Launching & Sustaining an Energy Savings Initiative

Better Buildings By Design 2013
Cast of Characters

- Richard Morley – VP Support Services – CVMC
- Gregory R. Liebert – Liebert Engineering, Inc.
- Randy Mead – Control Technologies
- Tim Perrin – Efficiency Vermont
- CVMC Board of Directors, and CEO
- Many, many others from across each organization
Background

- 334K sq-ft hospital in Berlin @ 122 beds
- $2.0–$2.5M annual energy costs (electric & oil)
Call to Action

“Mr. Morley, what is CVMC doing related to sustainability?”
What Should We Do?
Why an Energy Master Plan?

• Become the **Leader in Green Strategy Development & Implementation** in Central Vermont, and beyond.

• A credible Green Strategy / Story had to be built upon a foundation of **energy conservation and energy efficiency**.

• Commitment to developing a comprehensive Energy Master Plan to **benchmark energy and water use**, to uncover conservation and efficiency opportunities in order to improve their carbon footprint and green profile, and give them substantial message to share with staff, patients, and community.

• The Energy Master Plan would guide **Energy Reduction Measure** (ERM) analysis and implementation if feasible.
Why an Energy Master Plan?

- Implementation of the plan shall reduce annual energy costs, while **maintaining environmental comfort and air quality**, and avoid creating a “sick building” in the name of energy savings.

- All energy conservation and efficiency improvements shall be **justified using life-cycle cost methods**, specifically net present value analysis that weigh initial capital cost, future operating, and maintenance costs.

- Achievement of **Energy Star** for Healthcare certification (first in Vermont).
Energy Use Analysis

- **Existing documentation** including original construction drawings, as-built documents (as available) and control system documentation were collected, reviewed and summarized.

- **Field survey** to understand system configurations, and observe actual operating conditions.

- **Building Automation System (BAS)** accessed remotely to extract current and historical operational data for all major HVAC systems.

- Several years of **hourly electrical usage data** was collected, and analyzed for daily, weekly, monthly, seasonal, and yearly trends.

- Daily **fuel usage logs** were analyzed to determine use patterns.
Energy Use Analysis

CVMC Electrical Use Summary (2009)

- Fan Power: 35%
- AHU's: 12%
- Cooling: 4%
- Elevators: 3%
- Exhaust Fans: 2%
- Pumps: 1%
- Hospital Equipment & Plug Loads: 1%
- Condenser Water, HW/CH, Recirc, etc.: 1%
- Total Annual Electrical Use From Historical GMP Data: 8,308,324 KWh/yr

Based on 1.4 W/sqft

Liebert Engineering
Energy Use Analysis

Electrical Consumption
2009 Hourly Data Points

Peak Demand = 1520 KW

Cooling Season
Energy Use Analysis

Total Fuel Oil Consumption - 2009

Total Annual Consumption: 377,946 Gallons

- January: 34062 Gallons
- February: 26161 Gallons
- March: 26209 Gallons
- April: 20854 Gallons
- May: 14687 Gallons
- June: 12870 Gallons
- July: 15014 Gallons
- August: 14948 Gallons
- September: 17186 Gallons
- October: 23667 Gallons
- November: 25410 Gallons
- December: 33400 Gallons

Legend:
- Red: Space Heating
- Blue: Domestic Hot Water

Graphic by Liebert Engineering Incorporated
Survey & Findings

- Building exterior brick wall
- Heat loss differences between older and newer construction vintages
- Heat loss at construction seam / joint
- Band sill heat loss

- Cooling tower with active steam supply
- Heat loss at the sealing edges of the double door to the loading dock area
- Rooftop cooling tower
- Set of double doors – view of the outside surface.
Survey & Findings

Heating System:

- Two Fuel Fired Steam Boilers
- Capacity 12,075 lbs/hr each
- 86% Efficiency (non-condensing)
- Heat Recovery Strategies:
  - Flue Gas: none
  - Water Side: none
- Steam-to-Hot Water Heat Exchangers for:
  - Perimeter Zone Heat (convectors/baseboard)
  - Air System Reheat
  - Domestic Hot Water Generation
Survey & Findings

Air Handling Systems:

Main Hospital Served by:

- 13 Primary Air Handlers
  - Constant and Variable Volume
  - VFDs Installed/Utilized? On Most
  - Total Installed Air Flow: Approx. 300,000 CFM
  - Economizer Operation Utilized? Yes (Control Strategy Varies)
  - Heat/Energy Recovery Installed/Utilized? No

- 47 Exhaust Fans
  - Primarily Constant Volume
  - Virtually All Run Continuously
  - VFDs Installed/Utilized? Generally Not
Survey & Findings

Chilled Water System

- Two Water Cooled Chillers
  - 250 Ton (Efficiency 5.4 COP)
  - 800 Ton (Efficiency 5.9 COP)
- Two Evaporative Cooling Towers
  - 40 HP Fans on VFDs
- Two Condenser Water Pumps
  - 50 HP on VFDs
- Two Chilled Water Pumps
  - 60 HP on VFDs
- Current Heat Recovery Strategies:
  - Water Side Economizer: none; CMVC does not have this - less effective than their air-side economizers
  - Heat Recovery Chiller: none
Survey & Findings

Office and Administration Areas

Private and open offices, and general administration areas are dense with computers, printers, fax machines, copy machines, water coolers, coffee makers, specialty machines, task lighting, and personal devices and appliances, where the majority of them, if not all, consume electricity whether in operation or not. Of course they consume more when on, but the standby power or “phantom” loads are significant, and with a staff or over 300, total an amount worthy of reduction considerations.

Almost all of the standby power is converted into heat. During warm periods, additional energy is consumed to remove the extra heat from standby power devices through ventilation and air-conditioning. So, there is a cost for generating the waste heat, and a cost to remove it from the space.
Change Recommendations

Air Handling Systems:

1. Retro-commissioning, calibration, and verification
2. Sequence of Operation evaluation, documentation and modification for:
   - Supply air temperature reset
   - Economizer operation
   - Static pressure reset
   - Space temperature control
3. Redistribution of loads for improved performance
4. ASHRAE-170 for minimum requirements
Change Recommendations

Chiller Water and Boilers:

1. Retro-commissioning, calibration, and verification

2. Sequence of Operation evaluation, documentation and modification for:
   - Air side ecominizing
   - Chiller sequencing
   - Chiller & tower optimization
   - Seasonal start-up & shutdown

3. Cooling tower and chiller cross-connect
Change Recommendations

Chilled Water and Boilers:

CVMC Cooling Load vs. Reheat Load - 2009

Simultaneous Heating And Cooling

The Potential Heat Recovery At Any Point In Time Is The Lesser Of The Heat Source Or The Heat Load
Change Recommendations

People:

- **Get involved.** Regardless of title, position, schedule, or responsibilities, everyone either change the facility’s profile, or maintain the status quo.

- **Switch it off.** Everyone should be on the lookout for power consuming devices that are operating or in a standby mode, and switch them off if not needed.

- **Close windows and doors.** Doors, windows, and other openings to the outside during all seasons must be closed to stop an exchange of heat and air.

- **Don’t fiddle.** Leave setting on HVAC, mechanical, electrical, lighting systems, and equipment alone.

- **Volunteer** to for an energy committee and devote time to make a green difference.

- **Tell someone** if you’ve found or suspect something is consuming too much energy or wasting energy.
Energy Savings Analysis

Install a Condenser Water Heat Recovery Heat Pump System

Potential Savings:

Basis & Assumptions:

- Heat pump performance based on a COP of 3.8 (@ avg 130deg F HWS Temp)
- Cooling tower performance based on 45 gpm/hp
- Fuel @ $2.65 per gal. Elec @ $0.114/kWh
- Recovery Heat Pump Sized for 175 Tons

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<thead>
<tr>
<th>System Impacted</th>
<th>Annual Consumption Differential</th>
<th>Annual Cost Differential</th>
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<tbody>
<tr>
<td>Boiler</td>
<td>(93,000)</td>
<td>Gallons Fuel ($247K)</td>
</tr>
<tr>
<td>Cooling Tower</td>
<td>(37,000)</td>
<td>kWh ($4K)</td>
</tr>
<tr>
<td>Recovery Heat Pump</td>
<td>863,000</td>
<td>kWh $98K</td>
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Net Change: $153K
Est. Installed Cost: $350K
Simple Payback: 2.3 yrs
The Bottom Line

Client has a tremendous opportunity to save energy dollars by employing conservation and efficiency measures and programs. Implementing these measures and programs will reduce operating costs and “green up” the facility and the bottom line!

<table>
<thead>
<tr>
<th>Opportunity</th>
<th>Estimated Annual Savings ($)</th>
<th>Assumed Cost to Implement ($)</th>
<th>Simple Payback (years)</th>
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<tr>
<td>Supply Air Temperature Control</td>
<td>95k</td>
<td>235k</td>
<td>2.5</td>
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<td>Space Temperature Set-point control</td>
<td>63k</td>
<td>110k</td>
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<td>Energy Recovery</td>
<td>153k</td>
<td>350k</td>
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<tr>
<td>Fan Power Reduction</td>
<td>36k</td>
<td>120k</td>
<td>3.3</td>
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<tr>
<td>Lighting Fixture and Controls Upgrade</td>
<td>52.7k</td>
<td>150k</td>
<td>2.8</td>
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<tr>
<td>Plug Load Reductions</td>
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<tr>
<td>Subtotal</td>
<td>22.5k</td>
<td>18k</td>
<td>0.8</td>
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<tr>
<td>Estimated Annual Savings ($): Subtotal</td>
<td>422.2k</td>
<td>983k</td>
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<tr>
<td>Electric Utility Purchasing</td>
<td>10k</td>
<td>2k</td>
<td>0.2</td>
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<tr>
<td>Physical Plant / RCx</td>
<td>Unknown</td>
<td>Unknown</td>
<td>Unknown</td>
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<tr>
<td>Administration / People</td>
<td>20k</td>
<td>35k</td>
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<td>Data / Server Room</td>
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<td>37k</td>
<td>1.22</td>
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<td>TOTAL</td>
<td>452.2k</td>
<td>1,020k</td>
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Develop the Game Plan

ERM WORKSHEET LOG
Updated 10-20-2011

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<th>ERM Open Date</th>
<th>Active</th>
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<td>P-101001</td>
<td>Screw-base LED Lamp Upgrade</td>
<td>Opened – 1/1/01</td>
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<td></td>
<td>Closed – 3/1/11</td>
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<td>P-101002</td>
<td>MOB B LED Lighting Upgrade</td>
<td>Opened – 1/1/01</td>
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<td></td>
<td>Closed – 3/1/11</td>
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<tr>
<td>P-110201</td>
<td>Medical Center Lighting Upgrade</td>
<td>Opened – 11/2010</td>
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<td></td>
<td>Closed – 7/1/11</td>
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<td>P-110202</td>
<td>S3 AHU Controls / F3 Exhaust Retrofit (Kitchen)</td>
<td>Opened – 11/30/2010</td>
<td>CLOSED (Completed)</td>
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<td></td>
<td>Closed – 7/1/11</td>
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<td>P-110203</td>
<td>Energy Star Portfolio Manager</td>
<td>12/2010</td>
<td>YES</td>
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<td>P-110204</td>
<td>Behavior Health Isolation Rooms Negative</td>
<td>12/03/2010</td>
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<td>Pressure, Outside Air Reduction</td>
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CVMC Energy Savings Initiative ESI

Agenda for Meeting No. 36

Meeting Date: February 1, 2013
Meeting Location: Conference Room No. 4

NOTE: The No. 1 task for this meeting is to develop a schedule and milestones, and identify the resources required to accomplish the Objectives stated below.

MISSION: Get back on track, simplify the process, and achieve the Goal.

GOAL: Energy Star certification by the end of 2013! First hospital in VT to achieve the certification.

OBJECTIVES:
1. Finalize AHU SOO programming, upload, debugging, and verification. Complete ASAP.
   a. Chiller optimization – EVT
   b. Rosemont ΔP flow meters for chillers, calibrate, repair or replace - CTI
3. Find new loads for the Templifier, execute design, construction, programming, debugging, start-up and verification. Complete by start of the cooling season.
Develop the Game Plan

<table>
<thead>
<tr>
<th>ERM No.</th>
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<th>Category</th>
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</thead>
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<tr>
<td>P-110216</td>
<td>12/03/10</td>
<td>Parking Lot Upgrade to LED</td>
<td>Lighting</td>
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</table>

<table>
<thead>
<tr>
<th>Implementation Cost Estimated ($)</th>
<th>Implementation Cost Actual ($)</th>
<th>Est. Savings 1st yr. ($</th>
<th>Actual ($ Savings / yr.</th>
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<tbody>
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<td>$37,030.00</td>
<td>$5,280.00</td>
<td>71,720</td>
<td>44,000.00</td>
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</tbody>
</table>

| ROI Pre-tax (%) | Estimated CO₂ Reduction 71,720 lbm/yr | Estimated Energy Savings 44,000.00 kWh/yr | Contribution to Energy Star (Points) | TBD |

<table>
<thead>
<tr>
<th>On-going Measurement</th>
<th>Assigned to: Leo Martineau</th>
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<tbody>
<tr>
<td>Y</td>
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</tr>
</tbody>
</table>

Activity Journal:

02/04/11 Opened ERM

4.3 **Parking lot lighting (ERM P-110216)** – The 400 W high pressure sodium lights should be considered as candidates for upgrade to LED. 2111 rebates through Efficiency Vermont will be available.

**ACTION:** Team to make this an active ERM and determine cost, incentives, rebates, and return on investment for capital consideration.

4.3.1 Upgrade in progress; work by Benoit Electric.
Progress Towards Goal

ERM Master Cash Savings - Draft & Preliminary

Cumulative savings

- ERM Cost
- 1st Year
- 2nd Year
- 3rd Year
- 4th Year
- 5th Year
- Measure Life

Cumulative savings:
- ERM Cost: $699,750
- 1st Year: $270,974
- 2nd Year: $549,049
- 3rd Year: $812,973
- 4th Year: $1,083,897
- 5th Year: $1,354,872
- Measure Life: $2,709,744
Early Successes
Chiller Cross-connect
Re-tuning Control Sequences of Operation
Collect and Review Documentation
Floor Plans

CVMC FIRST FLOOR AHU ZONES
Central Vermont Medical Center

CHILLED WATER SYSTEM

- System Enable: Enable
- OAT System Enable Sp: 48.00 °F
- Outside Air Temperature: 42.21 °F
- Outside Air Enthalpy Sp: 15.00 btu/lb
- Outside Air Enthalpy: 0.0 btu/lb
- NORMAL POWER: On
- EMERG. POWER: Off

CH2 Operation Min Speed Sp: 0.00 %

- CHwp-1 Cmd: Off
- CHwp-1 Speed: 0%
- CHwp-1 Status: Off
- CHwp-2 Cmd: Off
- CHwp-2 Speed: 0%
- CHwp-2 Status: Off
- Cdwpsp Min Speed Sp: 0 %
- Cdwpsp Low Temp Sp: 55.00 °F
- Cdwpsp High Temp Sp: 90.00 °F

- Cdwpsp Temp: 0.0 °F
- Cdwpsp Sp: 93.00 °F
- Cdwpsp Flow: 0 gpm

- Cdwpsp Temp: 0.0 °F
- Cdwpsp Sp: 95.00 °F

- Bypass Valve: Closed
- CH2 Cmd: Off
- CH2 Status: Off
- CH1 Cmd: Off
- CH1 Status: Off

Chwr Flow: 0 gpm

- CHwr Temp: 0.0 °F
- CHwr Diff Pressure: 0.0 psi
- CHwr Diff Press Sp: 0.0 psi

Chwr Flow: 0 gpm

- Bypass Valve: Closed
- CH2 Cmd: Off
- CH2 Status: Off

Chwr Temp: 0.0 °F

- CHwr Low Temp Alarm: Normal
- CHwr High Temp Alarm: Normal

Chwr Sp Reset Schedule:
- When OAT Sp: 55.00 °F
- Chwr Sp should be: 44.00 °F
- When OAT Sp: 81.00 °F
- Chwr Sp should be: 42.00 °F

- CHwr Sp: 44.00 °F
- CHwr Low Temp Alarm: Normal
- CHwr High Temp Alarm: Normal

BAS Screen Shots
Sequence of Operations
CVMC Hot Water Upgrade Project:
Barre, Vermont CTI Job # V04355
Hot Water Circulating Pump Start Up
1. The hot water heating circulating pump shall run continuously. The hot water heating circulating pumps will cycle every 200 hours. On a call for start-up the hot water heating circulating pump will ramp up to the preset frequency. If the lead pump fails to start than the lag pump will enable and an alarm will be initiated. The lead pump is selectable from the graphical user interface (GUI).

Hot Water Heating System Operation
1. The hot water circulating pump VFD’s will modulate to maintain system differential pressure. Provide a user programmable set point on the “front-end” for the hot water heating system differential pressure. The hot water circulating pump VFD’s will not be modulated below the minimum flow set point for the pumps (33%, adjustable from GUI). Provided a user programmable set point for the hot water circulating pump VFD minimum flow. When the hot water pump VFD is at the minimum flow set point, the differential bypass valve will modulate to maintain system differential pressure. (16 psi, adjustable from GUI).

Hot Water Heating System Temperature Control
1. The hot water steam converters will cycle every 200 hours. On a call for switch over, the lag hot water steam converter motorized butterfly valve shall be opened. When the lag hot water steam converter motorized butterfly valve is opened, the lead hot water steam converter motorized butterfly valve shall be closed. If the lag hot water steam converter motorized butterfly valve fails to open an alarm shall be initiated and the lead steam converter motorized butterfly valve shall remain open. If the lead hot water steam converter motorized butterfly valve fails to close and alarm shall be initiated. The hot water steam converter steam control valves will modulate in sequence to maintain a hot water supply temperature according to the following reset schedule:

<table>
<thead>
<tr>
<th>OA Temp:</th>
<th>-30°F to 50°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWS Temp:</td>
<td>180°F to 160°F</td>
</tr>
<tr>
<td>OA Temp:</td>
<td>50°F to 95°F</td>
</tr>
<tr>
<td>HWS Temp:</td>
<td>160°F to 140°F</td>
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</tbody>
</table>

Provide user programmable set points for both reset schedule outdoor air temperature ranges. Provide a user programmable set point for both hot water heating temperature ranges. Provide a user programmable hot water heating system reset schedule override.

Perimeter Hot Water Heating System Operation And Control
1. The perimeter hot water circulating pumps shall be enabled when the outdoor air temperature is below set point. (40°F, adjustable from GUI) Provide a user programmable set point for perimeter hot water circulating pump enable temperature. The perimeter hot water circulating pumps will cycle every 200 hours. On a call for start-up the hot water heating circulating pump VFD will ramp up to the preset frequency. If the lead pump fails to start than the lag pump will enable and an alarm will be initiated. The perimeter circulating pump VFD’s will modulate to maintain system differential pressure. Provide a user programmable set point on the “front-end” for the perimeter heating system differential pressure. (8 psi, adjustable from GUI) The perimeter circulating pump VFD’s will not be modulated below the minimum flow set point for the pumps. Provide a user programmable set point for the perimeter circulating pump VFD minimum flow. When the perimeter pump VFD is at the minimum flow set point, the differential bypass valve will modulate to maintain system differential pressure. The mixing valve shall modulate to maintain a perimeter hot water supply temperature according to the following reset schedule.

<table>
<thead>
<tr>
<th>OA Temp:</th>
<th>-30°F to 50°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>HWS Temp:</td>
<td>160°F to 130°F</td>
</tr>
</tbody>
</table>

Provide user programmable set points for both reset schedule outdoor air temperature ranges. Provide a user programmable set point for both hot water heating temperature ranges. Provide a user programmable hot water heating system reset schedule override.

Revise Sequences to Actual Conditions

1980 Heating System Operation And Control
Reheat pumps:
The lead reheat hot water circulating pump shall be enabled at all times. If the lead pump fails to start then the lag pump will enable and an alarm will be initiated. When the outside air temperature falls below the user adjustable setpoint (currently 15°F), both reheat pumps will operate at the same time.

Perimeter pumps:
The lead reheat hot water circulating pump shall be enabled when the outside air temperature falls below the user adjustable setpoint (currently 45°F). If the lead pump fails to start then the lag pump will enable and an alarm will be initiated.

Heat Exchangers:
The heat exchanger control valves are currently controlled via a pneumatic control system.
Evaluate
Propose

Will you marry me?

No
Propose
Create/Validate New Sequences
Calibrate
Calibrate
Calibrate
Implement New Sequences
Monitoring Based Commissioning
Monitoring Based Commissioning
Monitoring Based Commissioning

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<th>times</th>
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<td>4-Jul-2011</td>
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<td>6:00a (45min)</td>
<td>merchantBank</td>
<td>thirdFloorZoneTemps</td>
<td>$2.69</td>
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<tr>
<td>Cooling Tower Fan On</td>
<td>coolingTowerFan</td>
<td>Details</td>
<td>4-Jul-2011</td>
<td>6hr 30min</td>
<td>12:00a (15min), 1:30a (15min), 2:30a (30min), ...</td>
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<td>heatPumpLoop</td>
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<td>fourthFloorS26Temp</td>
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<td>4-Jul-2011</td>
<td>1h</td>
<td>5:00p (1hr)</td>
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<td>4-Jul-2011</td>
<td>5hr 45min</td>
<td>6:45a (30min), 12:30p (30min), 1:15p (4hr 45min)</td>
<td>merchantBank</td>
<td>thirdFloorZoneTemps</td>
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<td>6:15a (30min), 7:15a (15min), 8:00a (15min), ...</td>
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<td>Temp too hot unoccupied</td>
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<td>fourthFloorS12Temp</td>
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<td>30min</td>
<td>11:00a (15min), 11:30a (30min), 1:15p (30min), ...</td>
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<td>Temp too hot occupied</td>
<td>fourthFloorS4Temp</td>
<td>Details</td>
<td>5-Jul-2011</td>
<td>8hr 45min</td>
<td>6:00a (1hr), 7:15a (30min), 8:00a (45min), ...</td>
<td>merchantBank</td>
<td>fourthFloorZoneTemps</td>
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<td>Temp too hot occupied</td>
<td>secondFloorS20Temp</td>
<td>Details</td>
<td>5-Jul-2011</td>
<td>8h</td>
<td>9:15a (1hr), 10:30a (45min), 11:30a (15min), ...</td>
<td>merchantBank</td>
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<td>No Night Schedule</td>
<td>secondFloorS11Temp</td>
<td>Details</td>
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<td>12h</td>
<td>12:00a (6hr), 6:00p (6hr)</td>
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<td>secondFloorZoneTemps</td>
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<td>12:00a (6hr), 6:00p (6hr)</td>
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<td>9:00a (1hr 45min), 11:00a (1hr 15min), 2:00p (2hr), ...</td>
<td>merchantBank</td>
<td>secondFloorZoneTemps</td>
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</tbody>
</table>
Energy Metrics
Update Documentation
Energy Star Score

13% reduction

Worst Performers = High Energy Use

Benchmark

Best Performers = Low Energy Use

Efficiency Vermont
<table>
<thead>
<tr>
<th>Project Description</th>
<th>Date Completed</th>
<th>Project Cost</th>
<th>Resource Savings $</th>
<th>kWh</th>
<th>MMBTU</th>
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<tr>
<td>Energy Audit</td>
<td>Jul 2010</td>
<td>$27,500</td>
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<td>Kitchen Exhaust Fan VFD</td>
<td>Oct 2010</td>
<td>$2,633</td>
<td>$15,764</td>
<td>25,768</td>
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<td>Hospital-wide - LED Lighting</td>
<td>Dec 2010</td>
<td>$4,700</td>
<td>$2,956</td>
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<td>MOB B Parking Lot - LED Lighting</td>
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<td>$3,600</td>
<td>$1,458</td>
<td>11,517</td>
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<td>Hospital-wide - T12 Retrofit &amp; Controls</td>
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<td>$50,606</td>
<td>$9,341</td>
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<td>Woodridge Nursing - T12 Retrofit</td>
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<td>Server Virtualization</td>
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<td>AHU-4 Controls</td>
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<td>Kitchen Exhaust Fan Controls</td>
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<td>$24,597</td>
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<td>Central Sterile Supply - Time of Day</td>
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<td>$0</td>
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<td>Emergency Room - Renovations</td>
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<td>$1,380</td>
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<td>1980 Hot Water Loop - Temp Reset</td>
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<td>$18,844</td>
<td>199,782</td>
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<td>Central Sterilizer - AHU-S20</td>
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<td>$44,195</td>
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<td>29,704</td>
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<td>Heat Recovery Heat Pump</td>
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<td>$470,000</td>
<td>$175,395</td>
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<td>LED Recessed Cans</td>
<td>Jan 2013</td>
<td>$400</td>
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<td>1,064</td>
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<td><strong>Totals</strong></td>
<td><strong>$760,153</strong></td>
<td><strong>$294,983</strong></td>
<td><strong>296,300</strong></td>
<td><strong>(11817.4)</strong></td>
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</tbody>
</table>
Ongoing Efforts

- Finish AHU SOO upload, debug, and verification
- Chilled Water SOO / Chiller optimization
- New loads for the Templifier
- Building heating hot water SOO
- HVAC operation versus requirements of ASHRAE-170
- AHU-1 off load and optimization
- Pneumatic to digital upgrades
- Shifting AHU loads
- Summer boiler
Lessons Learned

• Make the commitment
• Engage leadership
• Identify an Energy Champion
• Team-based approach to leverage skills
• Perseverance
• “It really does work”

• Have fun!
Questions?