Facilities Energy Report  
Fiscal Year 2016  
Third Quarter

I. Energy Use Summary

Campus energy use through the third quarter decreased 2.5%, but increased 1.3% weather adjusted, compared to the same period last year (Fig. 1&2). During the quarter energy use declined 7.3% in part due to the very mild weather. When adjusted for degree days, usage increased 0.2% relative to Q3 FY15 (Fig. 3&4). Total building square footage increased this fiscal year by 165,000 gsf or approximately 8%, with the addition of the South Campus Student Apartments and Commons. Energy use per square foot, therefore, decreased by 4.6% relative to last year.

<table>
<thead>
<tr>
<th>Year-to-Date Campus Energy Use</th>
<th>Total Energy</th>
<th>Electricity Use</th>
<th>Steam Use</th>
<th>Weather Adj Total</th>
<th>Weather Adj Total</th>
<th>Degree Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY15</td>
<td>406,289</td>
<td>27,325</td>
<td>208,482</td>
<td>404,295</td>
<td>195,698</td>
<td>6206</td>
</tr>
<tr>
<td>FY16</td>
<td>396,010</td>
<td>27,649</td>
<td>187,699</td>
<td>409,609</td>
<td>186,670</td>
<td>5232</td>
</tr>
<tr>
<td>Difference</td>
<td>(10,279)</td>
<td>324</td>
<td>(20,784)</td>
<td>5,314</td>
<td>(9,029)</td>
<td>(974)</td>
</tr>
<tr>
<td>% Change</td>
<td>-2.5%</td>
<td>1.2%</td>
<td>-10.0%</td>
<td>1.3%</td>
<td>-4.6%</td>
<td>-15.7%</td>
</tr>
</tbody>
</table>

II. Conservation Projects

A. Dana Engineering HVAC Replacement – This project replaces the heat pump system install in the mid-1980’s with a high efficiency chilled beam and fan coil unit system. Approximately half of the system was replaced in the summer of 2015. The other half of the system will be replaced this coming summer. The make-up air unit that provided ventilation air to the building was replaced with new energy recovery units. These units recover heat from the non-laboratory exhaust stream to pre-heat or pre-cool entering air.

B. Lighting Replacement – Facilities completed a number of lighting upgrades during the first half of FY16, most notably in the KLARC and ELC. Upgrades in Sojka Pavilion were completed in March. The projects are summarized in the attached Figure 5. The new lamps will reduce energy consumption an average of 60% and produce a net savings of $814,000 over the life of the systems.

C. Rooke Chapel Digital Controls – This project installed a new digital control system that allows the heating and cooling systems to be better managed and further optimized.

D. Breakiron Engineering Occupancy Sensors & Controls – New motion sensors in offices and classroom set back the temperature when the room is unoccupied. The original VAV box controls have been integrated with the current energy management system to expand control and monitoring capability.

E. O’Leary Center Occupancy Sensors & Controls – Similar to Breakiron, motion sensors in the offices and classrooms set back room temperature when spaces are unoccupied. Integrating the VAV controls enables optimization of building. The
The project also replaced chilled water system, hot water system, air handler, and exhaust fans controls. Replacing and integrating the existing controls enables optimization of building operation.

F. Marts Hall HVAC and Digital Controls – Replaced all air handlers. Replaced pneumatic controls with DDC.

G. Freas Hall HVAC and Digital Controls – Replaced all fan coil units. Replaced pneumatic controls with DDC.

H. Smith Hall HVAC and Digital Controls – Replaced fan coil units on ground floor of B&C wing and added DDC. Upgraded chilled water and hot water plant controls to DDC.

I. Cooley Hall HVAC and Digital Controls – Upgraded heating system from a distributed steam system to a gas high efficiency hydronic boiler. Added DDC to control air handler, boiler and chiller.

IV. Operations & Maintenance Practices

Facilities continues to monitor operation of building HVAC systems through the online Analytika data management and analysis system. There are not currently sufficient resources to take full advantage of its capabilities.

As of November, 2015 a controls technician was assigned to work exclusively on energy management issues. Each of the four technicians will rotate through the energy management assignment quarterly.

V. Renewable Energy

Facilities installed a solar water heating system on the Biology building roof in August. The system pre-heats feedwater for the autoclave boiler. The system produced a total of 2.2 MMBtu of thermal energy during February and March.

Bucknell extended the contract for wind generated renewable energy credits (RECs) for an additional year, through 2019. The contract increases the annual purchase from 4,000 to 5,000 MWh in 2019 to cover new LEED certified buildings including Carnegie, Roberts Hall, Graham Building, and Academic East.
Figure 1

Year to Date
Campus Energy Use

[Graph showing MMBtu usage from July to June for FY15 and FY16, with a table below the graph showing the actual usage values for each month.]

Figure 2

Weather Adj Year to Date
Campus Energy Use

[Graph showing MMBtu usage with weather adjustment from July to June for FY15 and FY16, with a table below the graph showing the adjusted usage values for each month.]
Figure 3

Weather Adj YTD Energy Use

Figure 4

Weather Adj Quarterly Energy
# Facilities Lighting Upgrades

<table>
<thead>
<tr>
<th>Location</th>
<th>Fixture Count</th>
<th>Old System</th>
<th>New System</th>
<th>Savings (kW)</th>
<th>Completion Date</th>
<th>Operating Hours</th>
<th>Energy Savings (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bostwick Cafeteria</td>
<td>138</td>
<td>Halogen 75</td>
<td>LED 41</td>
<td>4.69</td>
<td>Aug-15</td>
<td>6500</td>
<td>45,209</td>
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<tr>
<td>Kinney Natatorium</td>
<td>76</td>
<td>Metal Halide 860</td>
<td>LED 378</td>
<td>28.73</td>
<td>Aug-15</td>
<td>3000</td>
<td>109,896</td>
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<tr>
<td>Kinney Natatorium</td>
<td>28</td>
<td>Metal Halide 460</td>
<td>LED 158</td>
<td>4.42</td>
<td>Aug-15</td>
<td>3000</td>
<td>25,368</td>
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<tr>
<td>Bison Café</td>
<td>127</td>
<td>Incandescant 150</td>
<td>LED 63</td>
<td>8.00</td>
<td>Jan-16</td>
<td>6500</td>
<td>92,621</td>
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<tr>
<td>Hunt Hall</td>
<td>102</td>
<td>Incandescant 150</td>
<td>LED 18</td>
<td>1.84</td>
<td>Jan-16</td>
<td>3600</td>
<td>48,470</td>
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<tr>
<td>Tustin Theater</td>
<td>32</td>
<td>Incandescant 300</td>
<td>LED 102</td>
<td>3.26</td>
<td>Jan-16</td>
<td>600</td>
<td>4,095</td>
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<td>Davis Gym</td>
<td>20</td>
<td>Metal Halide 1100</td>
<td>LED 378</td>
<td>7.56</td>
<td>Jan-16</td>
<td>3000</td>
<td>43,320</td>
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<tr>
<td>Sojka Pavillion</td>
<td>52</td>
<td>Metal Halide 1100</td>
<td>LED 480</td>
<td>24.96</td>
<td>Mar-16</td>
<td>3000</td>
<td>96,720</td>
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<tr>
<td>Sojka Pavillion</td>
<td>22</td>
<td>Metal Halide 460</td>
<td>LED 228</td>
<td>5.02</td>
<td>Mar-16</td>
<td>3000</td>
<td>15,300</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>221.86</strong></td>
<td><strong>89.45</strong></td>
<td><strong>132.41</strong></td>
<td><strong>480,999</strong></td>
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