High Impact Hotel Projects

Greater Boston Energy Efficient Hotels Conference

December 6, 2012
Agenda

• High Energy Impact Projects
• Case Studies
  – Millennium Bostonian
  – Viking Hotel
• Available Resources
• Questions
Lighting

Two Common Types

• LED
  – MR16
  – PAR 30
  – A19

• Fluorescent
  – Compact fluorescent lamps (CFL)
  – 32W T8 conversion to 28W T8 or 25W T8
  – 32W U-tube conversion to 17W T8 linear
Chilled Water Plant

• Optimization Software
  – Multiple vendors available
  – Multiple chiller operation
  – Operates chiller plant at most efficient operating point

• Magnetic Bearing Chillers
  – IPLV ~ 0.31 kW/ton
  – Exceeds ASHRAE 90.1-2007 energy code
  – Retrofit compressors or new installation
Boiler Plant

• Condensing Heating Hot Water Boilers
  – Efficiency range 90% - 96%
  – Excellent application for hotels with heat pumps or pools

• Condensing Domestic Hot Water (DHW) Boilers
  – Thermal efficiencies up to 99%
  – Capacity from 125-1,200 gal
  – Long Life
Heat Pump Alternatives

• 4-Pipe Fan Coil Units (FCUs)
  – Integrates wirelessly with network guest room controls
  – Requires chiller installation and HW boiler capacity verification
  – Excellent occupant comfort

• 2-Pipe Fan Coil Unit
  – Electric strip heat for shoulder months
  – Integrates wirelessly with network guest room controls
Kitchens

• Kitchen Hood Controls
  – HVAC system modulates based on cooking range activities i.e heat and smoke

• Walk-In Cooler Refrigeration Controls
  – Cycles refrigeration compressors on/off based on walk-in cooler space temperature
Heat Recovery

- **Glycol Run Around Loop**
  - Good for long distance pipe runs
  - Pumping penalty

- **Heat Pipes**
  - Passive system
  - Limiting factor is distance
  - Bypass option to reduce pressure drop

- **Total Energy Recovery Wheel**
  - Retrofit or new application
  - Bypass option to reduce pressure drop
Cogeneration

- Simultaneous generation of electricity and thermal energy (Steam or HW)
- Thermal base load needed
- $750/kW utility incentive
Sebesta Blomberg’s Hotel Experience

Wide range:

• Nationwide
• Audits and retro-cx
• 250 – 1,400 rooms
• 190,000 – 1.1 mil. sqft.
• Range of systems, ages, condition
Case Studies

Viking Hotel, Newport, RI

Millennium Bostonian, Boston, MA
Millennium Bostonian Hotel

• 135,000 sqft, 201 guest rooms
• Built in 1982 plus 1998 addition
• Focused on rooftop units (RTUs), heat pumps, boilers, building envelope, controls, and lighting

• 14 ECMs identified
  – Annual savings estimate = $140,000 (19%)
  – Implementation costs = $660,500
## Millennium Bostonian Hotel

### Section Energy Conservation Measures (ECMs)

<table>
<thead>
<tr>
<th>Section</th>
<th>Energy Conservation Measures (ECMs)</th>
<th>Estimated Implementation Cost</th>
<th>Utility Incentive</th>
<th>Demand (kW)</th>
<th>Electric (kWh)</th>
<th>Gas (Therms)</th>
<th>Water/Sewer (kGal)</th>
<th>Estimated Annual Utility Savings</th>
<th>Estimated Annual Cost Avoidance</th>
<th>GHG Offset (Metric Tonnes CO2)</th>
<th>Simple Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Retrofit 34W T12 Light Fixtures with 28W T8</td>
<td>$7,200</td>
<td>$975</td>
<td>0.8</td>
<td>6,800</td>
<td>0</td>
<td>0</td>
<td>$952</td>
<td>3</td>
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<tr>
<td>5.2</td>
<td>Retrofit 32W T8 U-Tube Light Fixtures with 17W T8</td>
<td>$1,100</td>
<td>$400</td>
<td>0.2</td>
<td>1,200</td>
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<td>0</td>
<td>$168</td>
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<td>5.3</td>
<td>Install Par 20 LED Lamps</td>
<td>$6,400</td>
<td>$637</td>
<td>10.0</td>
<td>88,000</td>
<td>0</td>
<td>0</td>
<td>$12,320</td>
<td>0</td>
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<tr>
<td>5.4</td>
<td>Install Par 38 LED Lamps</td>
<td>$1,400</td>
<td>$840</td>
<td>1.3</td>
<td>6,500</td>
<td>0</td>
<td>0</td>
<td>$910</td>
<td>3</td>
<td>0.8</td>
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<td>5.5</td>
<td>Replace 200W Halogen with 49W LED</td>
<td>$8,500</td>
<td>$0</td>
<td>3.2</td>
<td>18,500</td>
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<td>0</td>
<td>$2,59</td>
<td>0</td>
<td>9</td>
<td>3.3</td>
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<td>5.6</td>
<td>Replace Incandescent Exit Signs with LED</td>
<td>$3,600</td>
<td>$120</td>
<td>0.3</td>
<td>2,600</td>
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<td>0</td>
<td>$364</td>
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<td>5.7</td>
<td>Install MR16 LED lamps</td>
<td>$13,400</td>
<td>$7,840</td>
<td>6.3</td>
<td>46,000</td>
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<td>0</td>
<td>$6,44</td>
<td>0</td>
<td>21</td>
<td>0.9</td>
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<td>5.8</td>
<td>Add Integrated Enthalpy Economizer Strategy</td>
<td>$7,800</td>
<td>$900</td>
<td>0</td>
<td>43,000</td>
<td>0</td>
<td>0</td>
<td>$6,02</td>
<td>0</td>
<td>20</td>
<td>1.1</td>
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<tr>
<td>5.9</td>
<td>Demand Controlled Ventilation</td>
<td>$12,200</td>
<td>$1,350</td>
<td>16</td>
<td>3,000</td>
<td>1,700</td>
<td>0</td>
<td>$910</td>
<td>3</td>
<td>0.8</td>
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<td>5.10</td>
<td>Install Sink Aerators</td>
<td>$0</td>
<td>$75</td>
<td>0</td>
<td>0</td>
<td>110</td>
<td>3.2</td>
<td>$340</td>
<td>6</td>
<td>0.0</td>
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<td>5.11</td>
<td>Modify Condenser Water Loop Heating Setpoint</td>
<td>$0</td>
<td>$0</td>
<td>21</td>
<td>102,000</td>
<td>(1,455)</td>
<td>0</td>
<td>$12,537</td>
<td>(29)</td>
<td>0</td>
<td>0.0</td>
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Subtotal | $61,600 | $13,137 | 59.1 | 317,600 | 355.0 | 3.2 | $45,135 | 125 | 1.1 |

### Section Capital Energy Conservation Measures (ECMs)

<table>
<thead>
<tr>
<th>Section</th>
<th>Capital Energy Conservation Measures (ECMs)</th>
<th>Estimated Implementation Cost</th>
<th>Utility Incentive</th>
<th>Demand (kW)</th>
<th>Electric (kWh)</th>
<th>Gas (Therms)</th>
<th>Water/Sewer (kGal)</th>
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<th>GHG Offset (Metric Tonnes CO2)</th>
<th>Simple Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>Install Natural Gas Condensing Boilers</td>
<td>$115,000</td>
<td>$7,000</td>
<td>0</td>
<td>0</td>
<td>12,100</td>
<td>0</td>
<td>$14,762</td>
<td>638</td>
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<tr>
<td>6.2</td>
<td>Install Energy Management System (EMS)</td>
<td>$456,500</td>
<td>$34,950</td>
<td>0</td>
<td>510,000</td>
<td>6,000</td>
<td>0</td>
<td>$78,720</td>
<td>553</td>
<td>4.0</td>
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<tr>
<td>6.3</td>
<td>Replace Duplex City Water Booster Pumps</td>
<td>$27,500</td>
<td>$3,600</td>
<td>16,000</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>$2,59</td>
<td>0</td>
<td>7</td>
<td>4.7</td>
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</table>

Subtotal | $599,000 | $45,550 | 0 | 526,000 | 18,100 | 0 | $95,722 | 1,199 | 4.2 |

## Combined CapEx and ECMs

<table>
<thead>
<tr>
<th>Section</th>
<th>Estimated Implementation Cost</th>
<th>Utility Incentive</th>
<th>Demand (kW)</th>
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<th>Gas (Therms)</th>
<th>Water/Sewer (kGal)</th>
<th>Estimated Annual Utility Savings</th>
<th>Estimated Annual Cost Avoidance</th>
<th>GHG Offset (Metric Tonnes CO2)</th>
<th>Simple Payback (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL</td>
<td>$660,600</td>
<td>$58,657</td>
<td>59.1</td>
<td>643,600</td>
<td>18,455</td>
<td>3.2</td>
<td>$140,857</td>
<td>1,325</td>
<td>3.3</td>
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### Estimated Blended Marginal Rates and Greenhouse Gas Values

- **0.14 $/kWh** Electricity
- **1.22 $/Therm Gas**
- **65 $/kGal**
- **0.00046 Metric Tonne CO2/kWh (Utility Power)**
- **0.00528 Metric Tonne CO2/Therm Natural Gas**
Viking Hotel

- 142,000 sqft, 222 guest rooms
- Built 1920’s
- Focused on roof top units (RTUs), heat pumps, boilers, controls, lighting, and envelope
- Heavily metered

- 14 ECMs identified
  - Annual savings estimate = $104,000 (18%)
  - Implementation costs = $773,000
### Viking Hotel

<table>
<thead>
<tr>
<th>“Low-cost” ECM</th>
<th>Cost</th>
<th>Savings</th>
<th>SPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Tune Bldg 3 RTU controls</td>
<td>$16,800</td>
<td>$12,500</td>
<td>1.3</td>
</tr>
<tr>
<td>2 Reduce Bldg 3 RTU run hours</td>
<td>$600</td>
<td>$6,500</td>
<td>0.1</td>
</tr>
<tr>
<td>3 Add economizer RTU-1 to -7</td>
<td>$16,600</td>
<td>$3,500</td>
<td>4.7</td>
</tr>
<tr>
<td>4 Demand control ventilation</td>
<td>$6,800</td>
<td>$3,500</td>
<td>1.9</td>
</tr>
<tr>
<td>5 Revise RTU sequence and controls</td>
<td>$7,400</td>
<td>$4,500</td>
<td>1.6</td>
</tr>
<tr>
<td>6 VFD kitchen MAU and EF</td>
<td>$8,600</td>
<td>$5,200</td>
<td>1.7</td>
</tr>
<tr>
<td>7 Water source heat pump loop temp.</td>
<td>$14,200</td>
<td>$8,500</td>
<td>1.7</td>
</tr>
<tr>
<td>8 Install pool cover</td>
<td>$2,000</td>
<td>$1,400</td>
<td>1.4</td>
</tr>
<tr>
<td>9 Lighting controls</td>
<td>$15,000</td>
<td>$8,700</td>
<td>1.7</td>
</tr>
<tr>
<td>10 Reduce DW heating short cycle</td>
<td>$1,400</td>
<td>$3,500</td>
<td>0.4</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td><strong>$89,500</strong></td>
<td><strong>$58,000</strong></td>
<td>1.5</td>
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</tbody>
</table>
### Viking Hotel

<table>
<thead>
<tr>
<th>“Capital” ECM</th>
<th>Cost</th>
<th>Savings</th>
<th>SPB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting retrofit</td>
<td>$15,000</td>
<td>$8,700</td>
<td>1.7</td>
</tr>
<tr>
<td>Replace historic bldg boiler</td>
<td>$35,000</td>
<td>$3,700</td>
<td>9.5</td>
</tr>
<tr>
<td>Install networked guestroom controls</td>
<td>$133,000</td>
<td>$13,500</td>
<td>9.9</td>
</tr>
<tr>
<td>Replace single glazed with double glazed</td>
<td>$393,800</td>
<td>$19,800</td>
<td>19.8</td>
</tr>
</tbody>
</table>
Available Resources

- Boston Green Tourism
- EPA EnergyStar guides
- ASHRAE Procedures for Commercial Building Energy Audits
- Illuminating Engineering Society of North America (IESNA)
- Flex Your Power: *Hotels Best Practices Guide* and *Boosting Restaurant Profits with Energy Efficiency*
- Green Hotels Association
- LEED, Green Key, Green Globes, etc.
Take Away

✓ There are always improvements
✓ Don’t need large capital investments to save
✓ Pay attention to changing conditions
✓ SET GOALS
✓ Savings, comfort, extended equipment life
✓ Contact NSTAR or National Grid regarding available incentives for energy efficiency projects.
Thank you!

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