Does Sustainable Design Deliver?

2008

12 sustainably designed buildings

26% less energy use
13% lower maintenance costs
27% higher occupant satisfaction
33% fewer CO2 emissions
Does Sustainable Design Deliver?

22 sustainably designed buildings
25% less energy use
19% lower operational costs
27% higher occupant satisfaction
36% fewer CO2 emissions
Does Sustainable Design Deliver?

100 high-performance buildings

43% less energy use

35% less water use

10% lower building operating expenses

1% higher overall tenant satisfaction
GSA’s Approach

1. Examine existing GSA building studies
2. Gather building performance data
3. Define the building set based on data availability
4. Execute analysis & identify industry benchmarks
5. Report data findings
## Performance Metrics

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Annual energy consumption and costs ( kBtu/\text{GSF} )</td>
</tr>
<tr>
<td><strong>Water Efficiency</strong></td>
<td>Annual water consumption and costs ( \text{Gal/SGF} )</td>
</tr>
<tr>
<td><strong>Building Operating Expenses</strong></td>
<td>Annual building operating expenses including O&amp;M, janitorial, &amp; utility costs ( \text{Cost/RSF} )</td>
</tr>
<tr>
<td><strong>Solid Waste Generation &amp; Diversion</strong></td>
<td>Annual waste and recycling amounts ( \text{Pounds/RSF} )</td>
</tr>
<tr>
<td><strong>Tenant Satisfaction</strong></td>
<td>Occupant satisfaction ratings for air quality, noise, temperature, cleanliness, light, and overall satisfaction</td>
</tr>
</tbody>
</table>
Data Sources

Energy Usage Analysis System (EUAS)
• GSA’s system for utility billing information, including energy and water consumption data. GSA’s owned portfolio tracks billing and utility expenses based on the metering configuration of the building or project.

Financial Management Information System (FMIS)
• GSA’s financial reporting system for building-related expenses.

Sustainable Operations and Maintenance Tool
• GSA’s system for tracking buildings that meet the Guiding Principles for Existing Buildings, and for collecting the amount of solid waste generated and recycled for each GSA-owned building.

Real Estate Across the United States (REXUS)
• GSA’s system for identifying physical building details including the building’s name, property type, age, address, GSA Region, and gross square footage.

Tenant Satisfaction Survey (TSS)
• GSA’s process for capturing annual Federal Tenant Satisfaction Survey results by building and by tenant.
Define the Building Set

High-Performance Buildings
- Buildings that meet the Guiding Principles for Sustainable Federal Buildings

<table>
<thead>
<tr>
<th>High-Performance Buildings</th>
<th>Legacy Stock Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>485,348</strong> gross square feet*</td>
<td><strong>374,685</strong> gross square feet*</td>
</tr>
<tr>
<td><strong>48.4</strong> years old*</td>
<td><strong>52.2</strong> years old*</td>
</tr>
<tr>
<td><strong>341,100</strong> rentable square feet*</td>
<td><strong>273,350</strong> rentable square feet*</td>
</tr>
</tbody>
</table>

* Averages

Legacy Stock Buildings
- Buildings that have not been upgraded to meet the Guiding Principles
Define the Building Set

- Federally-owned, under GSA’s management
- Office building, courthouse, or combination
- Complete FY 2015 - 2017 data for each metric
<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy Efficiency</strong></td>
<td>Energy Information Administration (EIA) Commercial Buildings Energy Consumption Survey (CBECES) 2012</td>
</tr>
<tr>
<td><strong>Water Efficiency</strong></td>
<td>ENERGY STAR® Portfolio Manager 2012</td>
</tr>
<tr>
<td><strong>Building Operating Expenses</strong></td>
<td>Building Owners and Managers Association (BOMA) Experience Exchange Report (EER)</td>
</tr>
<tr>
<td><strong>Solid Waste Generation &amp; Diversion</strong></td>
<td>[Not Tracked]</td>
</tr>
<tr>
<td><strong>Tenant Satisfaction</strong></td>
<td>Center for the Built Environment (CBE) Occupant Indoor Environmental Quality Survey 2015</td>
</tr>
</tbody>
</table>
Key Findings

Compared to legacy stock buildings, GSA’s high-performance buildings show:

- **23%** decrease in energy use
- **28%** decrease in water use
- **23%** decrease in building operating expenses
- **9%** decrease in waste landfilled
- **2%** increase in overall tenant satisfaction

[www.gsa.gov/impacthp](http://www.gsa.gov/impacthp)
Key Findings

Compared to industry benchmarks, GSA’s high-performance buildings show:

- Energy use: 43%
- Water use: 35%
- Building operating expenses: 10%
- Waste landfilled: not tracked
- Overall tenant satisfaction: 1%

www.gsa.gov/impacthp
Key Findings

Compared to legacy stock buildings:
- 23% decrease in energy use
- 28% decrease in water use
- 23% decrease in building operating expenses
- 9% decrease in waste landfilled

Compared to industry benchmarks:
- 43% decrease
- 35% decrease
- 10% decrease
- Not tracked

www.gsa.gov/impacthp
Energy Efficiency

- 1918 building renovated in 2013
- variable refrigerant flow HVAC
- LED lights w/ sensors & dimmers
- thermally-enhanced envelope
- geothermal heat pump
- rooftop photovoltaic system

Wayne Aspinall Federal Building & Courthouse
Grand Junction, CO

- EUI is 15 kBtu/GSF

© Kevin G Reeves Photographer
Water Efficiency

Federal Center South
Seattle, WA

- Rainwater capture in a 25,000 gallon cistern
  - used for toilet water, process water, and irrigation
- High-efficiency bathroom fixtures
- WUI is 5.1 gallons per GSF
High-performance buildings cost
- $0.60 less/RSF in O&M expenses,
- $0.50 less/RSF in janitorial expenses
- $0.53 less/RSF in utility expenses
compared to legacy stock buildings
Solid Waste Generation & Diversion

- Increased waste diversion rate from 31% to 80% in 5 years
  - implemented a food waste and organics composting program
- Generates revenue from recycling supports tenant agency programs
- Diverted 80% of total solid waste in FY16

Edward Roybal Federal Building
Los Angeles, CA
### Tenant Satisfaction

- **1917 building renovated in 2013**
- **Glazing glare control**
- **Occupant thermal comfort systems**
- **Individually controlled thermal zones**
- **Daylight harvesting control system**
- **Operable windows linked to room-specific ventilation systems**

<table>
<thead>
<tr>
<th>Category</th>
<th>High-Performance</th>
<th>Legacy Stock</th>
<th>CBE 2014 Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleanliness</td>
<td>11% ▲</td>
<td>10% ▲</td>
<td></td>
</tr>
<tr>
<td>Air Quality</td>
<td>5% ▲</td>
<td>2% ▲</td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>5% ▲</td>
<td>7% ▲</td>
<td></td>
</tr>
<tr>
<td>Noise Levels</td>
<td>26% ▲</td>
<td>30% ▲</td>
<td></td>
</tr>
<tr>
<td>Thermal Comfort</td>
<td>10% ▲</td>
<td>7% ▲</td>
<td></td>
</tr>
<tr>
<td>Overall Tenant</td>
<td>1% ▲</td>
<td>1% ▼</td>
<td></td>
</tr>
</tbody>
</table>

**GSA Headquarters**

Washington, DC

[Image of the office space with individuals working]

---

This chart shows the average satisfaction levels across different categories for tenants, comparing high-performance and legacy stock buildings. The CBE 2014 Benchmark is also indicated for reference.
High-Performance Buildings Save Money

<table>
<thead>
<tr>
<th>Performance Metric</th>
<th>Current Actual Cost (200 buildings)</th>
<th>Projected Cost if All 200 Buildings were High-Performance</th>
<th>Potential Additional Savings in Legacy Stock Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>$105,206,021</td>
<td>$92,304,650</td>
<td>$12,901,371</td>
</tr>
<tr>
<td>Water</td>
<td>$10,090,138</td>
<td>$8,626,759</td>
<td>$1,463,379</td>
</tr>
<tr>
<td>Building Operating Expenses</td>
<td>$287,876,172</td>
<td>$257,624,529</td>
<td>$30,251,644</td>
</tr>
<tr>
<td>Solid Waste</td>
<td>$440,341</td>
<td>$422,359</td>
<td>$17,982</td>
</tr>
<tr>
<td>Total</td>
<td>$403,612,962</td>
<td>$358,978,297</td>
<td>$44,634,376</td>
</tr>
</tbody>
</table>
Recommendations

In deciding which upgrades will best maximize performance on each measure, GSA recommends that decision makers:

• Examine the existing conditions and performance of buildings to identify opportunities for improvement
• Maintain a portfolio-wide approach to reducing excess costs of lower performing buildings
• Prioritize improvement opportunities according to net present value, savings to investment ratio, and net operating income
• Leverage external financing wherever possible, such as ESPC and UESC
Contact Information

Don Horn, FAIA
GSA Office of Federal High-Performance Buildings
202-302-7653
donald.horn@gsa.gov

www.gsa.gov/impacthp