



CONSIGLI  
*Est. 1905*

# Powering the Future: The Impact of Energy Storage

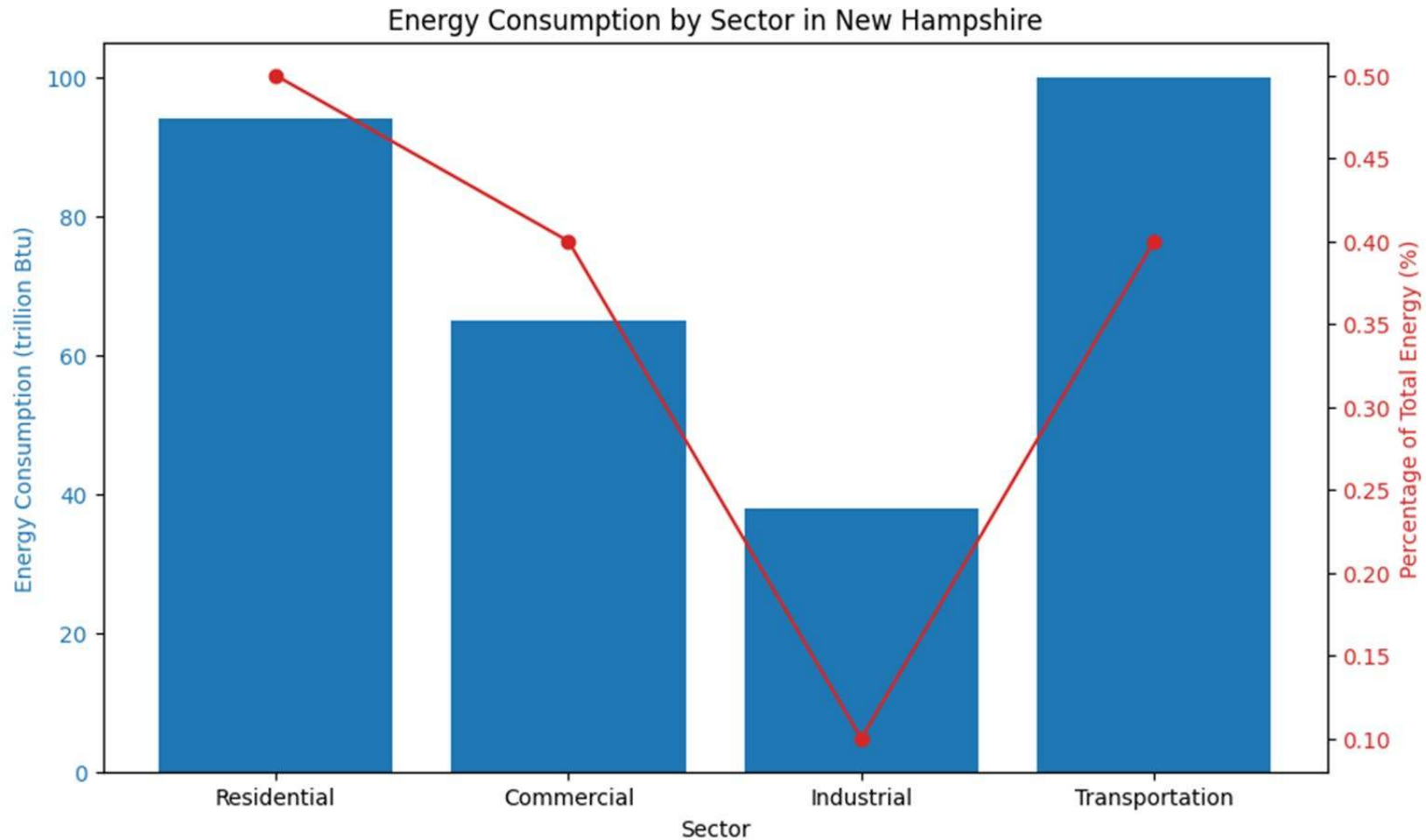
## Innovation at UNH: Thermal Energy Storage Project

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Kailash Viswanathan & Adam Kohler

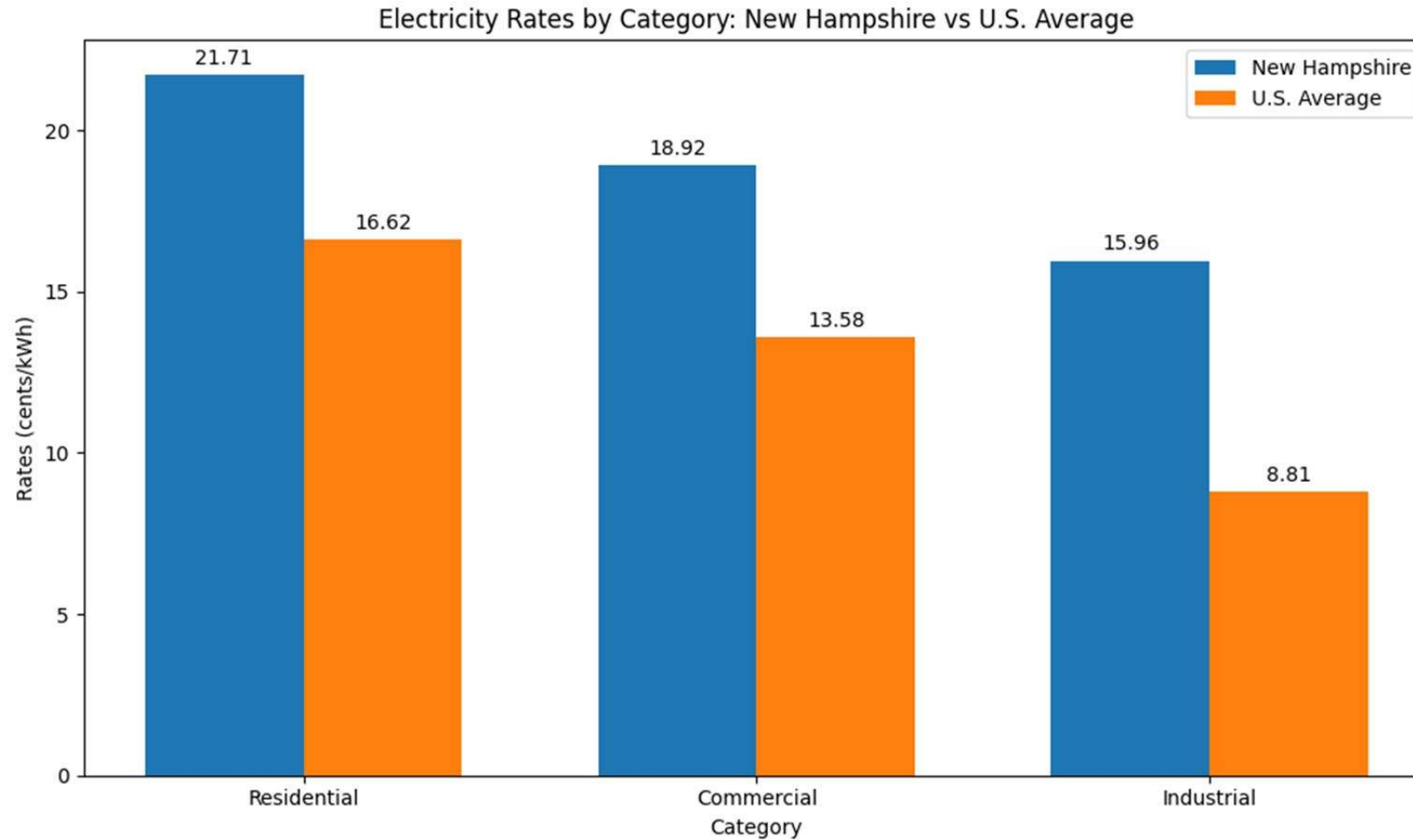


# Energy Outlook



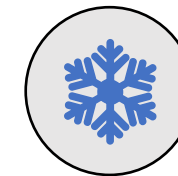
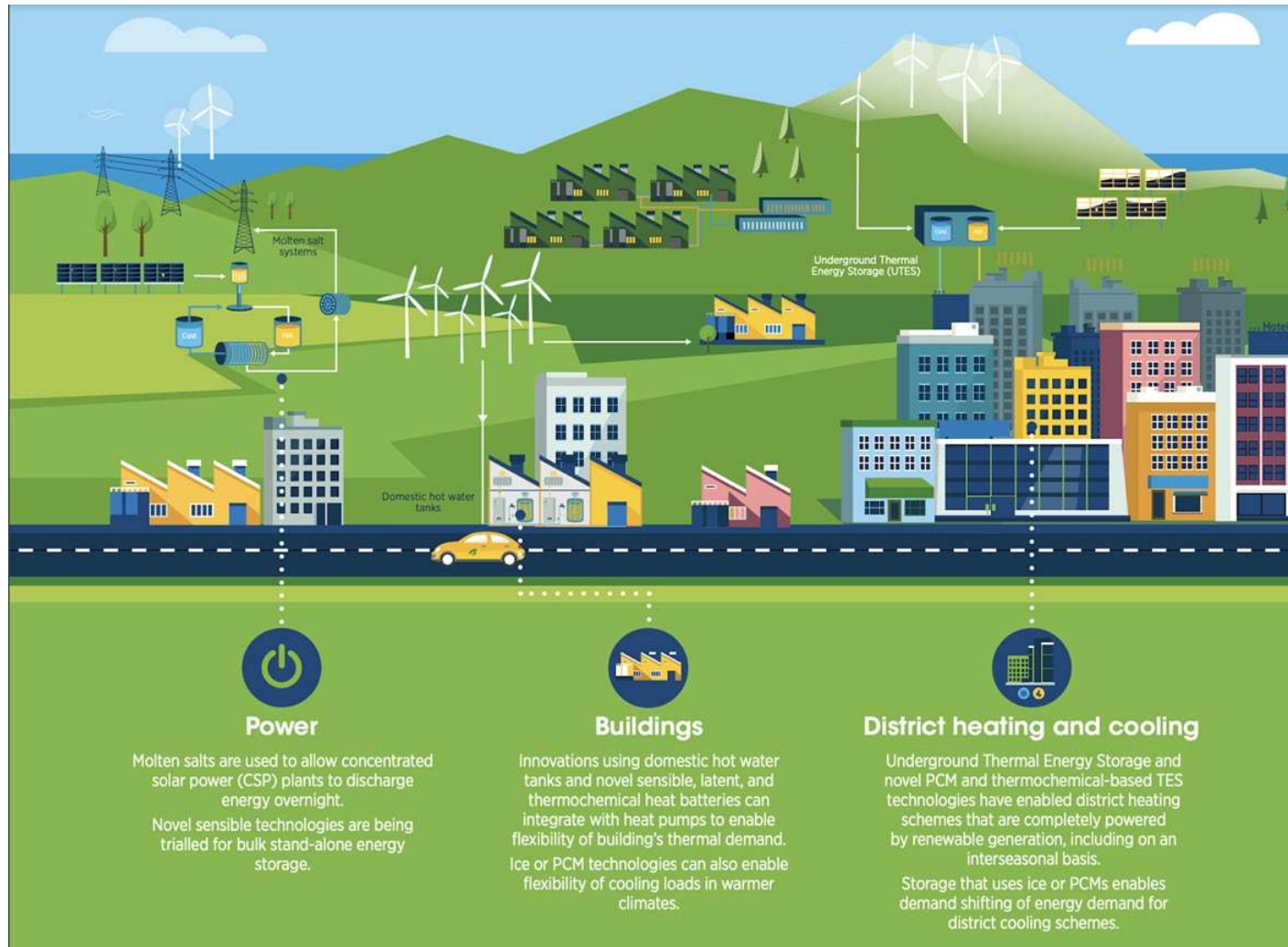


# Energy Outlook

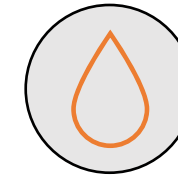




# Trends in Energy Storage



Ice Storage



Domestic Hot Water



Thermal Energy Storage



# Applications

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Thermal Energy Storage (TES) has a wide range of applications across various sectors. Here are some key applications:

District Heating and Cooling

Turbine Inlet Cooling

Building Heating and Cooling

Domestic Hot Water

Industrial Processes

Greenhouses

Concentrated Solar Power (CSP) Plants

These applications demonstrate the versatility and importance of TES in enhancing energy efficiency, supporting renewable energy integration, and reducing energy costs across various sectors.



# Types of Energy Storage: Buildings/District Energy

## Ice Storage



## Domestic Hot Water Storage



## Thermal Energy Storage





# Thermal Energy Storage (TES)

- Chilled water tank (not ice, no heat)
- Concrete tank (not steel)
- 1.4M Gallons / 10,800 ton-hrs / ~38 MWh
- Simple technology, long life low maintenance compared to chillers
- Increases resilience and sustainability
- Compliments cogeneration system and electricity procurement strategy (TOU rates)
- Benefits the grid – less demand during peaks

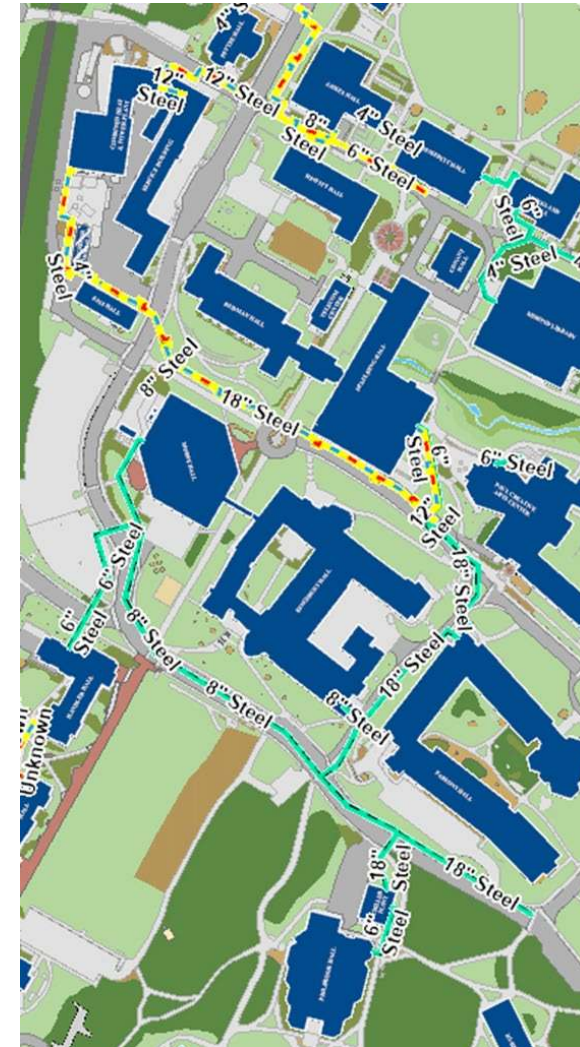




# District Cooling at UNH



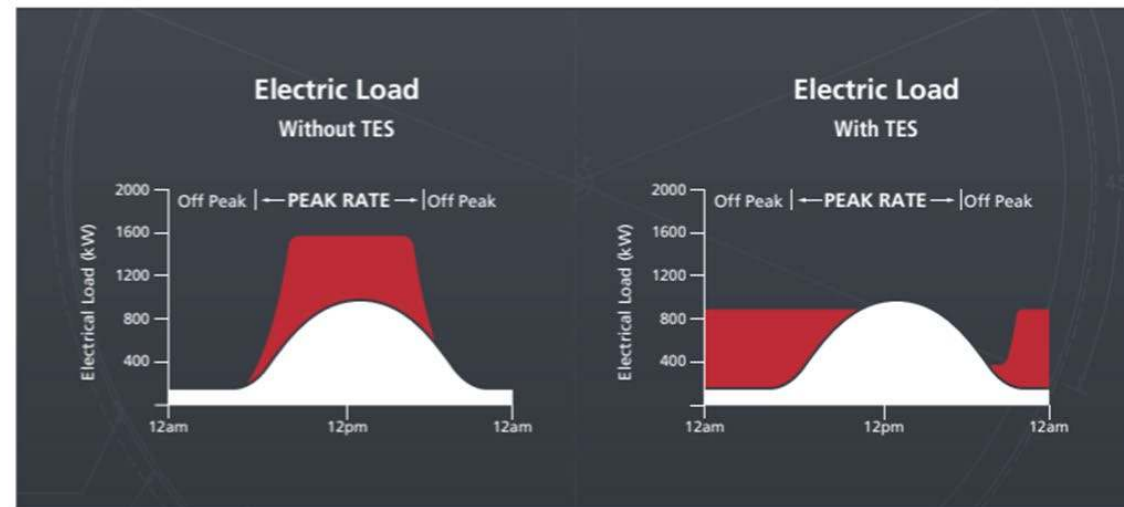
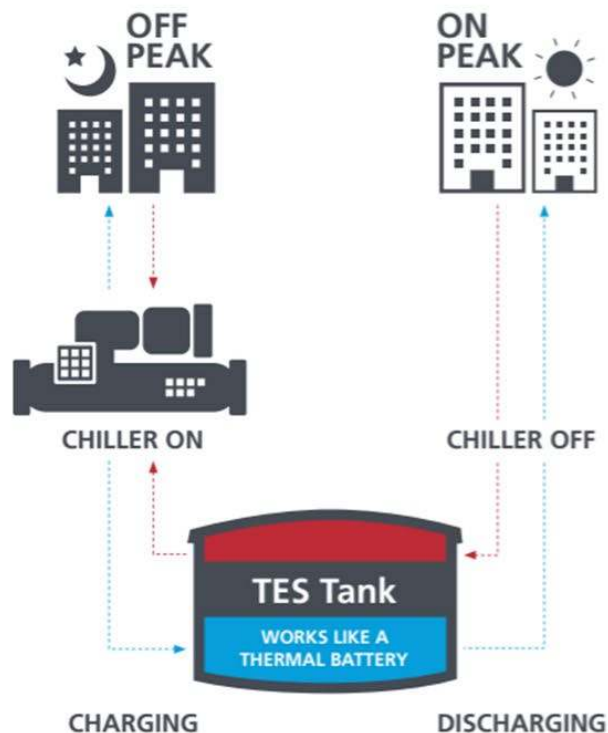
- UNH's largest district chilled water system includes 5 chillers at 2 plants totaling 2700 tons
- Provides cooling for over 11 buildings totaling >1M sq-ft, including many research buildings, dining hall, and residence halls.
- During the design of Spaulding Hall we decided to pursue district chilled water system, with the goals of reducing both project cost and operational costs.
- Project was cost effective due to need for additional cooling + Investment Tax Credit
- Largest hurdle to overcome in process was location of the tank due to aesthetic concerns (keep it close)





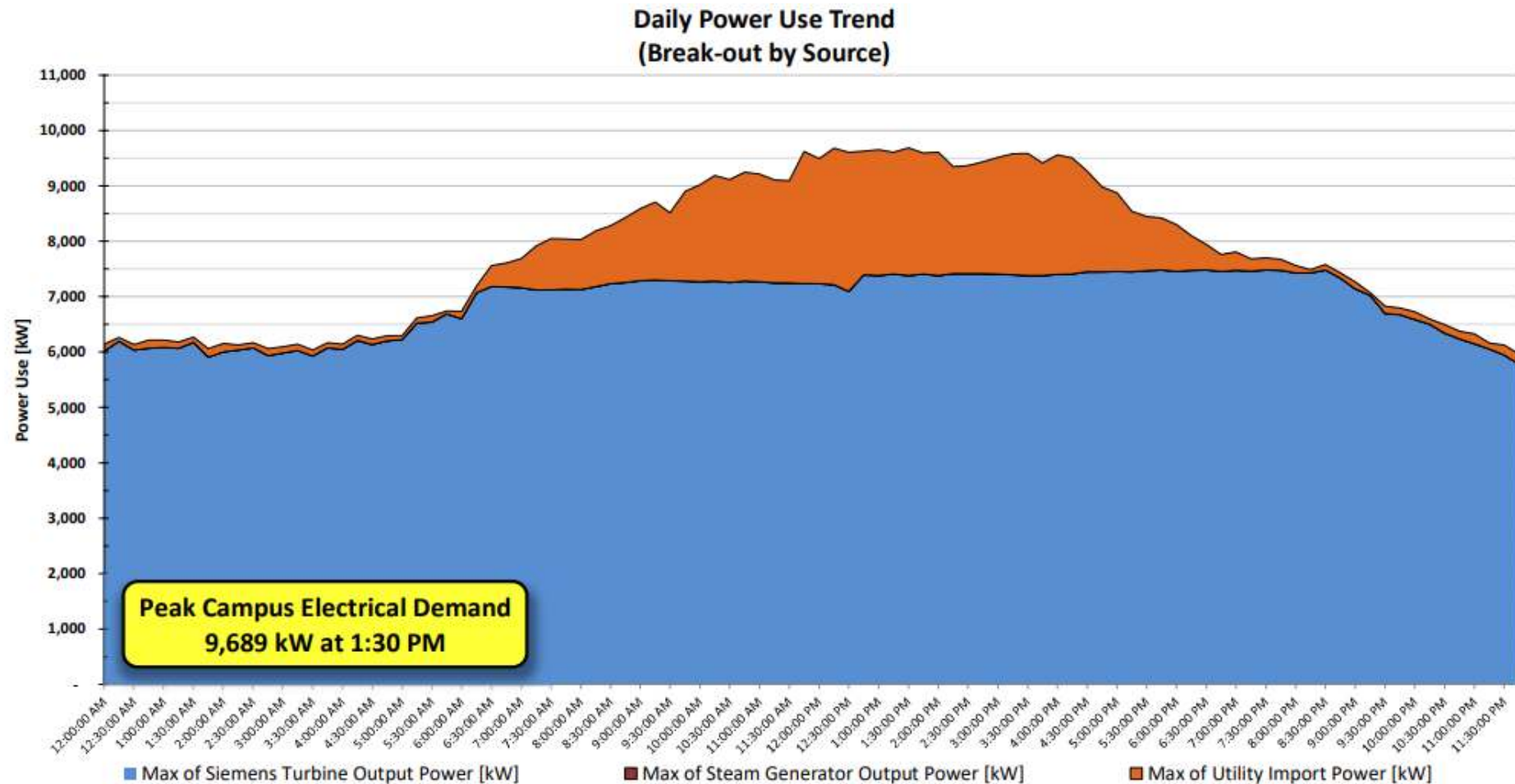
# How it Works

By producing chilled water during off-peak hours and then utilizing the stored water during peak periods, the peak electrical load is permanently reduced. TES reduces peak electric demand and energy consumption and ASHRAE research concludes that TES can increase the utilization of renewable generation.





# UNH Load Profile





# TES Project Development Timeline



Sustainability  
Institute Fellow  
Studies Energy  
Storage  
Opportunities for  
UNH



2017

2018



UNH completes  
Utilities Master  
Planning and  
includes TES  
concept

Engineering firm  
hired to conduct  
TES feasibility study  
Potential tank  
locations identified,  
cost estimating



2019

2020

2021

2022



Consultant hired to  
complete Project  
Requirement  
Documents

2023



RFP for Design-  
Build Team Issued  
Consigli/AEI/LB/VH  
B Team Hired

2024



Tanks Completed  
& Filled



# Design-Build Approach



**Critical Early  
Decisions**



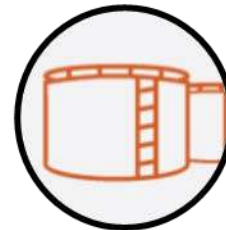
**Maximizing  
Incentives**



**Procure Long-  
Lead Items**



**Cost & Schedule  
Certainty**



**Aesthetics &  
Landscape**



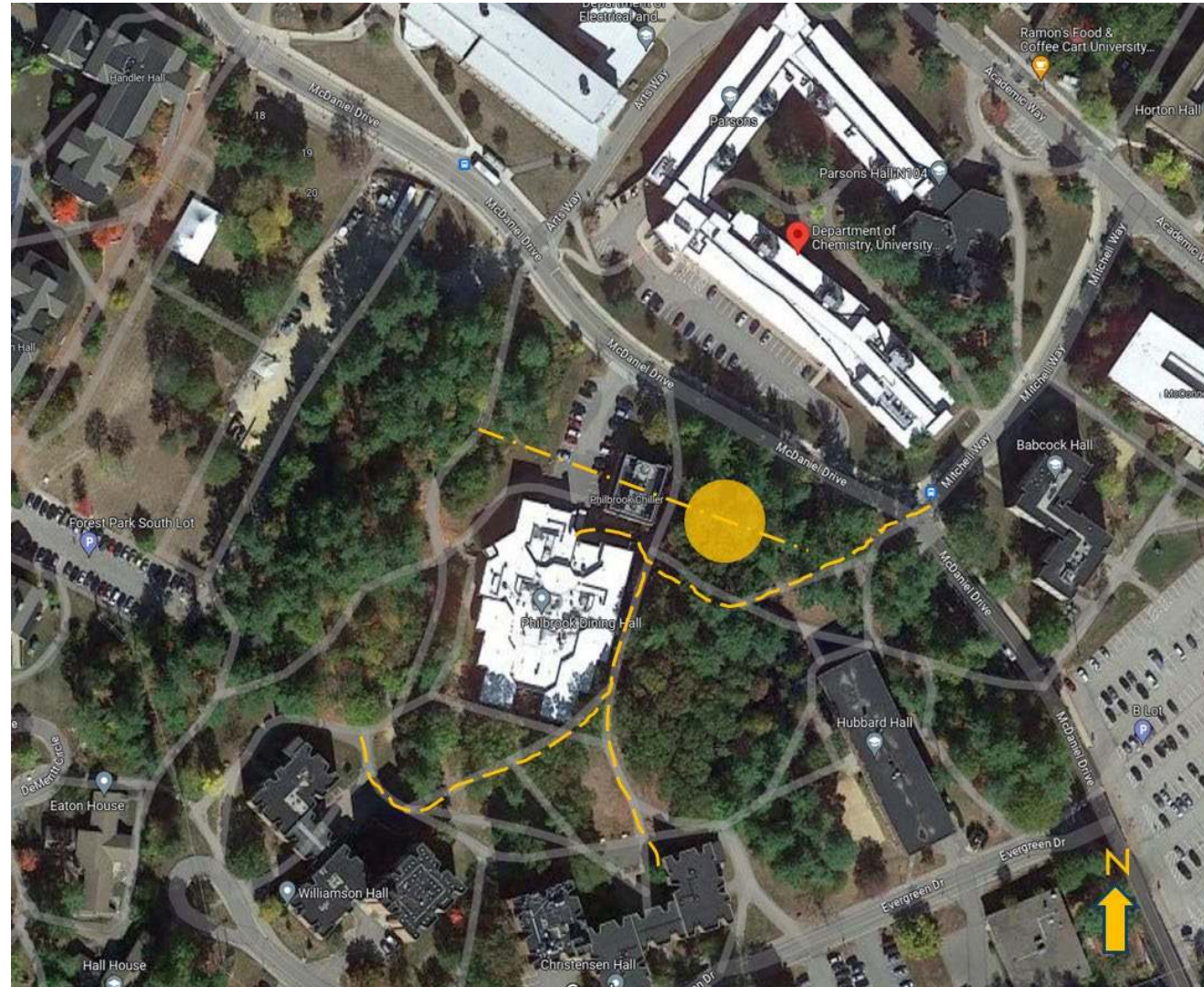
# TES Aesthetics



- Location
- Massing
- Elevation  
(Height and depth)
- Finish colors, patterns, textures, etc.
- Coordination between the Dual Temp and TES projects for system hydraulics



# TES Aesthetics: Locating the Tank





# TES Aesthetics: Right Sizing



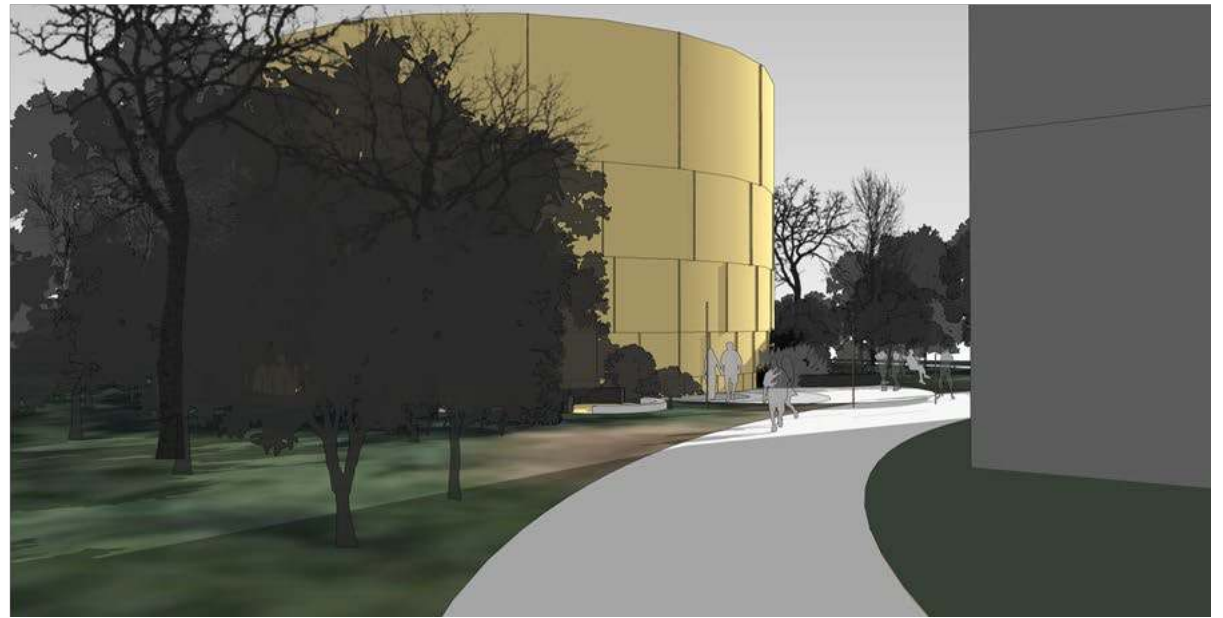
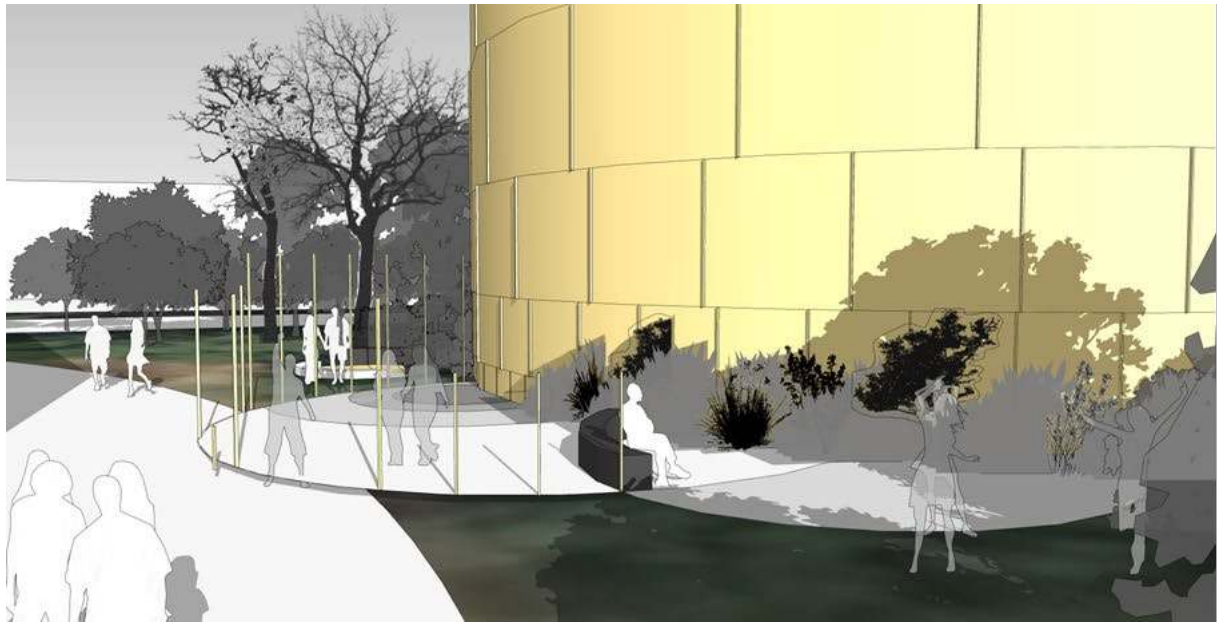


# TES Aesthetics: Right Sizing





# TES Aesthetics: Early Design Concept





# TES Aesthetics: Early Design Concept





# Construction





# Construction





# Construction





# Construction





# Construction





# Construction





# Construction





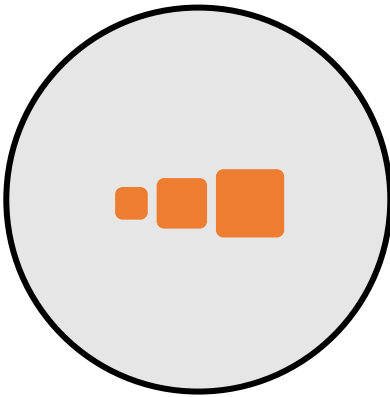
# Construction





# Benefits

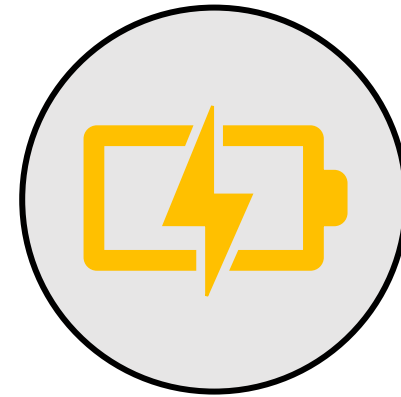
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Load  
Shifting



Energy  
Efficiency



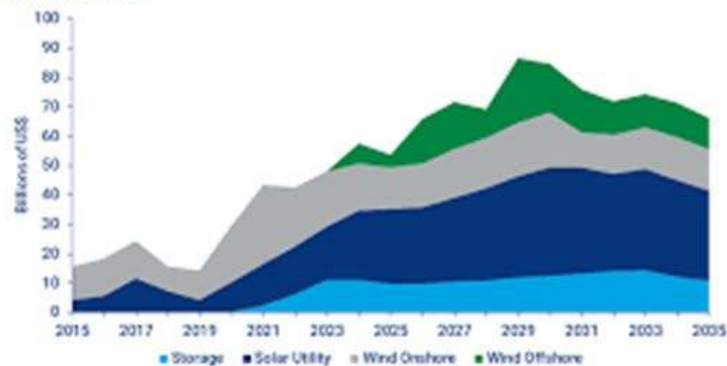
Renewable  
Integration



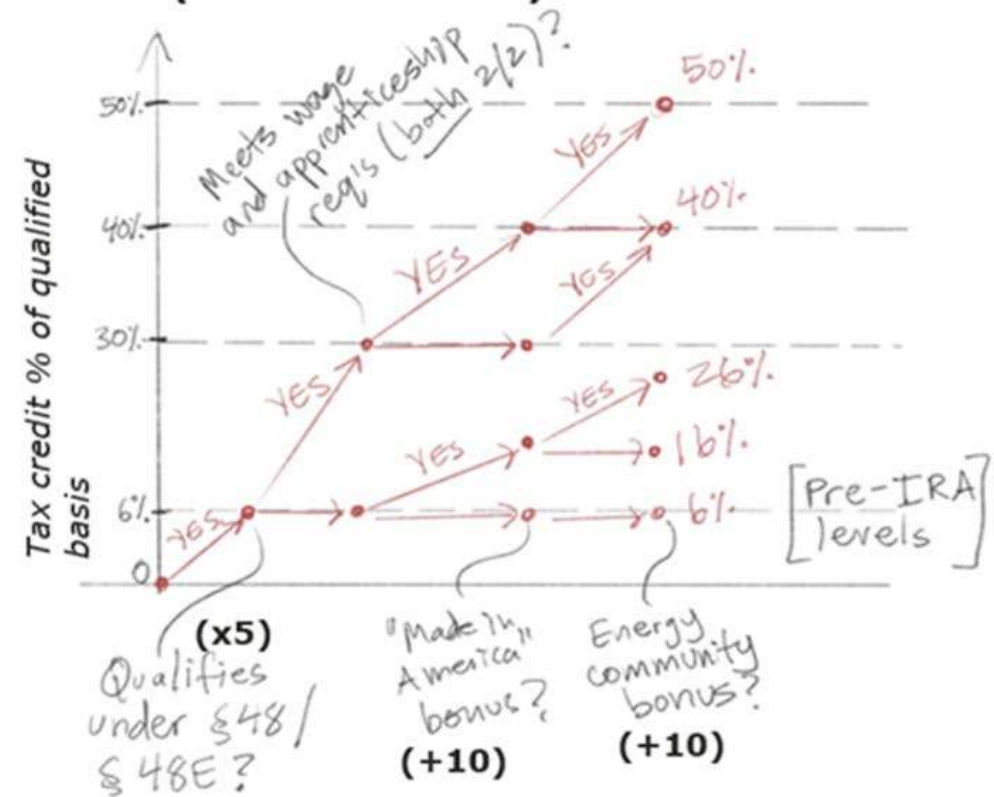
# IRA: Inflation Reduction Act



Projected US renewable energy investment under the Inflation Reduction Act



## ITC Ladder (48 and 48E)





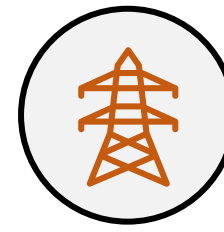
# Policy That Can Help Energy Storage



Regulatory  
Support – Time of  
Use Rates



Incentives and  
Subsidies – Utilities  
and IRA



Enhanced Grid  
Reliability



Environmental  
Impact



Economic  
Growth



# Thank you!



## Questions?