

WHAT DOES A NET ZERO CARBON (NZC) CAMPUS LOOK LIKE?



Energy efficient buildings with low EUI ([SUCF Directive 1B-2](#) targets or lower)



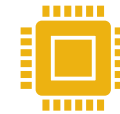
Low temperature heating systems (supply water temperatures < 130F)



Beneficial electrification of heat and fleet/migrate from on-site fossil fuel combustion



Renewable energy generation that matches campus use profile 24x7x365



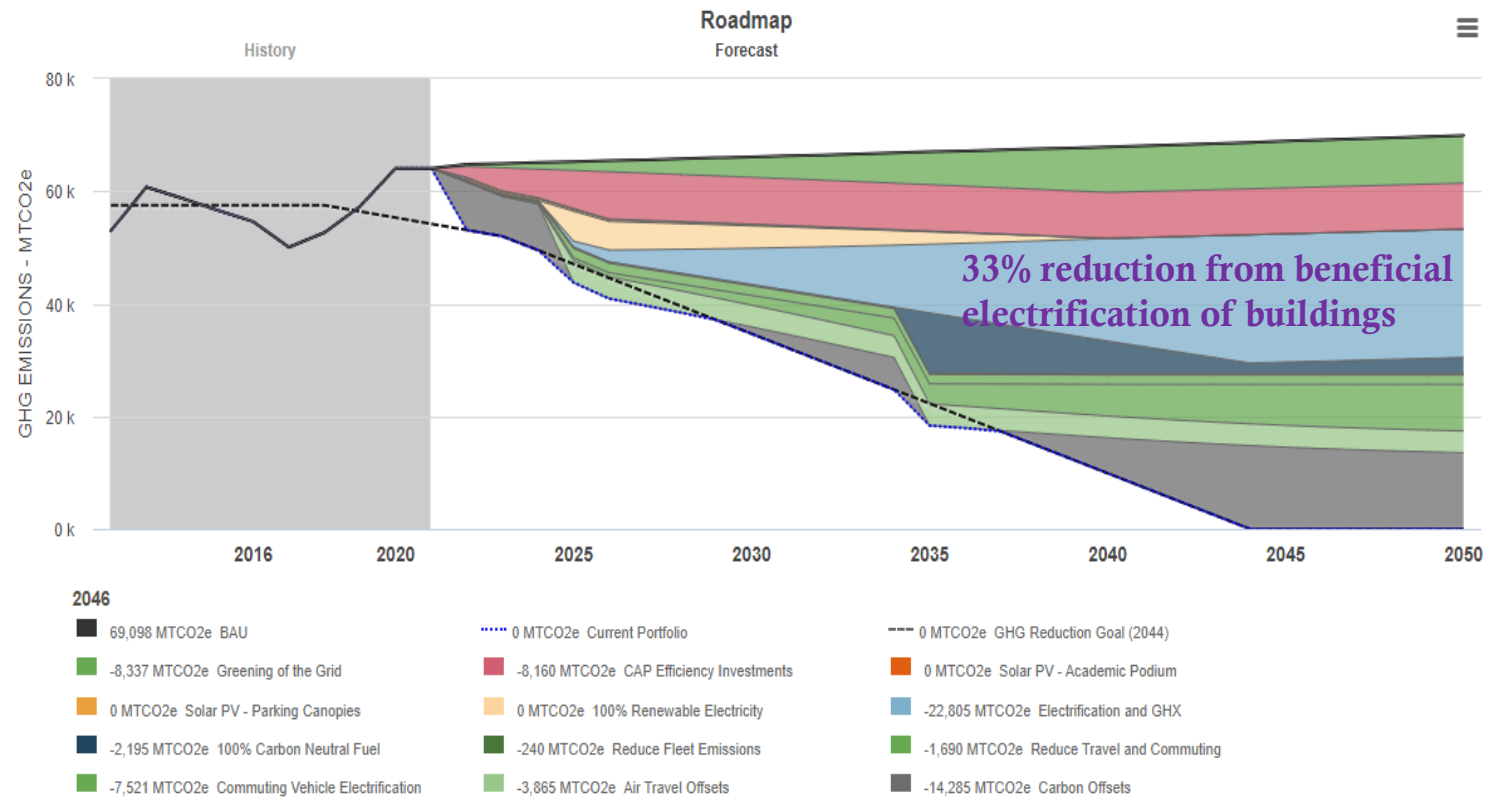
Advanced data-driven operations/grid connectivity/smart buildings



Well trained operators and educated and engaged users

WORDS OF WISDOM??

- ❖ Start with an overall vision- a high-level roadmap
- ❖ One solution does not fit all cases, "It Depends" is often a good answer
- ❖ Don't be afraid to pivot
- ❖ Some things take longer: practice patience
- ❖ Be opportunistic
- ❖ Remember that a vision without execution is called hallucination



HIGH LEVEL ROADMAP TO NZC



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Empire Commons

Colonial Quad

State Quad

Freedom Apartments

EVSE

Dutch Quad

Indigenous Quad

Biodigester/
Pyrolysis

Liberty Terrace

CO2 Offset



EV Fleet



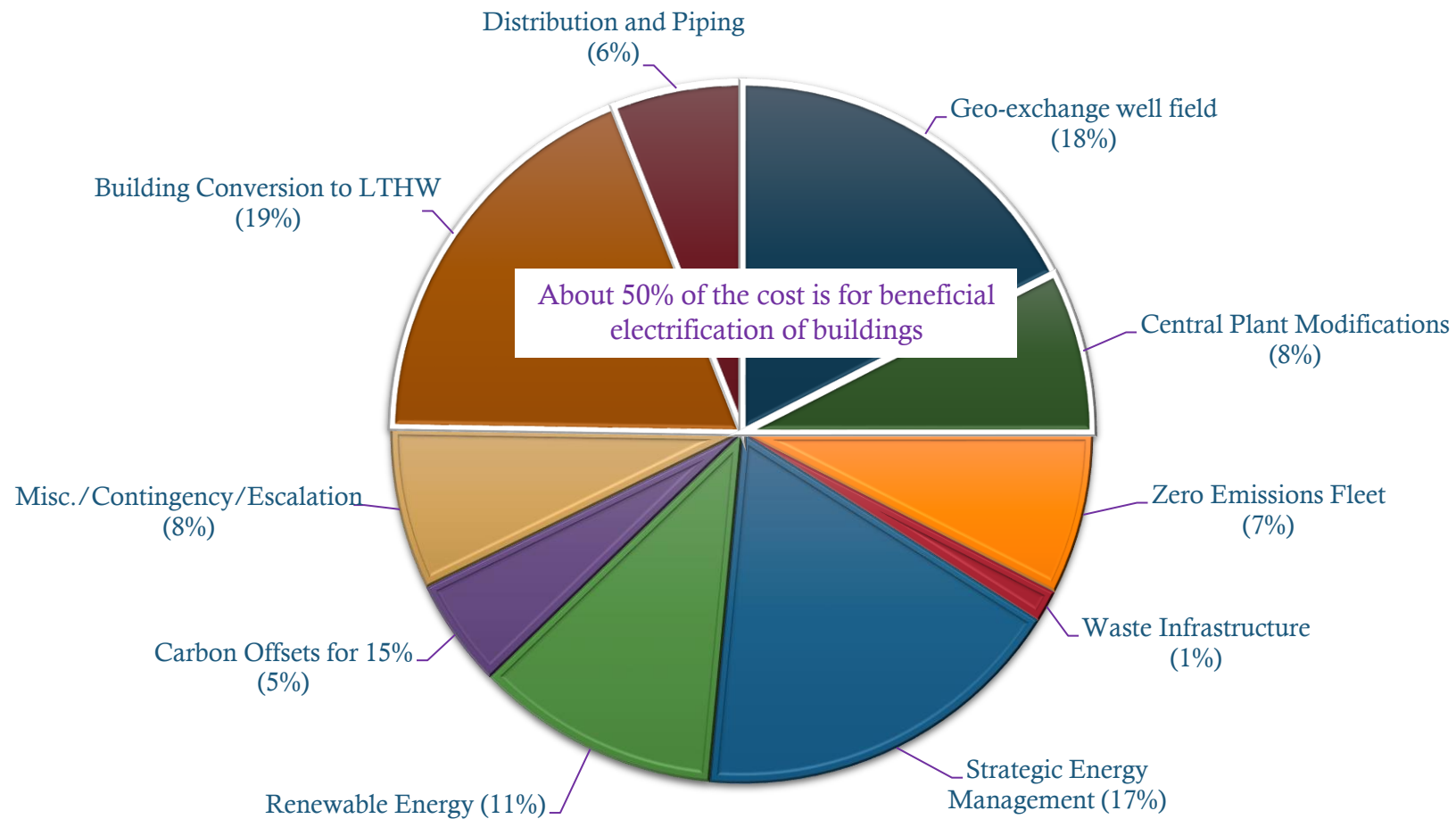
Renewable Energy with Storage



- ✓ Strategic Energy Management: Envelope, Lighting, HVAC, BMS, cooling in all res halls, LTHW ready
- ✓ Beneficial Electrification: geothermal well field, LTHW distribution network, Great Dane Heat Recovery Plant
- ✓ Renewable Energy with Storage
- ✓ Fleet Electrification
- ✓ Waste to Energy
- ✓ Carbon Offsets

A SUSTAINABLE, NET ZERO CAMPUS

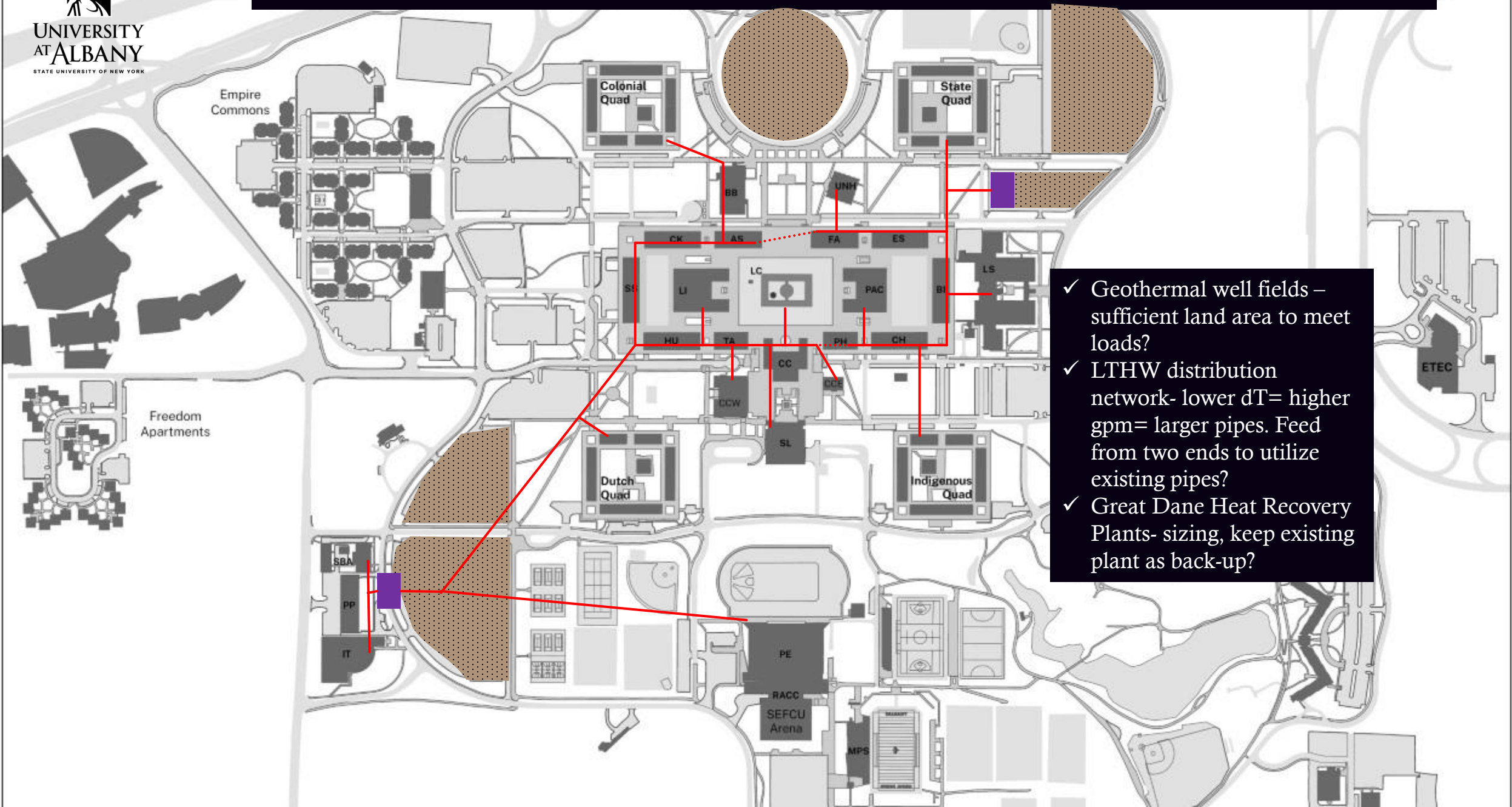
PRICE TAG TO DECARBONIZE UALBANY





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BENEFICIAL ELECTRIFICATION- BACK OF THE ENVELOPE VISION

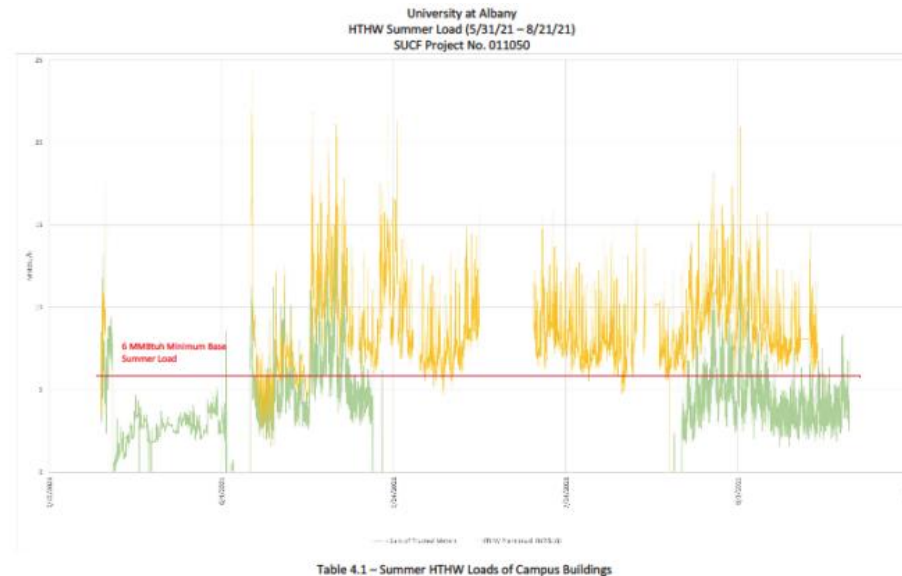


- ✓ Geothermal well fields – sufficient land area to meet loads?
- ✓ LTHW distribution network- lower dT = higher gpm= larger pipes. Feed from two ends to utilize existing pipes?
- ✓ Great Dane Heat Recovery Plants- sizing, keep existing plant as back-up?

STEP 1 of 100: Absorption Chiller Replacement



- ❖ (2) 1,400-ton HTHW-fired absorbers reaching end of life
- ❖ Replace with new (1) 1,500-ton Heat Recovery Chiller and (1) 2,500-ton electric chiller
- ❖ Electrical capacity- not a problem



YELLOW GRAPH – HTHW Distribution
 GREEN GRAPH – Trusted Meters

- ❖ New HR Chiller can serve all summer heating loads.
- ❖ Can shut down HTHW generators all summer long!
- ❖ Reject excess to cooling tower or well field?

Can the existing distribution networks and buildings handle LTHW?

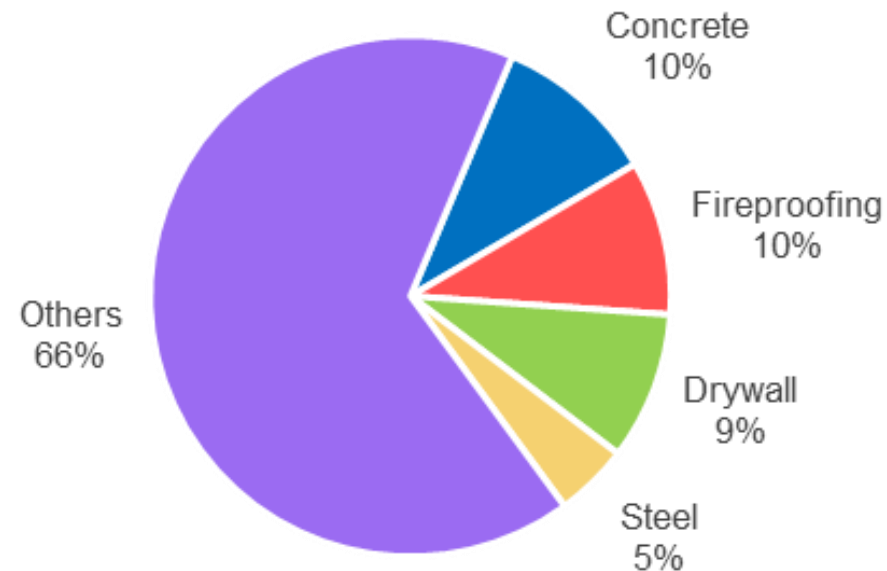
- ❖ VAV reheats have supply temperature resets. 110F-120F for summer
- ❖ Steam equipment needs to be replaced
- ❖ HTHW-fired DHW equipment needs to be replaced
- ❖ Can use existing HTHW pipes to deliver LTHW during summer months
- ❖ During heating season, HR Chiller can provide heating to Athletic Complex and cooling to campus year-round loads

**Beneficial electrification achieved- well, at least for 3 months of the year.
 16% estimated reduction in annual CO2 emissions!**

A WORD ABOUT EMBODIED CARBON

- ❖ ETEC: All-electric, LEED Platinum, Net Zero Energy Ready Lab Building
- ❖ Measured EUI: 58
- ❖ 32,885MT-CO₂e embodied carbon vs.
- ❖ 425 MT-CO₂e/year from annual utility usage
- ❖ A code-compliant building would result in 1,000 MT-CO₂e/year
- ❖ Is this building really carbon friendly?

Category 2: Capital Goods (MTCO₂e)



Calculated based on Supply Chain Emissions Factors with Margins: emissions associated with cradle-to-shelf for the material per unit of economic value (USEEIO database)