Hotel Energy Efficiency

A Webinar on Energy Efficiency Opportunities in Minnesota’s Hospitality Sector
January 12, 2016

Research funded by the Minnesota Department of Commerce, Division of Energy Resources
Michaels Energy

- Headquarters in La Crosse WI
- Engineering and Energy Efficiency Consulting
- Six CARD grant studies since 2008
CARD Grants: Help Utilities Achieve 1.5% Annual Savings Goals
Agenda

• Background on the Study
• Initial Findings
  - Guest Comfort and Energy Efficiency
  - End Use Analysis
  - Non-Energy Savings
• Specific Measures
• Recommendations
• Discussion
STUDY BACKGROUND
Why Mid-Scale Hotels?

• Energy Intensive Small Businesses

• Unique issues
Assumptions on Measures

* Photo credit for Ozone Laundry Systems, www.ozonelaundrysystmes.com
Pilot Design

Pilot Program Design

Recruitment: Recruit hotels via partnerships with trade organizations, utilities, hotel chains, and management groups.

Benchmark:
- Gather hotel building and occupancy information from staff
- Collect and review historical energy use data (electric, gas, water)
- Calculate ENERGY STAR benchmark score

Audit:
- Invite utility representatives and/or local contractors to participate in walkthrough to assist with rebate applications and equipment proposals
- Interview hotel staff, including manager and facility engineer
- Technical Audit (ASHRAE Level II)
  - Document all equipment for guestrooms, HVAC, interior and exterior lighting, water heating, pool heating and circulation pumps, and laundry
  - Measure various building conditions, including guestroom light levels, building and pool room pressure, pool/spat temperatures and pool room temperature and humidity
  - Gather equipment usage information (lighting runtimes, guestroom equipment status when room is vacant)
  - Document ENERGY STAR requirements for building certification (if applicable)

Follow-up:
- Comprehensive report and recommendations for each hotel
- Contractors present respective equipment proposals (if applicable)

Top 10-25%:
- ENERGY STAR Certification

Bottom 10-25%:
- Additional technical support, connection to contractors, bids
INITIAL FINDINGS
GUEST COMFORT
Guest Comfort Survey

Highlights from Guest Comfort Survey
Guest Comfort

- Satisfaction with Temperature Control
- Temperature Consistency
- Quietness of the Heating and Cooling Unit
- Ambient Quietness
- Bed Comfort
- Sheet Softness
- Towel Softness
- Satisfaction with Water Temperature
- Satisfaction with Water Pressure

Legend:
- 1 = Least Satisfactory
- 2
- 3
- 4 = Neutral
- 5
- 6
- 7 = Most Satisfactory
- N/A
What matters most to Guests

- Cleanliness
- Bed Comfort
- Quietness
- Friendly Staff
- Room Temperature
- Bathroom Amenities
- Hotel Common Areas
- Room Lighting
ENERGY USE
Electric End Use

- Electric Heating, 31%
- Lighting, 20%
- AC & Dehumid., 18%
- Fans & Pumps, 11%
- Major Appliances, 8%
- Misc, 9%
- Kitchen, 3%
Annual Gas Use

Hotel Annual Gas Usage

- PILOT STUDY AVERAGE: 34,000 therms
- MNTAP AVERAGE: 30,000 therms

Annual Gas Use [therms]

Number of Rooms

8 ← 233
Gas End Use

- Natural Gas HVAC
  - 19%
- Natural Gas Domestic Hot Water
  - 28%
- Natural Gas Pool HVAC and Water
  - 22%
- Natural Gas Laundry
  - 12%
- Natural Gas Fireplaces
  - 6%
- Natural Gas Kitchen
  - 13%
NON-ENERGY SAVINGS
<table>
<thead>
<tr>
<th>Energy Saving Measure</th>
<th>% of Hotels Identified</th>
<th>Average Measure Cost ($)</th>
<th>Average Annual Energy Savings ($)</th>
<th>Average Maintenance Savings ($)</th>
<th>Average Utility Rebate ($)</th>
<th>Payback WITH Maint. Savings (Years)</th>
<th>Payback W/O Maint. Savings (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace Exterior Lighting with LED</td>
<td>92%</td>
<td>$14,000</td>
<td>$1,700</td>
<td>$740</td>
<td>$2,200</td>
<td>4.8</td>
<td>6.9</td>
</tr>
<tr>
<td>Retrofit T8 and T12 Fixtures with LED Tubular Lamps</td>
<td>92%</td>
<td>$6,600</td>
<td>$1,100</td>
<td>$330</td>
<td>$1,500</td>
<td>3.9</td>
<td>4.6</td>
</tr>
<tr>
<td>Replace Pool Area Lighting with LED</td>
<td>74%</td>
<td>$3,500</td>
<td>$940</td>
<td>$340</td>
<td>$470</td>
<td>2.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Replace Common Area Lighting with LED</td>
<td>76%</td>
<td>$3,900</td>
<td>$1,500</td>
<td>$1,500</td>
<td>$1,400</td>
<td>0.9</td>
<td>1.7</td>
</tr>
</tbody>
</table>
## Water Savings

<table>
<thead>
<tr>
<th>Energy Saving Measure</th>
<th>% of Hotels Identified</th>
<th>Average Measure Cost ($)</th>
<th>Average Annual Energy Savings ($)</th>
<th>Average Water Savings ($)</th>
<th>Average Utility Rebate ($)</th>
<th>Payback WIH Water Savings (Years)</th>
<th>Payback W/O Water Savings (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install Efficient Showerheads in Guestrooms</td>
<td>84%</td>
<td>$5,700</td>
<td>$640</td>
<td>$690</td>
<td>$380*</td>
<td>4.6</td>
<td>8.3</td>
</tr>
<tr>
<td>Install Efficient Faucet Aerators in Guestrooms</td>
<td>92%</td>
<td>$600</td>
<td>$120</td>
<td>$190</td>
<td>$70</td>
<td>2.4</td>
<td>4.4</td>
</tr>
<tr>
<td>Implement Low Temperature Laundry System</td>
<td>82%</td>
<td>$1,000*</td>
<td>$1,000</td>
<td>$1,100</td>
<td>$0</td>
<td>0.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*Photo credits CenterPoint Energy*
Blower Door Testing

Bare wall
ENERGY STAR
## Recommended Measures

<table>
<thead>
<tr>
<th>Energy Saving Measure</th>
<th>% of Hotels in need of Measure</th>
<th>Average Measure Cost ($)</th>
<th>Average Electrical Savings (kWh)</th>
<th>Average Monthly Demand Savings (kW)</th>
<th>Average Gas Savings (therms)</th>
<th>Average Annual Energy Savings ($)</th>
<th>Average Non-Energy Savings ($)</th>
<th>Average Utility Rebate ($)</th>
<th>Average Payback (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Replace Exterior Lights with LED Fixtures</td>
<td>92%</td>
<td>$14,000</td>
<td>27,000</td>
<td>-</td>
<td>-</td>
<td>$1,700</td>
<td>$740</td>
<td>$2,200</td>
<td>4.8</td>
</tr>
<tr>
<td>Retrofit T8 and T12 Fixtures with LED Tubular Lamps</td>
<td>92%</td>
<td>$6,600</td>
<td>12,000</td>
<td>2.3</td>
<td>-</td>
<td>$1,100</td>
<td>$330</td>
<td>$1,500</td>
<td>3.9</td>
</tr>
<tr>
<td>Replace Pool Area Lighting with LED Lamps</td>
<td>74%</td>
<td>$3,500</td>
<td>11,000</td>
<td>1.7</td>
<td>-</td>
<td>$940</td>
<td>$340</td>
<td>$470</td>
<td>2.3</td>
</tr>
<tr>
<td>Replace Common Area Lights with LED Lamps</td>
<td>76%</td>
<td>$3,900</td>
<td>17,000</td>
<td>2.5</td>
<td>-</td>
<td>$1,500</td>
<td>$1,500</td>
<td>$1,400</td>
<td>0.9</td>
</tr>
<tr>
<td>Install Occupancy Sensors on Lighting in Public Spaces</td>
<td>74%</td>
<td>$730</td>
<td>3,400</td>
<td>0.1</td>
<td>-</td>
<td>$260</td>
<td>-</td>
<td>$130</td>
<td>3.0</td>
</tr>
<tr>
<td>Replace PTACs with Heat Pump Units</td>
<td>42%</td>
<td>$6,000*</td>
<td>54,000</td>
<td>3.5</td>
<td>-</td>
<td>$4,200</td>
<td>-</td>
<td>$4,800</td>
<td>0.3</td>
</tr>
<tr>
<td>Install Liquid Pool Cover</td>
<td>79%</td>
<td>$920</td>
<td>2,100</td>
<td>0.1</td>
<td>690</td>
<td>$740</td>
<td>$30</td>
<td>-</td>
<td>1.6</td>
</tr>
<tr>
<td>Install Efficient Showerheads in Guestrooms</td>
<td>84%</td>
<td>$5,700</td>
<td>-</td>
<td>-</td>
<td>710</td>
<td>$640</td>
<td>$690</td>
<td>$380</td>
<td>4.6</td>
</tr>
<tr>
<td>Install Efficient Faucet Aerators in Guestrooms</td>
<td>92%</td>
<td>$600</td>
<td>-</td>
<td>-</td>
<td>140</td>
<td>$120</td>
<td>$190</td>
<td>$70</td>
<td>2.4</td>
</tr>
<tr>
<td>Replace Standard Water Heaters with High Efficiency Units</td>
<td>66%</td>
<td>$5,800*</td>
<td>-</td>
<td>-</td>
<td>840</td>
<td>$690</td>
<td>-</td>
<td>$1,000</td>
<td>7.0</td>
</tr>
<tr>
<td>Implement Low Temperature Laundry System</td>
<td>82%</td>
<td>$1,000*</td>
<td>-</td>
<td>-</td>
<td>1,100</td>
<td>$1,000</td>
<td>$1,100</td>
<td>-</td>
<td>0.5</td>
</tr>
<tr>
<td>Install Occupancy Controller for Vending Machines</td>
<td>66%</td>
<td>$590</td>
<td>2,600</td>
<td>-</td>
<td>-</td>
<td>$170</td>
<td>-</td>
<td>$120</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>TOTALS</strong></td>
<td><strong>%</strong></td>
<td><strong>$49,340</strong></td>
<td><strong>129,100</strong></td>
<td><strong>10.2</strong></td>
<td><strong>3480</strong></td>
<td><strong>$13,060</strong></td>
<td><strong>$4,920</strong></td>
<td><strong>$12,070</strong></td>
<td><strong>2.1</strong></td>
</tr>
</tbody>
</table>
Not Ready for Prime Time?

Guest Room Energy Management Systems

Ozone Laundry

MichaelsEnergy
LOW TEMP LAUNDRY
How do Low Temperature Detergents Work?

- **Savings from:**
  - Enzymes break down the dirt and stains at lower temperatures
  - Polymers and surfactants keep the dirt and grease suspended in the water so less rinse cycles are needed

- **Results:**
  - Reducing hot water usage
  - Reducing number of cycles
EcoLab’s Aquanomic Laundry Program

Traditional Laundry Program
Typical 100-lb. Machine

- 111 Gallons of Hot Water
- 103 Gallons of Cold Water
- 214 Gallons of Water
- 0.97 Therms of Energy

Aquanomic Laundry Program
Typical 100-lb. Machine

- 51 Gallons of Hot Water
- 83 Gallons of Cold Water
- 133 Gallons of Water
- 0.43 Therms of Energy

Traditional Wash Cycle
Typical 100-lb. Machine

- Hot Water
- Cold Water

Aquanomic Smart Wash Process
Typical 100-lb. Machine

- No change in overall cycle time versus traditional wash.

Source: EcoLab
## Hotel Laundry

<table>
<thead>
<tr>
<th></th>
<th>Base</th>
<th>Proposed</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Therms</td>
<td>1,950</td>
<td>800</td>
<td>1,150</td>
</tr>
<tr>
<td>Gallons Water</td>
<td>400,000</td>
<td>192,000</td>
<td>218,400</td>
</tr>
<tr>
<td>Detergent</td>
<td>$4,800</td>
<td>$5,760</td>
<td>$960 Cost</td>
</tr>
</tbody>
</table>
LIQUID POOL COVER
HVAC Issues with Hotel Pools

Indoor Environment
• Air Temp 82 F, Water Temp 80 F, RH 60% Max
• Room at Negative Pressure

Lots of Open Hours with No Use

Pool Covers – Nobody uses them…

Integrity of Structure Important
Liquid Pool Cover

+ VS +

Michaels Energy
The Hazard Potential or...the “yuck” factor

What is this stuff?

<table>
<thead>
<tr>
<th>Alcohol Type</th>
<th>Percentage</th>
<th>TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethyl Alcohol – or corn based alcohol</td>
<td>95.24%</td>
<td>1000 ppm</td>
</tr>
<tr>
<td>Isopropyl Alcohol – “rubbing alcohol”</td>
<td>4.76%</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

Amount = 1 oz. per 400 SF of Surface

Active Ingredient is Biodegradable – need to add to pool daily

How about that Chlorine?

Chlorine needed all the time for disinfecting | TLV = 0.5 ppm
## Measurement and Verification of Savings

<table>
<thead>
<tr>
<th>HVAC System Type</th>
<th>Hotel 1</th>
<th>Hotel 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DX with Water Heat Recovery</td>
<td>Outdoor Air Dilution with DX Cooling</td>
</tr>
<tr>
<td><strong>Reduced Evaporation</strong></td>
<td>40%</td>
<td>19%</td>
</tr>
<tr>
<td><strong>kW Savings, at $9.43/kW</strong></td>
<td>$300</td>
<td>$100</td>
</tr>
<tr>
<td><strong>kWh Savings at $0.07/kWh</strong></td>
<td>$900</td>
<td>$200</td>
</tr>
<tr>
<td><strong>Therm Savings at $0.79/Therm</strong></td>
<td>-</td>
<td>$400</td>
</tr>
<tr>
<td><strong>Total Energy Savings, $</strong></td>
<td>$1,200</td>
<td>$700</td>
</tr>
<tr>
<td><strong>One Time Equipment Cost</strong></td>
<td>$500</td>
<td>$500</td>
</tr>
<tr>
<td><strong>Annual Chemical</strong></td>
<td>$180</td>
<td>$320</td>
</tr>
<tr>
<td><strong>Payback First Year, months</strong></td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td><strong>Payback After First Year, months</strong></td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>% Effectiveness</strong></td>
<td>73%</td>
<td>64%</td>
</tr>
</tbody>
</table>
Rebating Consumables?

Liquid Pool Covers

Low Temperature Laundry Detergents
RECOMMENDATIONS
Brand Standards and Hotel Leadership

Brand
- Brand Standard
- Green Certification Programs

Ownership Entity
- Capital Budget
- Multiple Locations

General Manager
- O & M Budget
- Staff Management
- Implementation
Case Study of GM Leadership
## Potential for Savings

<table>
<thead>
<tr>
<th>Savings Potential</th>
<th>Electrical Savings (kWh)</th>
<th>Monthly Demand Savings (kW)</th>
<th>Gas Savings (therms)</th>
<th>Annual Energy Savings ($)</th>
<th>Non-Energy Savings ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weighted Single-Property Savings</td>
<td>85,600</td>
<td>6.9</td>
<td>2,700</td>
<td>$9,000</td>
<td>$4,100</td>
</tr>
<tr>
<td>MN Savings Potential</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% Impact 125 Hotels</td>
<td>10,700,000</td>
<td>860</td>
<td>340,000</td>
<td>$1,100,000</td>
<td>$510,000</td>
</tr>
<tr>
<td>25% Impact 310 Hotels</td>
<td>26,800,000</td>
<td>2,200</td>
<td>840,000</td>
<td>$2,800,000</td>
<td>$1,300,000</td>
</tr>
<tr>
<td>50% Impact 625 Hotels</td>
<td>53,500,000</td>
<td>4,300</td>
<td>1,700,000</td>
<td>$5,600,000</td>
<td>$2,600,000</td>
</tr>
</tbody>
</table>
Summary and Recommendations

- Utility Energy Audits
- Involve contractors
- Drive rebate awareness and use
- Engage GM in leadership
- Tap into brand standard requirements
- Minimize guest comfort concerns
- Pros and Cons to ENERGY STAR
Questions?

Hotel Energy Efficiency Final Report

Contact us!
Michaels Energy
430 1st Ave North
Minneapolis, MN 55401

612-418-3432
nmkelly@michaelsenergy.com