Energy Reduction Opportunities at St. Luke’s Hospital

Benjamin Wagener
Advisor: A.J. Van den Berghe

Minnesota Technical Assistance Program

University of Minnesota
Company Overview

- Healthcare facility serving 500,000 residents
- 2,592 employees, 365 physicians
- Originally built in 1923
- Steam system
- Cooling tower and chiller system
Motivations for Change

• Rising energy costs
  – From 2010 to 2012
    • Electricity Consumption = 6.18% increase
      – Rate Increase of 4.85%
    • Steam Consumption = 4.96% decrease
      – Rate Increase of 26.48%

• MN Next Generation Act of 2007 and Conservation Improvement Program
Reasons for MnTAP Assistance

• Past MnTAP intern focus on waste reduction
• Lighting retrofit project
  – Exchanging T12 fixtures for T8 lamps and electronic ballasts
  – Exchanging Incandescent Lamps to CFL
• Steam trap leak testing
• Investigating new opportunities for energy savings
• Benchmarking
• Compartmentalizing energy consumption
Approach

• Understand processes and equipment
• High energy consuming processes
Finding Energy Opportunities

• Priorities
  – Lighting
  – Steam system and steam traps
• Data logging equipment
• Review case studies
• Surveying
Interior Lighting

• Currently, 21+ different light fixtures
  – T8, T12, CFL, PL CFL, and Incandescent fixtures.
  – Annual Electricity Cost = $159,000
Interior Lighting (con’t)

• Opportunities
  – T12 lamps, magnetic ballasts, and a few incandescent lamps have been discontinued
  – Inefficient and costly energy consumption

• Solutions
  – Audit, survey, prioritized retrofit project, efficient lighting fixture exchange, occupancy detectors.
T12 to T8 and I to CFL Retrofit Project

• Opportunities
  – Status, direction, more efficient available fixtures

• Solutions
  – Scheduled fixture exchanging by room or dept.

<table>
<thead>
<tr>
<th>Retrofit</th>
<th>Power Savings (kW)</th>
<th>Energy Savings (kWh)</th>
<th>Annual Electric Savings</th>
<th>Annual Maintenance Savings</th>
<th>Rebate</th>
<th>Cost</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>T12 and T8 to F32T8 at 28W</td>
<td>147</td>
<td>582,085</td>
<td>$39,277</td>
<td>$12,835</td>
<td>$29,476</td>
<td>$95,897</td>
<td>1.27</td>
</tr>
<tr>
<td>T12 and T8 to F32T8 at 28W with OS</td>
<td>147</td>
<td>701,035</td>
<td>$43,942</td>
<td>$12,835</td>
<td>$29,476</td>
<td>$135,852</td>
<td>1.87</td>
</tr>
<tr>
<td>Incandescent and CFL to LED</td>
<td>45.64</td>
<td>120,983</td>
<td>$9,838</td>
<td>- $462</td>
<td>$9,128</td>
<td>$21,611</td>
<td>1.33</td>
</tr>
<tr>
<td>Incandescent and CFL to LED with OS</td>
<td>45.64</td>
<td>122,063</td>
<td>$9,881</td>
<td>- $462</td>
<td>$9,128</td>
<td>$25,047</td>
<td>1.69</td>
</tr>
</tbody>
</table>
Northland Parking Ramp Lights

- 54 150W HPS light fixtures
  - Annual Electricity Cost = $4,800

Opportunities
- Inefficient technology

Solutions
- T8 vapor tight fixtures, LEDs

<table>
<thead>
<tr>
<th>New Fixture</th>
<th>Power Savings (kW)</th>
<th>Energy Savings (kWh)</th>
<th>Annual Electric Savings</th>
<th>Annual Maintenance Savings</th>
<th>Rebate</th>
<th>Cost</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>F32T8 2 Lamp</td>
<td>7.02</td>
<td>61,495</td>
<td>$3,293</td>
<td>$3,682</td>
<td>$1,404</td>
<td>$9,115</td>
<td>1.11</td>
</tr>
<tr>
<td>LED</td>
<td>5.56</td>
<td>48,723</td>
<td>$2,609</td>
<td>$4,868</td>
<td>$1,112</td>
<td>$30,618</td>
<td>3.95</td>
</tr>
</tbody>
</table>
Steam Traps

• 151 steam traps
  – About 52 used in heating season or used for redundancy
Steam Traps (con’t)

• Opportunities
  – No regular inspection
  – Blow through, rapid cycling, leaking, plugged/flooded

• Solutions
  – Ultrasonic audit, repair, replace.

<table>
<thead>
<tr>
<th>Number of Failed Traps</th>
<th>Est. Steam Loss (per year)</th>
<th>Annual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>13</td>
<td>14,890,666</td>
<td>$256,715</td>
</tr>
</tbody>
</table>
## Steam Traps (con’t)

<table>
<thead>
<tr>
<th>Month</th>
<th>Cumulative Trap Failure</th>
<th>Monthly Steam Loss Cost</th>
<th>Cumulative Steam Loss Cost</th>
<th>Monthly Inspection$^b$ &amp; Repair$^c$ Cost</th>
<th>Cumulative Cost of Not Repairing</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0.00</td>
<td>-</td>
<td>-</td>
<td>$1,050</td>
<td>- $1,050</td>
</tr>
<tr>
<td>1</td>
<td>0.27</td>
<td>$450</td>
<td>$450</td>
<td>$1,159</td>
<td>- $710</td>
</tr>
<tr>
<td>2</td>
<td>0.55</td>
<td>$900</td>
<td>$1,349</td>
<td>$1,269</td>
<td>$81</td>
</tr>
<tr>
<td>3</td>
<td>0.82</td>
<td>$1,349</td>
<td>$2,699</td>
<td>$1,378</td>
<td>$1,321</td>
</tr>
<tr>
<td>4</td>
<td>1.09</td>
<td>$1,799</td>
<td>$4,498</td>
<td>$1,487</td>
<td>$3,011</td>
</tr>
<tr>
<td>5</td>
<td>1.37</td>
<td>$2,249</td>
<td>$6,747</td>
<td>$1,597</td>
<td>$5,150</td>
</tr>
</tbody>
</table>

$^a$ linear 2.0% failure rate per year

$^b$ based on estimated inspection time (30 hrs) and labor rate ($35/hr)

$^c$ $200 per trap in materials; 2 hours labor per trap
### Recommended Process Changes

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Reduced Energy (per year)</th>
<th>Implementation Cost</th>
<th>Rebate</th>
<th>Utility Savings (per year)</th>
<th>Maintenance Savings (per year)</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retrofit All Incandescent and CFL Lamps with LED Lamps and Install OS</td>
<td>122,063 kWh</td>
<td>$26,582</td>
<td>$9,128</td>
<td>$9,881</td>
<td>- $505</td>
<td>1.69</td>
</tr>
<tr>
<td>Retrofit 48” T8 and T12 Fixtures to F32T8 28W Fixtures and Install OS</td>
<td>701,035 kWh</td>
<td>$135,852</td>
<td>$29,476</td>
<td>$43,942</td>
<td>$12,835</td>
<td>1.87</td>
</tr>
<tr>
<td>Retrofit Northland Parking Ramp HPS Fixtures to 2 T8 Lamp Vapor Tight Fixtures</td>
<td>61,495 kWh</td>
<td>$9,115</td>
<td>$1,404</td>
<td>$3,293</td>
<td>$3,682</td>
<td>1.11</td>
</tr>
<tr>
<td>Repair or Replace Failed Steam Traps</td>
<td>14,890,666 lbs of steam</td>
<td>$5,200</td>
<td>None</td>
<td>$256,715</td>
<td>None</td>
<td>0.20</td>
</tr>
</tbody>
</table>
Personal Benefits

- Practical understanding of systems
- Data analysis techniques
- Cost analysis understanding
- Dealing with unknowns
- Career exposure
Questions?