

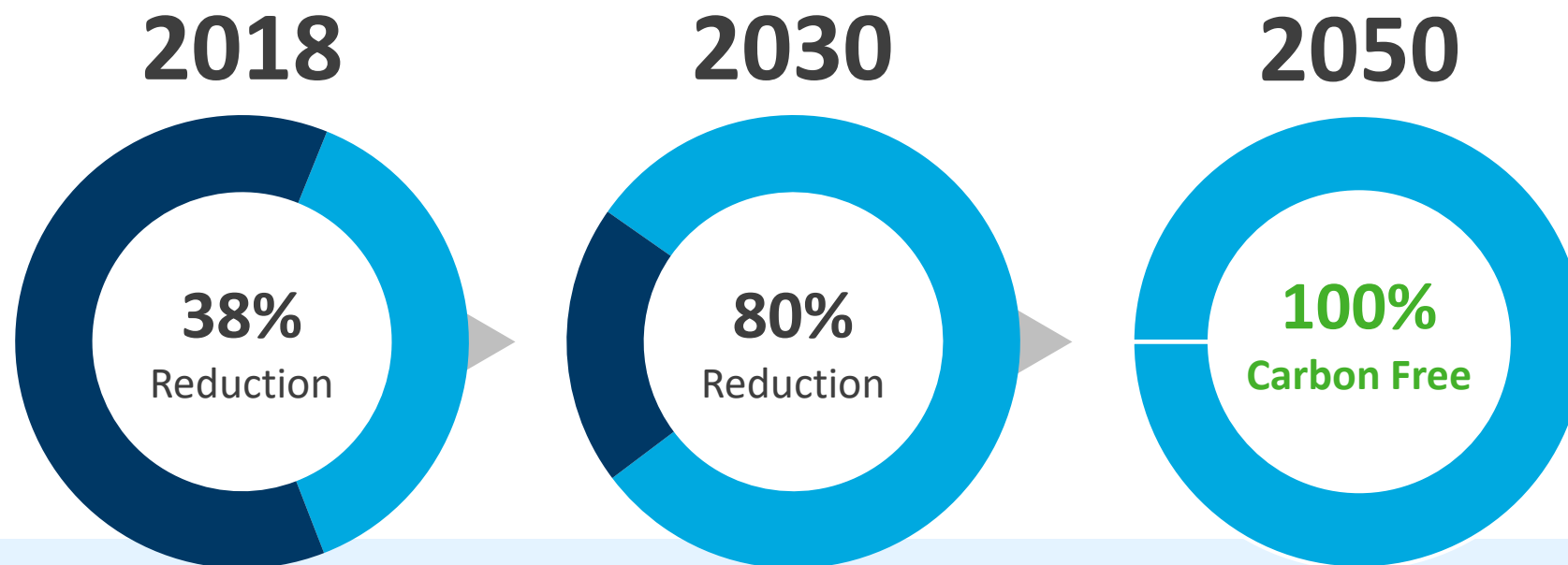
Presented at the 2019 ACEEE National Conference
on Energy Efficiency as a Resource

Time Value of Energy Efficiency

October 17, 2019



Xcel Energy Overview



- Xcel Energy serves 3.6 million electric and 2 million natural gas customers
- On track for 80% carbon reduction by 2030, and 100% carbon free by 2050
- Conservation Improvement Programs since early 1990s
- Significant and growing wind generation
- National leader in wind power generation and growing

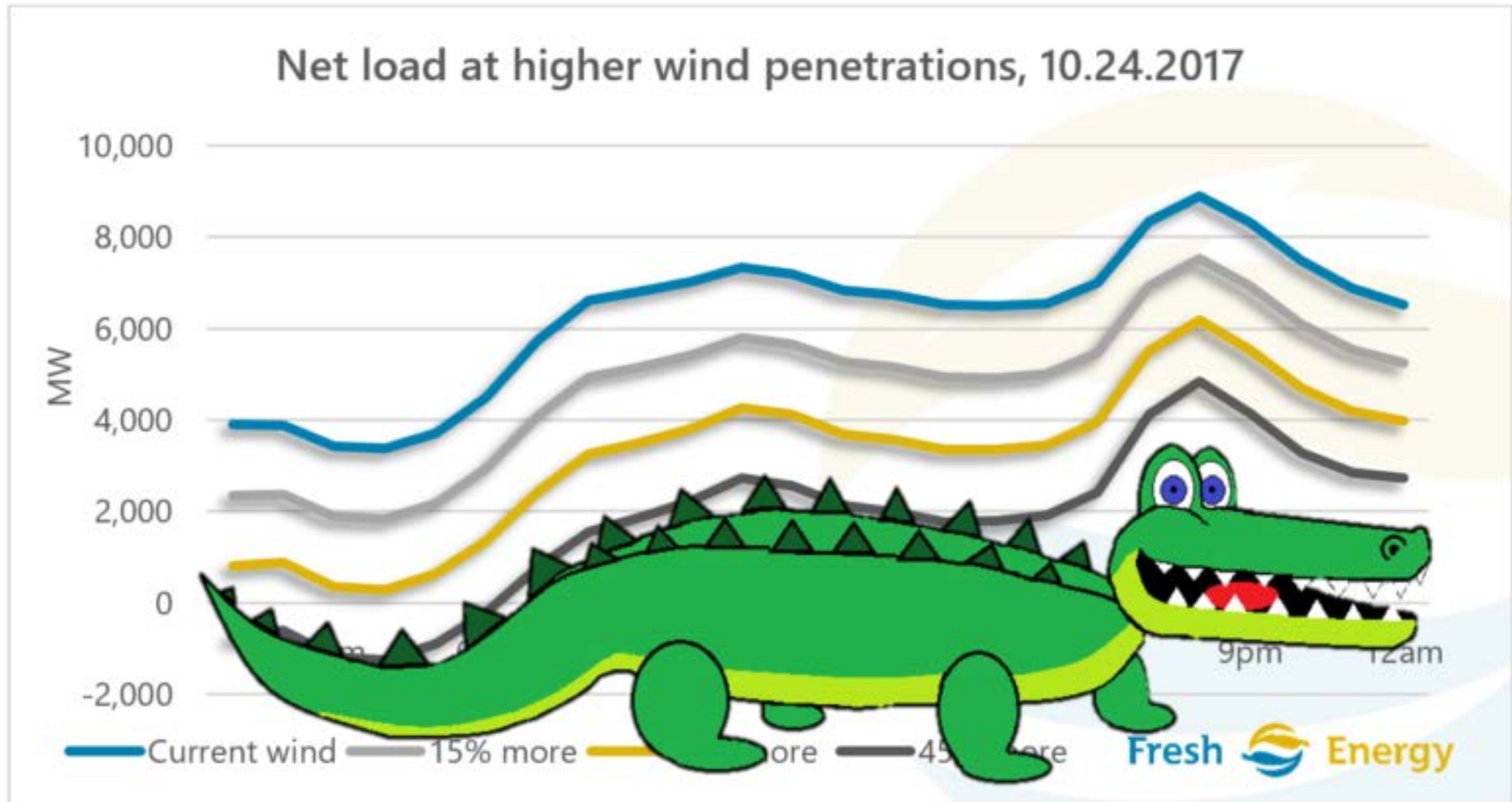
Does the Midwest have a duck problem?

NO



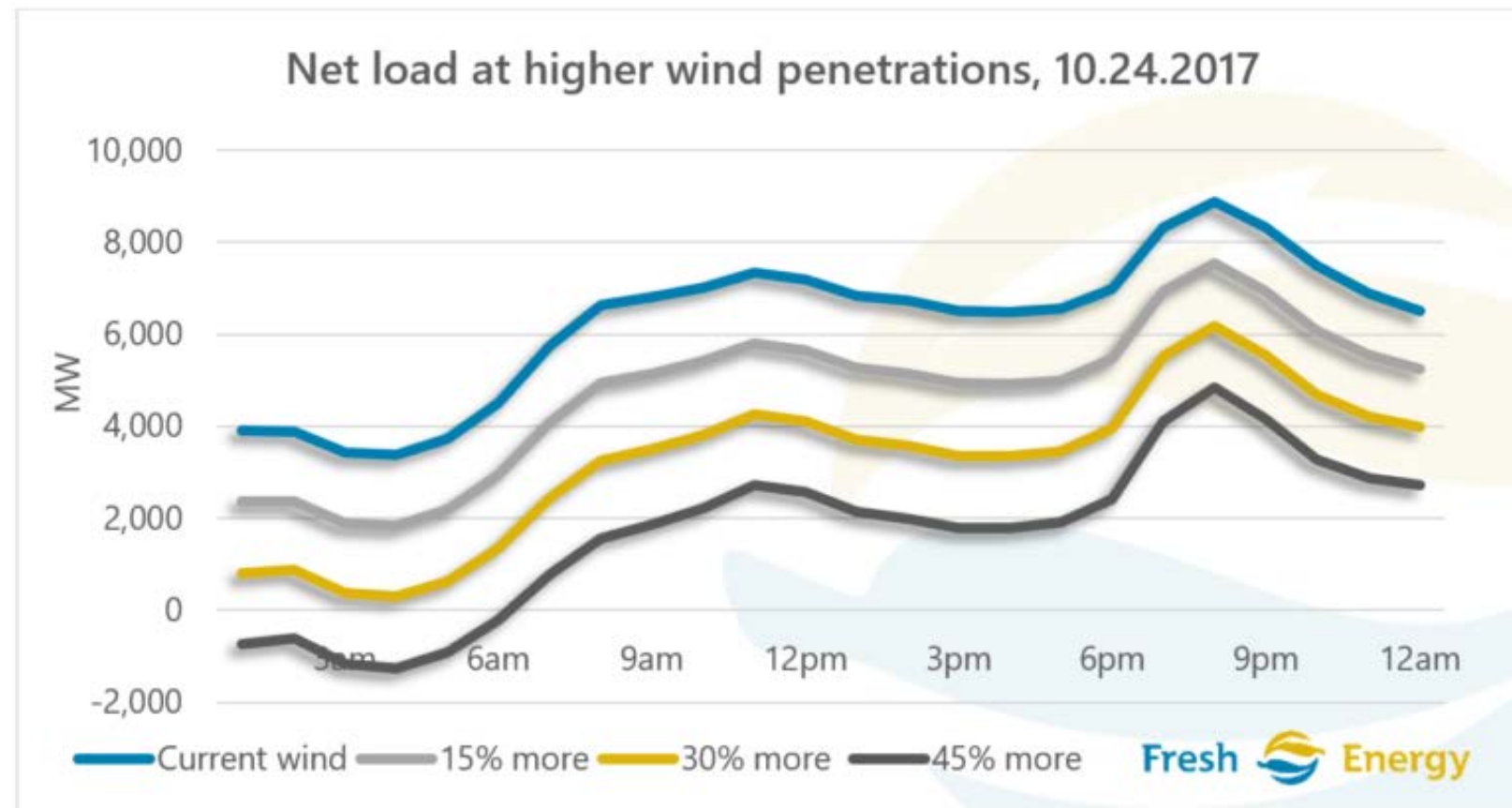
NO

Net Load at Higher Wind Penetrations, 10.24.2017



Smiling Gator of the Upper Midwest

- Energy markets will need to adapt to zero/low marginal costs at times
- Lowest system cost may mean “overbuilding” wind
- Different grids will have different profiles



**“Nothing is either good nor bad, but
~~thinking~~ costs and environmental
impacts make it so”**

- Hamlet

Shaping Load Profiles with Conservation

Xcel Energy's Energy Design Assistance

STEP 1



Enrollment

You provide basic information about your building through our EDA Application

STEP 2



Preliminary Analysis

Together we perform real-time evaluation of energy-efficiency improvements and bundle potential whole-building strategies for further analysis

STEP 3



Final Analysis

You determine which bundle strategies best fit your project goals, from which projected energy savings and utility incentives are determined

STEP 4



Verification

We confirm your project was constructed to plan and issue a verification report for you and your utility partner

STEP 5



Incentives

Your utility partner provides incentives for the strategies implemented in your project

Since 1993

Commercial buildings
20,000+ Square feet

Program includes

- Free energy analysis
- Design team incentive
- Owner incentive

2017 Program size

- 117 participants
- 56,895,120 kWh saved
- 12,328 kW saved
- 1,124,910 therms saved

DSM Seeing Reduced Benefits

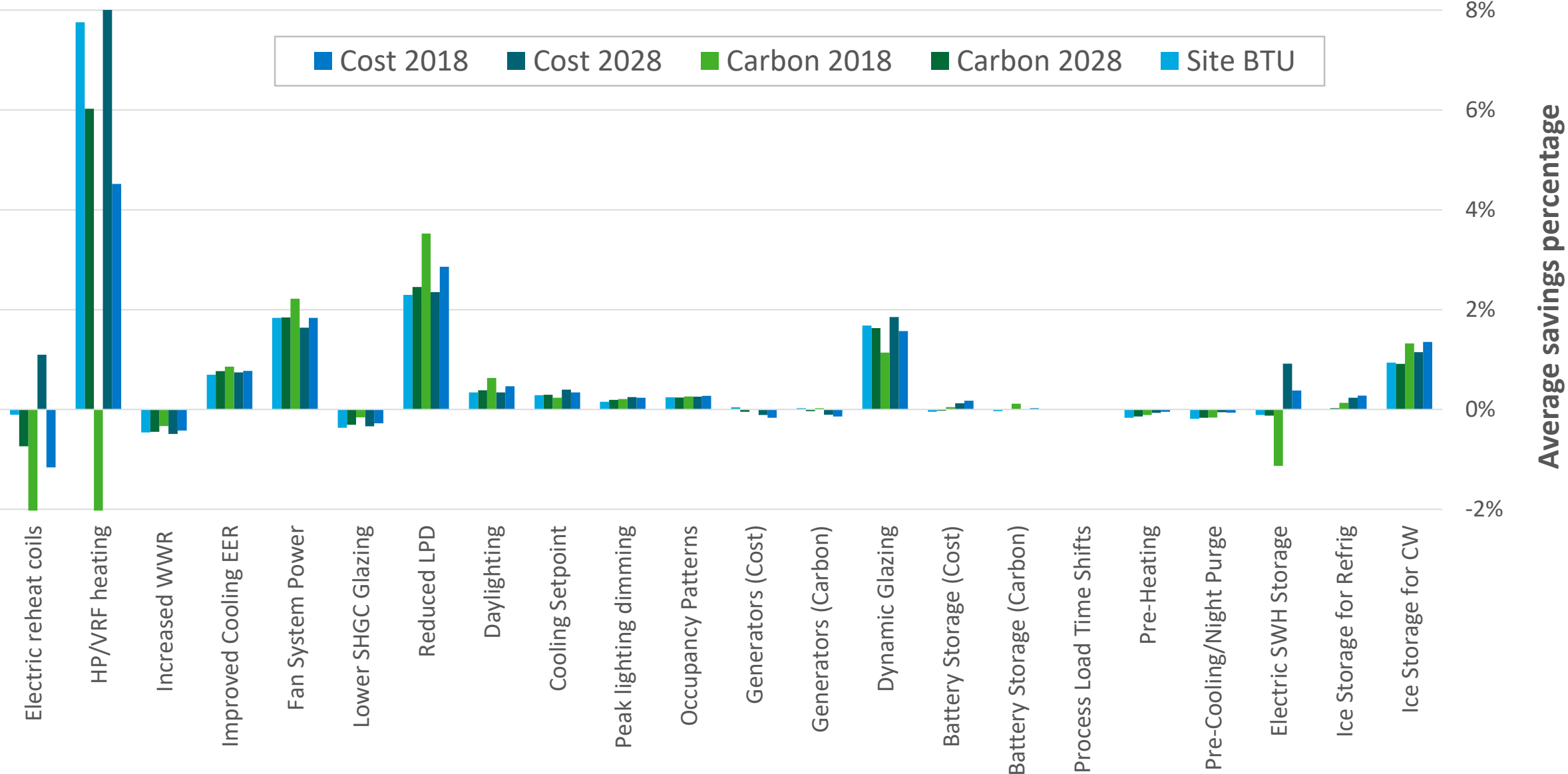
- Economic value of DSM is changing due to decarbonizing system
 - Loss of fuel savings
 - Less environmental benefits
- Currently at 58% carbon free, going to 75% by 2025
- Wanted to see if DSM could help shape the load

| Plan | Spend (Million \$) | GWh of Savings | Societal Net Benefits (Million \$) | System Net Benefits (Million \$) |
|-----------|--------------------|----------------|------------------------------------|----------------------------------|
| 2010-2012 | \$84 | 473.6 | \$285.4 | \$262.8 |
| 2013-2016 | \$90 | 507.3 | \$251.5 | \$175.2 |
| 2017-2019 | \$95 | 433.9 | \$128.5 | \$64.1 |
| 2020-2022 | \$95 | 433.9 | \$107.5 | \$40.7 |

Time Value of Energy Efficiency Methodology

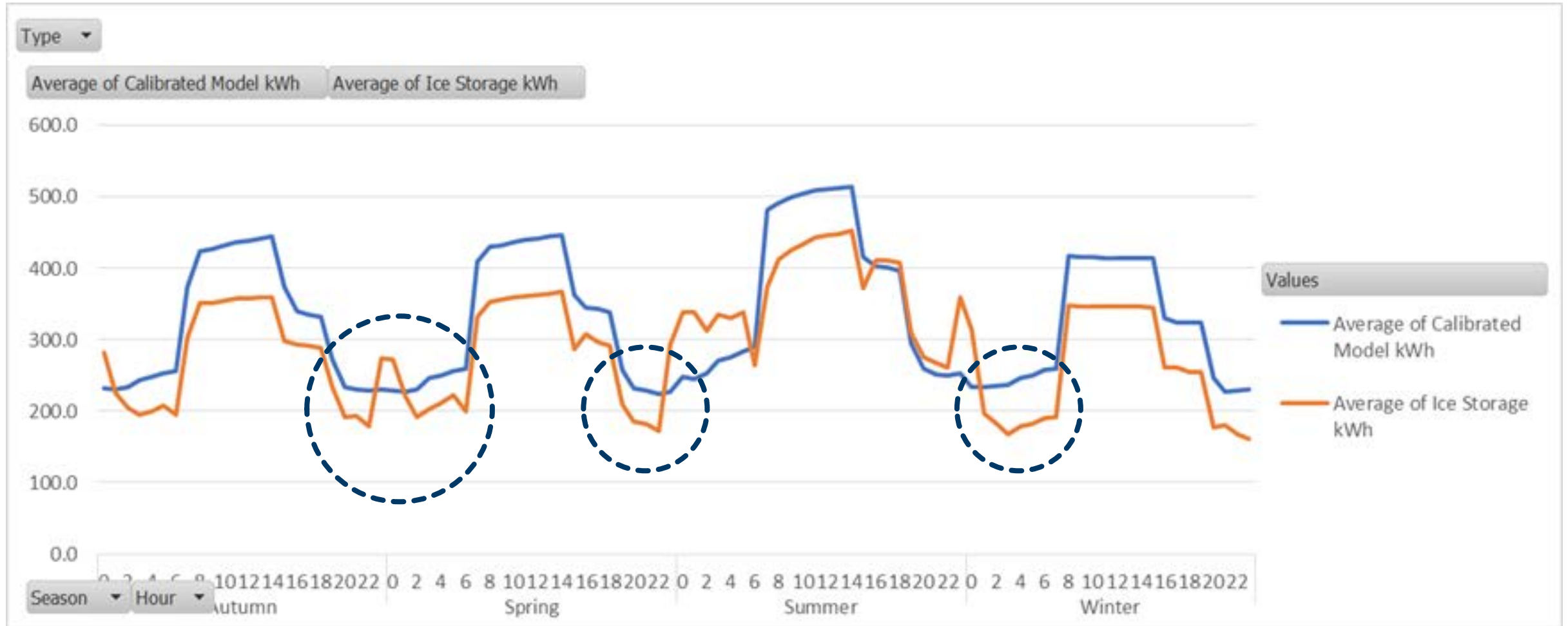
- Analyzed impacts on 10 DSM projects
 - 2018 marginal cost and carbon
 - 2028 marginal cost and carbon
- Analyzed 20 potential strategies
 - Ice Storage for Chilled Water
 - Ice Storage for Refrigeration
 - Electric SWH Storage
 - Pre-Cooling/Night Purge
 - Pre-Heating
 - Process Load Timing Shifts
 - Battery Storage (Carbon)
 - Battery Storage (Cost)
 - Dynamic Glazing
 - Standby Generators (Carbon)
 - Standby Generators (Cost)
 - Occupancy Pattern Shifts
 - Lighting 20% dim at peak times
 - Cooling Setpoint temperature Change
 - Daylighting
 - Reduced Overall LPD
 - Lower SHGC Glazing
 - Fan System Power Reduction
 - Improved Cooling Efficiencies
 - Increased WWR
 - Replace Heating With Heat Pumps/VRF
 - Replace Reheat Coils with Electric Resistance

Carbon and Cost Savings for Energy Efficiency Strategies in 2018 and 2028



Hourly Profile with Ice Storage

Shaping Consumption to Match Renewable Generation



Closing Thoughts

- Building stock turns over slowly about 2% per year
- Shape and shift may require different mechanical systems, hard to retrofit
- Buildings could potentially take excess generation and reduce load during high net load times
- System peak kW and kWh based programs do not have enough nuance



Thank You

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