UVM: Physical Plant Intern Projects (Summer 2010)

Presented by:

Lance Nichols – Senior / Mechanical Engineering
Isaiah Patterson – Senior / Electrical Engineering
Nick Peterson – Senior / Mechanical Engineering
Kyle Sala – Senior / Mechanical Engineering
Preventative Maintenance

Summer Intern Program 2010

Zone

Responsibilities:

Davis Zone:  Lance Nichols
21 Completed Buildings

Medplex Zone:  Nick Peterson
12 Completed Buildings

Trinity Zone:  Isaiah Patterson
13 Completed Buildings
Data Collecting Process

1. Physically go to every building within respective Zones and check each and every room for mechanical equipment.

2. Enter data into spreadsheet. Compare to already existing PM sheets.

3. Refer to the blueprints and AutoCAD to double-check our work.

4. Take pictures of all equipment.

Fire Pump

Floor: #1 / Rm: #118

208 - 230/460 VAC   120/60 Amps
Phase: 3   HP: 50   RPM: 1765
Motor/Pump MFG: Patterson Kelly
S/N: #FF-C058953   Model: #050180P3E
GPM: 1000   Motor Frame: #326TS
Electrical Panel: G-1 (RM #138)
Breaker: #50, #52 & #54
Bearings: #6312-Z-C3 / #6212-Z-C3
Data Collecting Process

• Gathering data on all “critical equipment” was the main objective this summer.
• Between the three (3) PPD Zones, there were approximately 2,100 pieces of equipment ...!

- Air Handling Units
- Air Conditioners
- Air Compressors
- Boilers
- Compressors
- Condensers
- Chillers
- Generators
- Exhaust Fans
- Fan Coil Units
- Pumps
- Humidifier
- Return Fan
- Transformers
- Unit Heaters
Backup Deaerator Project

Explores the feasibility of installing a second, smaller deaerator that would allow plant operations to continue at a minimal load.

What needs to be looked at:

- GPM feed water to boilers
- Size of Deaerator
- Operating Pressure and Temperature for maximum efficiency
- Cost of running deaerator and pumps running from; feed water → deaerator → boiler
- Valve Sizing
- Placement in Cage
Knowledge Acquired During PPD Summer Internship

- Valuable experience in the field of Engineering.
- Understanding of how Facilities Management works.
- Able to physically see all working components of a building’s HVAC system.
- Ability to recognize equipment and to give a clear explanation of its purpose.
- Understand how to read and interpret schematic drawings and/or blueprints.

Looking forward to learning much more throughout this year!
Morgan Horse Farm

<table>
<thead>
<tr>
<th>Existing Bulbs</th>
<th>Existing Watts</th>
<th>Replacement Bulb</th>
<th>Replacement Watts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Incandescent(60)</td>
<td>10440</td>
<td>Flourescent(13)</td>
<td>2262</td>
</tr>
<tr>
<td>Total Fluorescent(15)</td>
<td>30</td>
<td>no replacement</td>
<td>30</td>
</tr>
<tr>
<td>Total Fluorescent(22)</td>
<td>110</td>
<td>no replacement</td>
<td>110</td>
</tr>
<tr>
<td>Total Fluorescent(25)</td>
<td>1900</td>
<td>Flourescent(23W)</td>
<td>1748</td>
</tr>
<tr>
<td>Total Fluorescent(32)</td>
<td>128</td>
<td>Flourescent(23W)</td>
<td>92</td>
</tr>
<tr>
<td>Total Fluorescent(60)</td>
<td>360</td>
<td>Flourescent(23W)</td>
<td>138</td>
</tr>
<tr>
<td>Total Flood Lights(75)</td>
<td>300</td>
<td>LED Flood Light(16W)</td>
<td>64</td>
</tr>
<tr>
<td>Total Flood Lights(120)</td>
<td>1680</td>
<td>LED Flood Light(16W)</td>
<td>224</td>
</tr>
</tbody>
</table>

**Total: 14948 Watts**

That is a **10.28 kWh** drop in energy usage with a payback of **1.10 years** if every old style bulb was replaced to a high efficient bulb. We ended up only replacing bulbs in one large room of **24 lamps**. In the future it would be beneficial to replace more.
L & L “Above-Door” Light Upgrades

Old Lighting:
- Not Attractive
- Very noticeable / White on Brick
- Several were broken & “nested”
- Not energy efficient (50 watts)

Metal Halide; **50W** Lamp -- 65 units on Exterior of L & L / *existing*

New Lighting:
- Sleek Design – Manufacturer “RAB”
- Hardly noticeable / Dark Bronze
- Very energy efficient (**20 watts**)
- Excellent installation (*meets current National Electrical Codes -- or N.E.C.*)

LED; **20W** Lamps -- 65 units on Exterior of L & L / *replaced*
New LED Fixture Cut Sheet

**Product Highlights:**

- RAB #WPLED20
- **5 Year** Product Warranty
- Two (2) Mounting Types
- UL Listed
- LEED Certified
- 120 - 277 VAC Input Options
- **50,000 Hour** Rated LED Life
- Photo-cell Control Option
- Full “Cut-Off” Wall pack Fixture
- **20 watts**, High Output LED’s
Cage “Summer Savings” at HSRF

Information gathered from **June 23, 2010** when Cage / Central Heat Plant switched over to the Central Chilled Water Plant and took off the Steam Absorbers at the Health Science Research Facility. Savings are noted below.

<table>
<thead>
<tr>
<th></th>
<th>Location: Arts &amp; Science Average</th>
<th>Cage Average</th>
<th>HSRF Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average KW usage hour before switch:</td>
<td>404.41 KW</td>
<td>455.93 KW</td>
<td>766.81 KW</td>
</tr>
<tr>
<td>Change in KW usage:</td>
<td>↑ 273.24 KW</td>
<td>↑ 11.22 KW</td>
<td>↓ 308.93 KW</td>
</tr>
<tr>
<td>Average KW usage hour after switch:</td>
<td>677.65 KW</td>
<td>467.15 KW</td>
<td>457.88 KW</td>
</tr>
</tbody>
</table>

With the load of Medplex on the Chillers, the following **savings** were calculated and estimated for the Summer to be:

- **Hourly:** $2.03
- **Daily:** $48.75
- **Summer:** $4,387.14
Make-up Water Well @ CHP

- Central Heating Plant (Cage) uses over 9.6 million gallons of water per year in make-up for both the steam system & cooling towers.
- Costs UVM approximately $32,000 per year.
- Could be *primary* to offset cost of water or *secondary* source to act as back-up to system.
Make-up Water Well

- How the well would be used, exactly what infrastructure needed, etc. (not known, until drilled).

- "Simple Payback" would be around 1 to 2 years, ideally.

- Not a huge savings, but there isn’t one (1) project that will cut the utility bill -- roughly in half (50%).

**Approximate Well and Infrastructure Cost**

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drilling (500 feet, minimum)</td>
<td>$ 5,500.00</td>
</tr>
<tr>
<td>Hydro Fracturing (if needed)</td>
<td>$ 1,600.00</td>
</tr>
<tr>
<td>Pump &amp; Motor, Piping, other Plumbing, and Variable Drives</td>
<td>$ 9,300.00</td>
</tr>
<tr>
<td>Additional Water Softener &amp; Chemical Treatment (if needed)</td>
<td>$ 5,000.00</td>
</tr>
<tr>
<td>Storage Cistern (~3,500 gallons)</td>
<td>$ 3,000.00</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td><strong>$24,400.00</strong></td>
</tr>
</tbody>
</table>
Skills & Knowledge Gained

• Critical & technical planning.
• Making the right contacts to get right information.
• Apply problem solving learned in school, but not with actual numbers and formulas.
• Insight on project or facilities management.
• Learned about a field of engineering I knew little about prior to this internship experience at UVM.
Steam Modeling

• “Pipe2000” software to model steam distribution.
• Reports pressure and flow rate at each node.
• Used as a planning tool for high demand days, change from HPS (high) to LPS (low), change in boiler pressure or expansions to the system.
• Used as a preliminary design tool in the North Campus Steam and Chilled Water Upgrade(s).
Boilers & Central Heating Plant

BOILERS #1 thru #5
UVM Campus: HPS Distribution
280 East Avenue -- Energy Audit

• Used **Infrared Thermal Camera** to find areas of heat loss to help renovate the building space.
Skills and Knowledge Gained

- Read mechanical drawings, effectively.
- Practical “Hands-On” experience.
- Interaction with other facility professionals
- Wrote a Request For Proposal (RFP) for a steam line upgrade project -- next spring ...
- AutoCAD utilization.
- Steam & Hydraulic Modeling – using the “Pipe2000” software.
Any Questions?

Thank you for your time!