Steele Hall
Energy Retrofit Project

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Steele Hall Description

Building:

- Built in 1920
- Major renovations in 2000 and 2007
- Earth Sciences, Environmental Studies and Chemistry research labs and offices
- Five floors (including mechanical penthouse)
- 47,495 sq. ft.
Project Goals

Capital renewal
- Replacing failing steam coils in AHUs
- Upgrade aging Laboratory air control system

Hot Water Conversion
- Replace steam coils with hydronic heating coils
- Replace ancillary steam heating equipment with hydronic equipment

Energy Efficiency Measures
- Develop cost effective Energy Efficiency and Carbon Reduction measure
Steele Hall Description

Mechanical Systems Before Project

- Two 40,000 CFM, 100% OA AHUs
- AHUs equipped with run-around heat recovery, steam and CHW coils
- Two main exhaust systems of three 20,000 CFM fans c/w heat recovery coils
- Two exhaust systems of two 4,500 CFM fans w/o heat recovery
- Separate hot water heating network for air reheat and perimeter radiation
- Campus Steam and CHW networks utilization
Steele Hall Description

Yearly Energy Usage

- Electricity : 1,500,000 kWh
- Steam : 10,756,000 lbs
- Campus CHW : 400,000 ton-hour
- EUI : 362 kBTU/sq. ft. (106 ekWh/sq.ft.)
- Energy cost : $430,000
- GHG emission : 1,920 MTCDE
Energy Efficiency Measures Description

Laboratories ventilation air reduction

- Laboratory Ventilation Risk Assessment realization

<table>
<thead>
<tr>
<th>AIRFLOWS</th>
<th>BEFORE</th>
<th>AFTER</th>
<th>REDUCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average supply/exhaust CFM</td>
<td>48,000</td>
<td>37,000</td>
<td>23%</td>
</tr>
</tbody>
</table>
Energy Efficiency Measures Description

Existing heat recovery run-around system optimization – Initial arrangement

Average efficiency ± 23%
Energy Efficiency Measures Description

Existing heat recovery run-around system optimization – New arrangement

Average efficiency ± 58%
Energy Efficiency Measures Description

Heat recovery chillers addition

- Using the Campus chilled water network as an energy source
Energy Efficiency Measures Description

Low temperature heating network deployment

- Replace existing VAV reheat coils selected at 110°F supply water temperature
- Use existing AHUs chilled water coils as double function coils for heating purpose using 110°F supply water temperature
## Project’s Results

<table>
<thead>
<tr>
<th>ENERGY</th>
<th>BEFORE</th>
<th>AFTER</th>
<th>SAVINGS</th>
<th>SAVINGS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEAM (lbs)</td>
<td>10,756,000</td>
<td>1,995,000</td>
<td>8,761,000*</td>
<td>81%</td>
</tr>
<tr>
<td>ELECTRICITY (kWh)</td>
<td>1,500,000</td>
<td>1,309,000</td>
<td>191,000</td>
<td>17%</td>
</tr>
<tr>
<td>CAMPUS CHW (ton-hour)</td>
<td>400,000</td>
<td>-6,100</td>
<td>406,100</td>
<td>102%</td>
</tr>
<tr>
<td>EUI (kBTU/sq ft)</td>
<td>357</td>
<td>134</td>
<td>223</td>
<td>62%</td>
</tr>
<tr>
<td>GHG emission (MTCDE)</td>
<td>1,900</td>
<td>595</td>
<td>1,305</td>
<td>69%</td>
</tr>
<tr>
<td>ENERGY COST ($)</td>
<td>$430,000</td>
<td>$190,000</td>
<td>$240,000</td>
<td>56%</td>
</tr>
</tbody>
</table>

*Equates to over 100,000 gallons of #6 fuel oil saved at the central boiler plant*
Lessons Learned

Place for improvement

- Low temperature heating elements: 2 rows VS 4 rows reheat coils

Successful achievement

- Realize most of the building heating through air and minimize peripheral heating through radiators
- Cost effective heat recovery chiller capacity selection
- Thorough controls commissioning sessions and operational follow-up lead to a stable and efficient systems operation
QUESTIONS?

Thank you!

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