GPG FINDINGS

The GPG program enables GSA to make sound investment decisions in next generation building technologies based on their real world performance.

www.gsa.gov/gpg

THIN GLASS IN INSULATED FIBERGLASS FRAME

Pre-Manufactured Like Storm Windows

Single- & double-pane configurations 2 to 3 times lighter than inserts manufactured with standard glass

M&V

Where did Measurement and Verification occur?

NATIONAL RENEWABLE ENERGY LABORATORY assessed the impact of lightweight secondary windows provided by Alpen High Performance Products in a two-story office building at the Denver Federal Center.

RESULTS

How did lightweight secondary windows perform in M&V?

15% AVERAGE WHOLE-BUILDING ENERGY SAVINGS

EASY INSTALLATION < 10 MINUTES FOR 1 PERSON NO DRILLED HOLES OR PERMANENT DEVICES

COMFORT INCREASED

20° WARMER INTERIOR GLASS

73% REDUCTION IN CONDENSATION

97% LESS AIR LEAKAGE

Cost-Effective Across Climate Zones

Positive return on investment at average GSA utility rates, $0.11/kWh and $7.43/mmBtu

<table>
<thead>
<tr>
<th>CLIMATE ZONE</th>
<th>CITY</th>
<th>WHOLE BUILDING ENERGY SAVINGS kBtu/ft²/yr</th>
<th>ENERGY COST SAVINGS $/ft²/yr</th>
<th>ANNUAL SAVINGS $/yr</th>
<th>SAVINGS %</th>
<th>PAYBACK* YRS</th>
<th>ROI positive ROI if &gt;1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A Miami, FL</td>
<td>8.1</td>
<td>$0.27</td>
<td>$16,480</td>
<td>11%</td>
<td>11.2</td>
<td>1.59</td>
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<tr>
<td>2A Houston, TX</td>
<td>9.5</td>
<td>$0.30</td>
<td>$16,088</td>
<td>12%</td>
<td>10.1</td>
<td>1.76</td>
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<tr>
<td>2B Phoenix, AZ</td>
<td>10.7</td>
<td>$0.35</td>
<td>$17,770</td>
<td>14%</td>
<td>8.7</td>
<td>2.05</td>
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</tr>
<tr>
<td>3A Atlanta, GA</td>
<td>10.3</td>
<td>$0.35</td>
<td>$17,770</td>
<td>14%</td>
<td>8.7</td>
<td>2.05</td>
<td></td>
</tr>
<tr>
<td>3B Las Vegas, NV</td>
<td>10.8</td>
<td>$0.36</td>
<td>$19,306</td>
<td>15%</td>
<td>8.4</td>
<td>2.11</td>
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<tr>
<td>3C San Francisco, CA</td>
<td>10.3</td>
<td>$0.28</td>
<td>$15,014</td>
<td>13%</td>
<td>10.8</td>
<td>1.84</td>
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<tr>
<td>4A Baltimore, MD</td>
<td>12.6</td>
<td>$0.43</td>
<td>$23,060</td>
<td>16%</td>
<td>7.1</td>
<td>2.52</td>
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<tr>
<td>5A Chicago, IL</td>
<td>13.5</td>
<td>$0.46</td>
<td>$24,669</td>
<td>17%</td>
<td>6.6</td>
<td>2.70</td>
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<tr>
<td>5B Boulder, CO</td>
<td>13.9</td>
<td>$0.47</td>
<td>$25,205</td>
<td>18%</td>
<td>6.5</td>
<td>2.76</td>
<td></td>
</tr>
</tbody>
</table>
| 6A Minneapolis, MN | 15.6 | $0.54                                    | $28,959                     | 19%                 | 5.6      | 3.17       |**

AVERAGE SAVINGS 11.3 $0.28 $20,432 15% 8.6 2.2

*Positive ROI if >1

**Modeling for high SHGC 0.42 in a medium-sized office building. A low SHGC 0.20 is more cost-effective in warm climates, with estimated payback < 10 years. Does not include savings from reduced air infiltration. Double-pane insert $22/ft². Single-pane insert $17/ft². Installation $115/ft².

DEPLOYMENT

Where does M&V recommend deploying lightweight secondary windows?

In cold climates, double-pane secondary windows will be more cost-effective. In warm climates, the single-pane configuration may offer a better return on investment.

This retrofit technology is particularly well suited for historic structures where changes to the facade are not allowed.

*Alpen High Performance Products, Denver, 2021
*National Renewable Energy Laboratory, Denver, 2021
*Source: LBNL, December 2012
*Ibid, p. 66
*National Renewable Energy Laboratory, Denver, 2021
*Ibid, p. 10
*Ibid, p. 28
*Ibid, p. 28