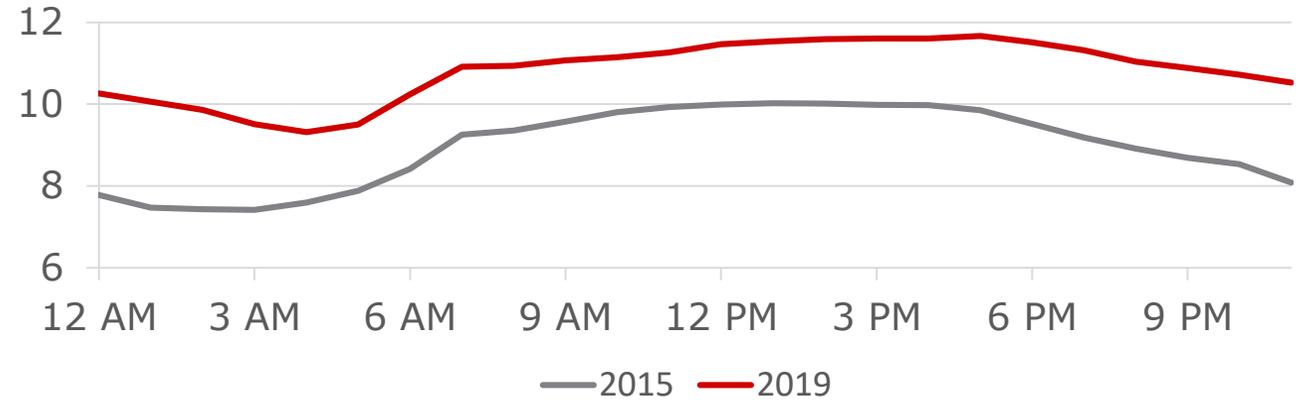
July 2019

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

City Campus ΔT, Average Summer Day

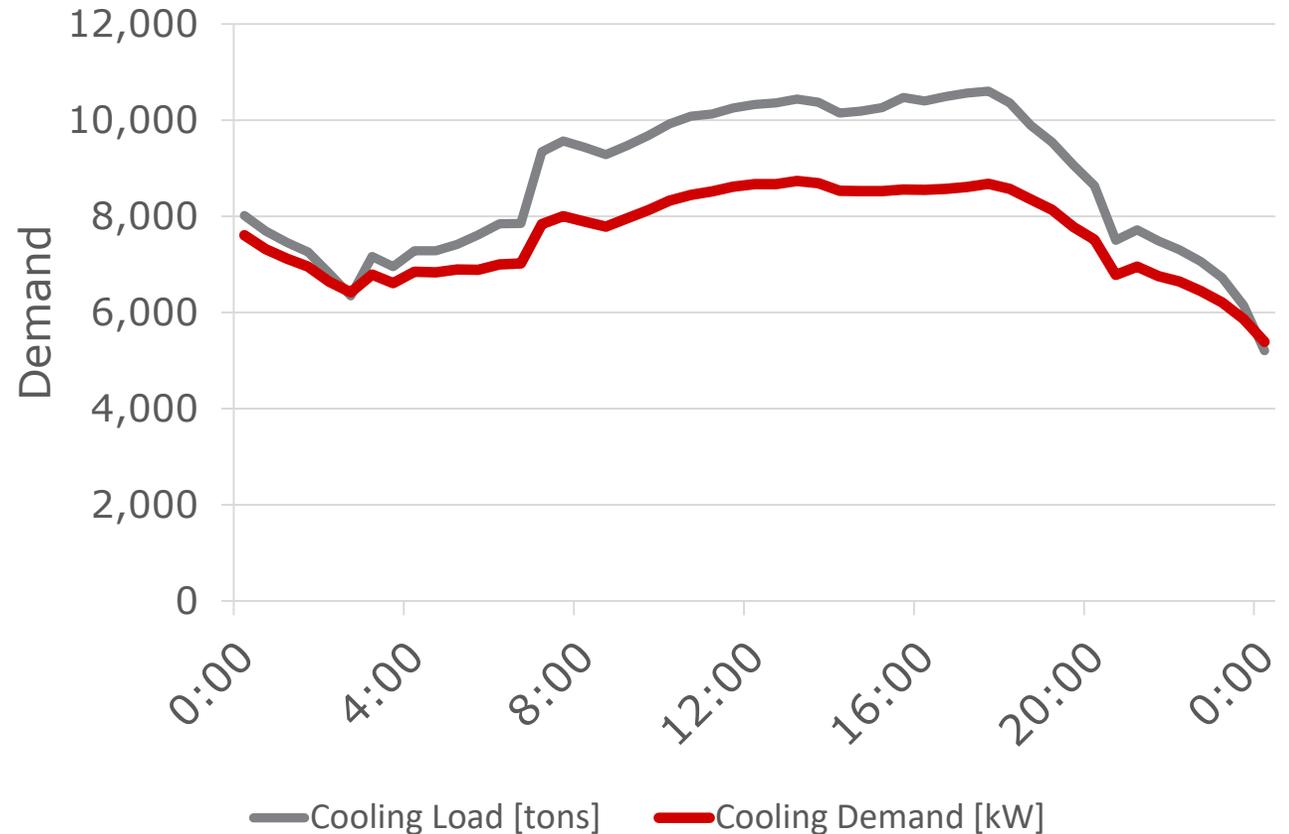


Year	Peak Date/Time	Peak Load [Tons]	Flow [GPM]	ΔT [°F]	Flow at 2019 Peak & Annual ΔT [GPM]
2018	7/12/18 10:30 AM	12,941	27,584	11.3	27,926
2019	8/20/19 3:30 PM	13,101	25,060	12.5	25,060
Flow Savings [GPM]					2,866
Pumping Savings [kW]					95
Demand Savings [\$ /year]					\$13,723

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

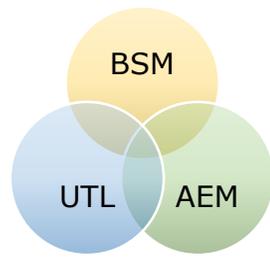


Case Study: Thermal Energy Storage

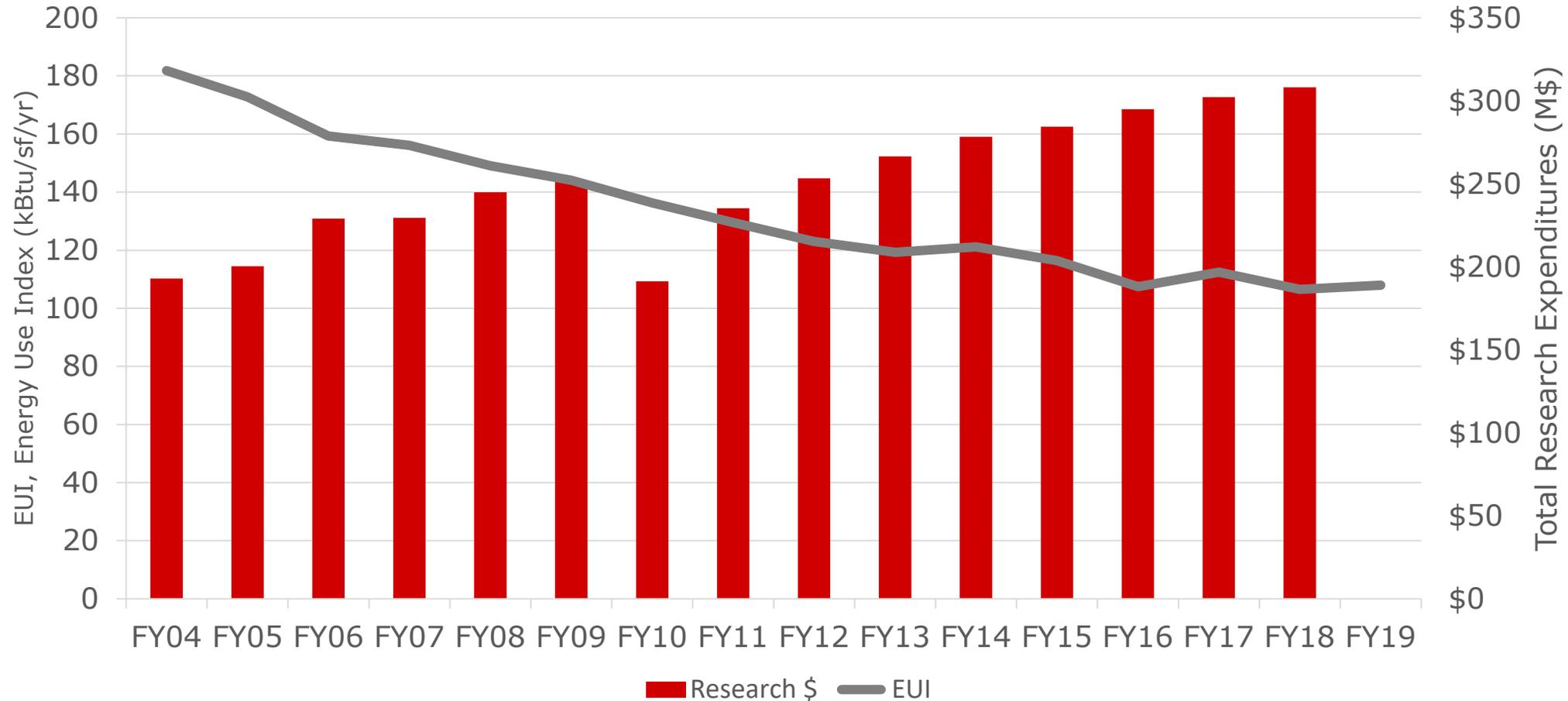
- Flatten load profile
- Eliminate excess ratchet charges
- Offset new chiller additions
- East Campus TES built in 2013
- City Campus TES built in 2018
- Total Demand Reduction of 8 MW, over \$1.5MM annual savings



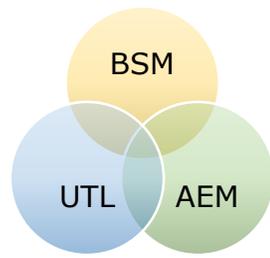
Campus Energy Reduction



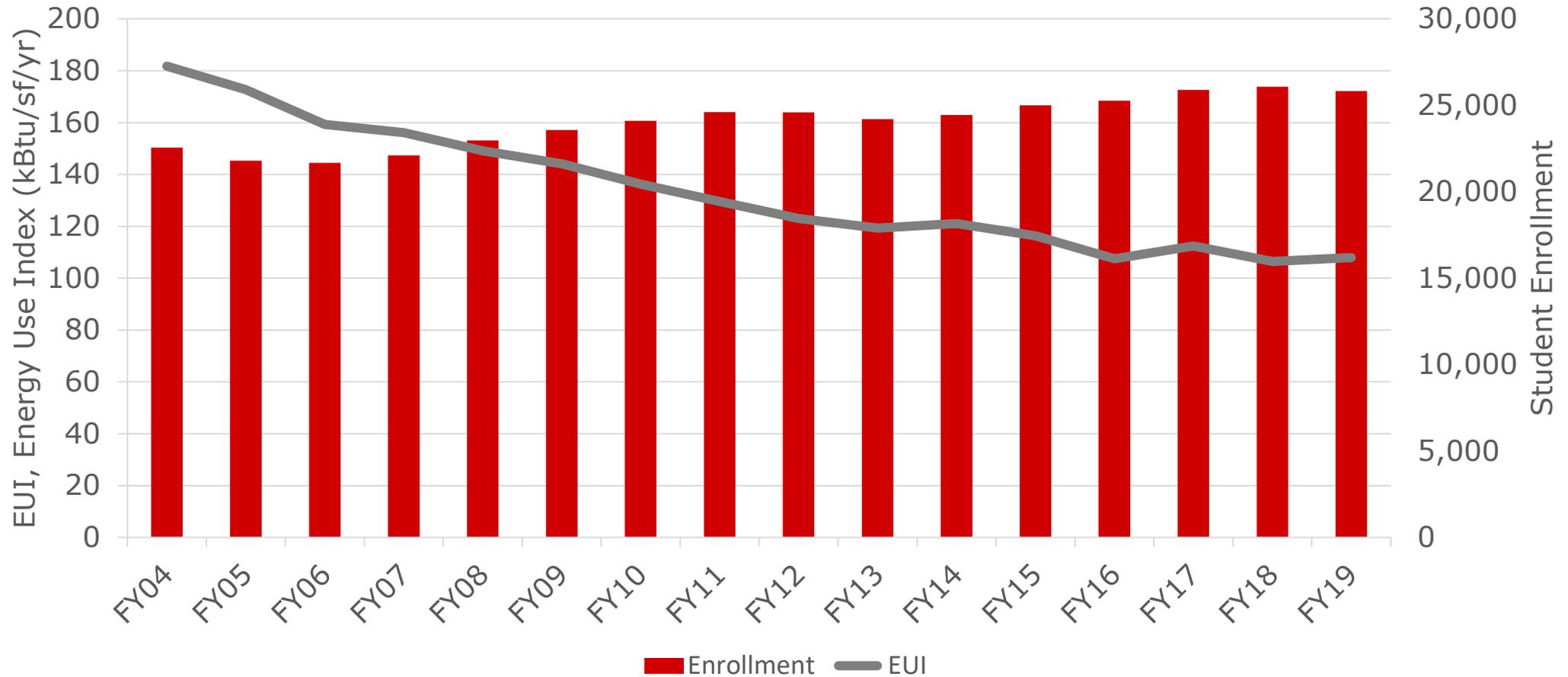
UNL Energy Use vs Research Expenditures



Campus Energy Reduction

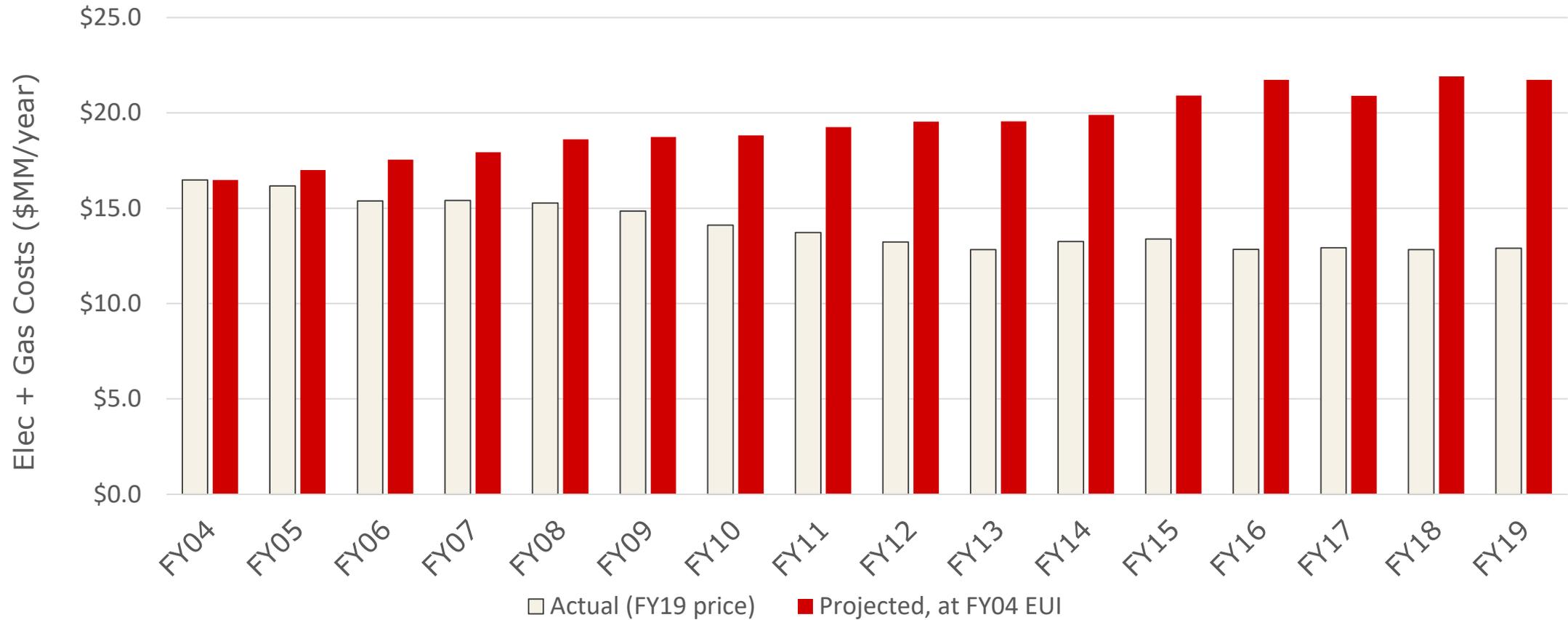


UNL Energy Use vs Student Enrollment



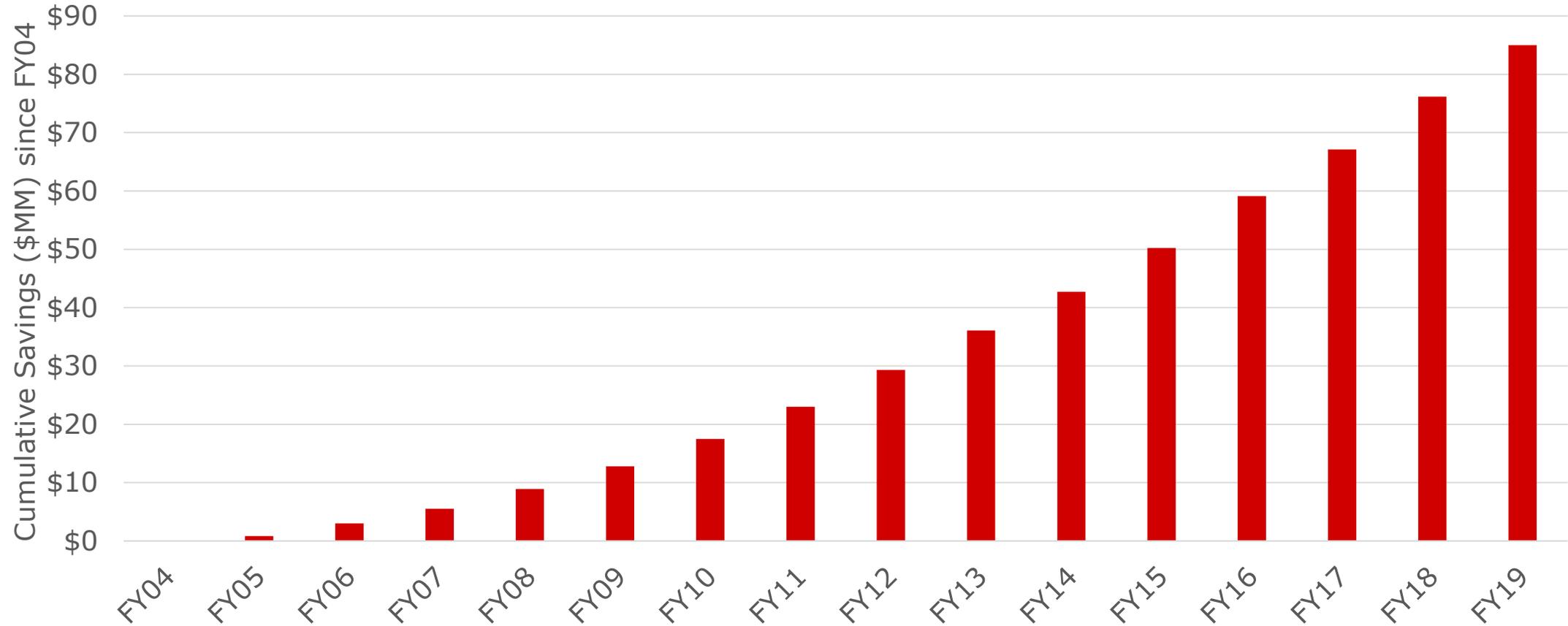
Campus Energy Reduction

UNL Energy Costs since FY04



Campus Energy Reduction

UNL Energy Savings since FY04



Thank you!

Aaron Evans, PE
Utility Services Engineering Supervisor
University of Nebraska-Lincoln

