Hot Water Energy Storage Tank Optimization

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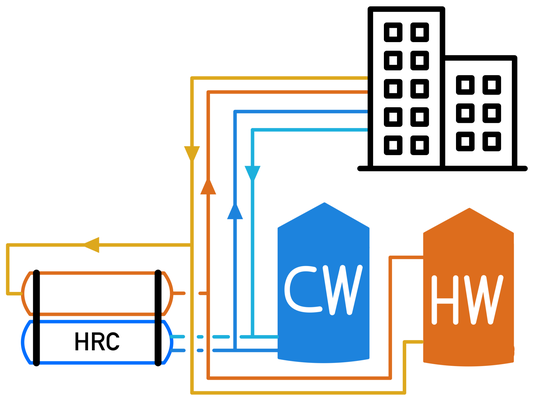
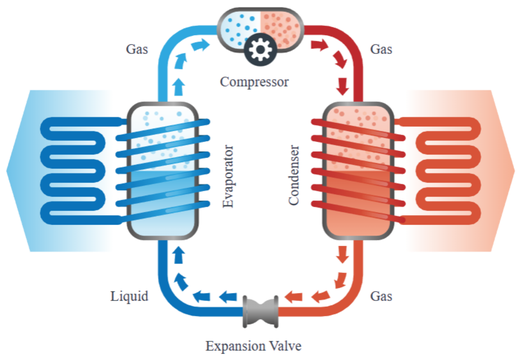
UC DAVIS FACILITIES MANAGEMENT

Introduction

UC Davis' "BIG SHIFT" is shifting from natural gas to electricity for campus heating to increase efficiency and reduce emissions. A key component of this big shift is a Thermal Energy Storage (TES) tank which will store heat extracted from the campus cooling system for heating use during costly peak electricity hours, increasing flexibility while decreasing operational costs.

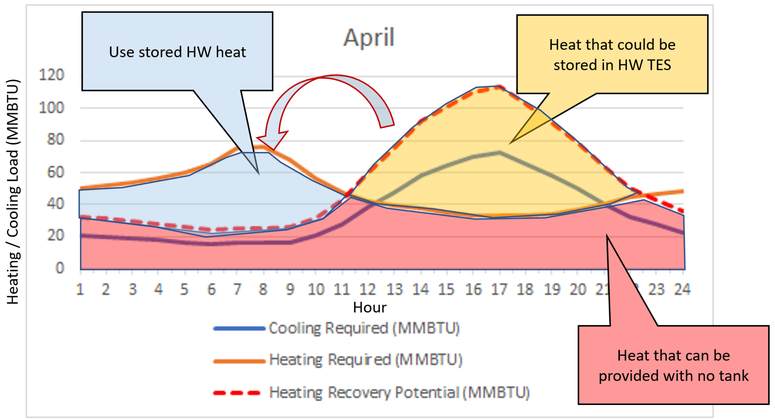




Objective/Problem

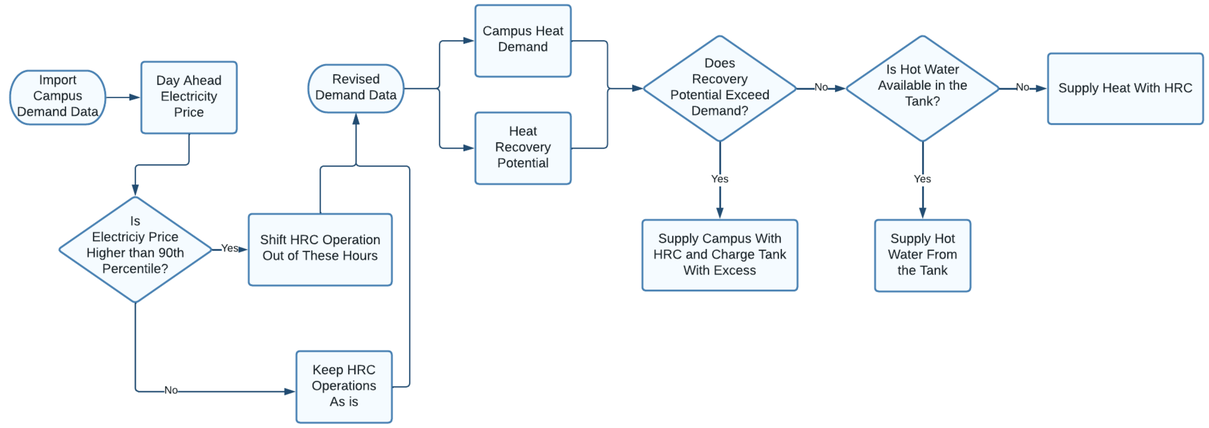
- Heat Recovery Chillers (HRC) produce hot and cold water simultaneously
- Goal is to store excess heat in periods of high cooling demand and supply it during high heating demand or high electricity price
- Our project determined the **optimal size of the TES tank**
  - Maximize energy conservation
  - Minimize cost and emissions

Heating/Cooling Demand for April Day



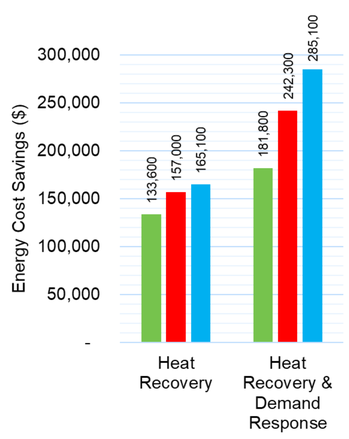
Methodology

In order the evaluate the performance of different tank capacities, the actual campus demand profile for the year 2022 was used.

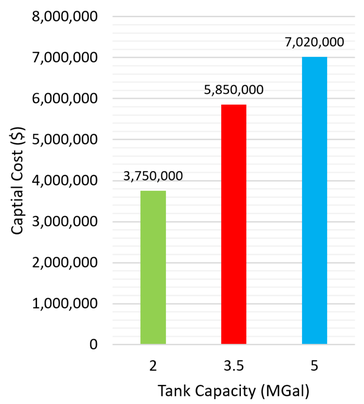


Results

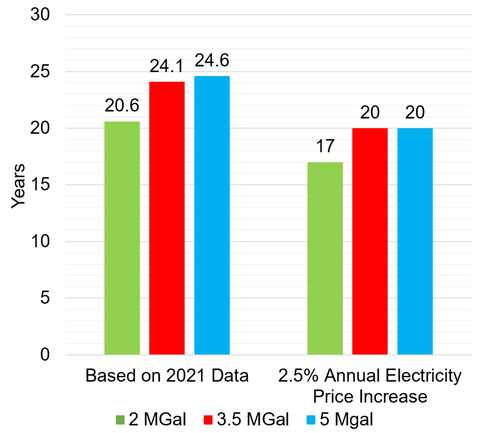
Energy Cost Savings



Tank Capital Cost



Simple Payback Time



Recommendation

- Increasing tank size reduces $/gal, increases flexibility, and increases savings.
- Most optimal to install **5MGal** tank.
  - Increase in payback time compared to smaller tanks is negligible for its 60 year lifespan.

5 MGal

$285,000 Annual Savings

20 Year Payback Period