Building Upgrades for Energy Efficiency

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SFTool.gov

Sustainable Facilities Tool
Make Sustainable Decisions

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Cost-Effective Upgrades

Learn About High-Performance
Learn about high-performance topics, such as indoor environmental quality (IEQ) and plug loads

Plan a Project
Review high-performance facility strategies for both new construction and renovation projects

Buy High-Performance
Discover which products and services meet different environmental programs, such as BioPreferred or Energy Star

Achieve High-Performance

Demonstrate Understanding
Use FEDSAT to take the first step on a path towards full FBPTA compliance

Explore a Building
Walk through a high-performance building to learn about strategies and products for each workspace and building system

Share Your Story
Learn from the experience of others and share stories from your own high-performance facility projects.
Opportunity for Improving Existing Buildings

- A typical office building can cut energy use
  - By up to 25% implementing no & low cost measures
  - By up to 45% by pursuing deeper retrofit measures

- Impacts: reduced operating costs, improved occupant comfort, greater asset value, and other related benefits
Introducing... Cost-Effective Upgrades

Cost-Effective Upgrades Tool
Please choose the building size and climate zone that most closely resemble your building's size and location. Note that the results may vary if you only occupy a portion of a building. Click the continue button when finished.

Select Your Building Size

- 5,000 gsf
- 10,000 gsf
- 25,000 gsf
- 50,000 gsf
- 100,000 gsf

Select Your Climate Zone

Climate zones are defined by DOE's Building America Climate Zones.
Cost Effective Upgrades
Demo
Background
Advanced Energy Retrofit Guide for Office Buildings

- Published in 2011
- Office buildings represent 17% of energy use in U.S. commercial buildings
- 60% of existing office buildings were built before 1980
- Actionable information, practical methodologies, and objective evaluations of the most promising retrofit measures

https://energy.gov/eere/buildings/advanced-energy-retrofit-guides
Scope of Retrofit Guide

Climate
- Hot-humid
- Hot-dry
- Cold
- Very Cold
- Marine

Retrofit Depth
- Existing Building Commissioning
- Standard Retrofit
- Deep Retrofit

Measure Analysis
- Energy Savings
- Cost

Example Retrofit Packages
- EBCx Package
- Standard Retrofit Package
- Deep Retrofit Package

M&V
Levels of upgrade options

- O&M improvements through Existing Building Commissioning (EBCx)
- Standard retrofits – cost-effective, low-risk upgrade options including equipment, system and assembly retrofits
- Deep retrofits – require a larger upfront investment and may have longer payback periods
### EBCx Results of Common Metrics

<table>
<thead>
<tr>
<th>Site Energy Use Intensity (EUI) (kBtu/sf/yr)</th>
<th>Annual Energy Cost per Square Foot</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline</td>
</tr>
<tr>
<td>Hot &amp; Humid</td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>88</td>
</tr>
<tr>
<td>Post-EBCx</td>
<td>97</td>
</tr>
<tr>
<td>% Reduction from Baseline</td>
<td>94</td>
</tr>
<tr>
<td>Cold</td>
<td>86</td>
</tr>
<tr>
<td>Very Cold</td>
<td>91</td>
</tr>
<tr>
<td>Average</td>
<td>91</td>
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</tbody>
</table>
# EBCx Energy Savings Results

<table>
<thead>
<tr>
<th></th>
<th>Electricity Savings (annual kWh)</th>
<th>Electric Demand Savings (peak kW)</th>
<th>Gas Savings (annual therms)</th>
<th>Site EUI Savings (kBtu/sf/yr)</th>
<th>Savings as % of Total Site Usage</th>
<th>Source EUI Savings (kBtu/sf/yr)</th>
<th>Savings as % of Total Source Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot &amp; Humid</td>
<td>319,000</td>
<td>4</td>
<td>16,000</td>
<td>13</td>
<td>15%</td>
<td>24</td>
<td>11%</td>
</tr>
<tr>
<td>Hot &amp; Dry</td>
<td>497,000</td>
<td>4</td>
<td>26,000</td>
<td>21</td>
<td>22%</td>
<td>38</td>
<td>16%</td>
</tr>
<tr>
<td>Marine</td>
<td>410,000</td>
<td>0</td>
<td>37,000</td>
<td>26</td>
<td>27%</td>
<td>35</td>
<td>21%</td>
</tr>
<tr>
<td>Cold</td>
<td>341,000</td>
<td>(20)</td>
<td>30,000</td>
<td>20</td>
<td>24%</td>
<td>33</td>
<td>16%</td>
</tr>
<tr>
<td>Very Cold</td>
<td>338,000</td>
<td>(60)</td>
<td>34,000</td>
<td>23</td>
<td>25%</td>
<td>35</td>
<td>18%</td>
</tr>
</tbody>
</table>
## Measure - Daylight Harvesting

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Electricity Savings (annual kWh)</th>
<th>Electric Demand Savings (peak kW)</th>
<th>Gas Savings (annual therms)</th>
<th>Site EUI Savings (kBtu/sf/yr)</th>
<th>Savings as % of Total Site Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot &amp; Humid</td>
<td>177,969</td>
<td>82</td>
<td>(3,110)</td>
<td>1.5</td>
<td>2.0%</td>
</tr>
<tr>
<td>Hot &amp; Dry</td>
<td>173,328</td>
<td>78</td>
<td>(3,538)</td>
<td>1.2</td>
<td>1.6%</td>
</tr>
<tr>
<td>Marine</td>
<td>141,075</td>
<td>68</td>
<td>(4,335)</td>
<td>0.2</td>
<td>0.3%</td>
</tr>
<tr>
<td>Cold</td>
<td>156,231</td>
<td>69</td>
<td>(4,384)</td>
<td>0.5</td>
<td>0.7%</td>
</tr>
<tr>
<td>Very Cold</td>
<td>149,806</td>
<td>121</td>
<td>(4,761)</td>
<td>0.2</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

Values presented in this table are total savings from the reference building baseline usage, not incremental savings from a current code baseline.
## Measure - Daylight Harvesting

<table>
<thead>
<tr>
<th>Climate Zone</th>
<th>Equipment Cost</th>
<th>Install Cost</th>
<th>Total Cost</th>
<th>Total Annual Energy Cost Savings</th>
<th>Annual O&amp;M Cost Savings</th>
<th>Total Annual $ Savings</th>
<th>Simple Payback (years)</th>
<th>NPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hot &amp; Humid</td>
<td>$32,143</td>
<td>$77,309</td>
<td>$109,452</td>
<td>$17,085</td>
<td>$(1,304)</td>
<td>$15,782</td>
<td>7</td>
<td>$72,057</td>
</tr>
<tr>
<td>Hot &amp; Dry</td>
<td>$32,432</td>
<td>$78,004</td>
<td>$110,436</td>
<td>$14,119</td>
<td>$(1,446)</td>
<td>$12,674</td>
<td>9</td>
<td>$35,503</td>
</tr>
<tr>
<td>Marine</td>
<td>$33,588</td>
<td>$80,784</td>
<td>$114,372</td>
<td>$10,567</td>
<td>$(1,500)</td>
<td>$9,067</td>
<td>13</td>
<td>$(9,755)</td>
</tr>
<tr>
<td>Cold</td>
<td>$31,790</td>
<td>$76,459</td>
<td>$108,249</td>
<td>$14,659</td>
<td>$(1,663)</td>
<td>$12,996</td>
<td>8</td>
<td>$41,478</td>
</tr>
<tr>
<td>Very Cold</td>
<td>$31,661</td>
<td>$76,150</td>
<td>$107,811</td>
<td>$13,599</td>
<td>$(1,514)</td>
<td>$12,085</td>
<td>9</td>
<td>$31,404</td>
</tr>
</tbody>
</table>

Values presented in this table are total costs and savings, not incremental costs and savings from a current code baseline.
Discussion