Brown University – Thermal Efficiency Project

A holistic approach to GHG emissions, operating costs & aging infrastructure

Full project synopsis featured in the latest issue of District Energy Magazine

Campus Statistics
- 228 Buildings
- 92 connected to the district heating network
- $18 M annual energy spend
- District high temperature/high pressure hot water loop
- 33 district heating hubs
- 22 hot water hubs
- 11 steam hubs, 6 of which were already budgeted for conversion

District Heating Loop – Supply Temperature
- Current: 330°F
- Future: 250°F

District Heating Loop – Return Temperature
- Current: 275°F
- Future: 200°F

Central Heating Plant
- 240,000 lbs/hr total steam capacity
- Existing steam boilers modified to high temperature hot water

Project Drivers
- Reduce GHG emissions 42% below 2007 levels by 2020
- Address steam hub deferred maintenance requirements
- Increase district heating network efficiency

District Heating Loop – Supply Temperature
- Current: 330°F
- Return: 260°F

Optimizing Hot Water Hubs
- Increase the ΔT to optimize the district heating network efficiency

Re-engineering the District Heating Loop
- Lower temperature hubs connected in series to maximize the ΔT, reduce flow, enabling reuse of existing district network at lower temperatures.

Integrated Project Delivery Schedule

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<th>Year</th>
<th>Feasibility Study</th>
<th>Validation of guaranteed outcomes (cost, savings, incentives)</th>
<th>Planning &amp; design</th>
<th>Construction &amp; commissioning</th>
<th>Performance tracking</th>
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Optimal Hot Water Hubs

- Simplified maintenance with 40% fewer steam traps, fewer instruments
- Improved reliability for research buildings, which were struggling to get the right steam pressure during shoulder season

Operational Outcomes
- Asset renewal budget for steam hubs
- Simplified maintenance with 40% fewer steam traps, fewer instruments
- Improved reliability for research buildings, which were struggling to get the right steam pressure during shoulder season

Energy and Environmental Outcomes
- 4,700 MTCDE/yr GHG emissions reduction
- 91,000 MMBTU/yr natural gas savings
- 7.5 M gallons/yr water savings

Financial Outcomes
- 8.5% IRR
- $50M guaranteed energy savings
- $55M one-time incentives
- $55M in asset renewal Secondly leveraged for transformational change to the entire loop
- $16.8M total investment

District Heating Loop – Return Temperature
- Current: 275°F
- Future: 200°F

Steam Hub Conversions
- All steam hubs converted to hot water or decoupled from district network (mostly for process steam loads)

A different approach to achieve ambitious targets

1. Holistic deep energy retrofit unlocked more value than one-for-one piecemeal replacement approach could
2. An integrated project delivery method with early engagement and close, continuous collaboration with the Facilities Management, Sustainability, Financing and other stakeholders breaks down the silos and promotes effective project planning with minimum disruption
3. Outcome-based approach – guaranteed costs savings, incentives, project schedule – better aligns interests and delivers the greatest long-term value for Brown