Low-cost, high-performance systems suitable for sloped glazed areas or roof mounted skylights. Kawneer products are comprised of extrusions made from one of the earth's most plentiful recyclables — aluminum. Durable and lasting the extruded products also boast aesthetically appealing design features that can help contribute to energy efficiency and long term sustainability.
This declaration is an environmental product declaration (EPD) in accordance with ISO 14025. EPDs rely on Life Cycle Assessment (LCA) to provide information on a number of environmental impacts of products over their life cycle. **Exclusions:** EPDs do not indicate that any environmental or social performance benchmarks are met, and there may be impacts that they do not encompass. LCAs do not typically address the site-specific environmental impacts of raw material extraction, nor are they meant to assess human health toxicity. EPDs can complement but cannot replace tools and certifications that are designed to address these impacts and/or set performance thresholds – e.g. Type 1 certifications, health assessments and declarations, environmental impact assessments, etc. **Accuracy of Results:** EPDs regularly rely on estimations of impacts, and the level of accuracy in estimation of effect differs for any particular product line and reported impact. **Comparability:** EPDs are not comparative assertions and are either not comparable or have limited comparability when they cover different life cycle stages, are based on different product category rules or are missing relevant environmental impacts. EPDs from different programs may not be comparable.

**PROGRAM OPERATOR** | UL Environment  
**DECLARATION HOLDER** | Kawneer North America  
**DECLARATION NUMBER** | 47868332121.108.1  
**DECLARED PRODUCT** | Overhead Glazing, Aluminum Sloped Curtain Wall  
**REFERENCE PCR** | Earthsure. Cradle to Gate Window Product Category Rule. September 2015  
**DATE OF ISSUE** | December 7, 2015  
**PERIOD OF VALIDITY** | 5 Years  
**CONTENTS OF THE DECLARATION**  
- Product definition and information about building physics  
- Information about basic material and the material’s origin  
- Description of the product’s manufacture  
- Indication of product processing  
- Information about the in-use conditions  
- Life cycle assessment results  
- Testing results and verifications  

The PCR review was conducted by: **PCR Review Panel**  
- Chair: Thomas P. Gloria  
- Industrial Ecology Consultants  

This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories  
- INTERNAL  
- EXTERNAL  

Wade Stout, UL Environment  

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:  

Thomas Gloria, Industrial Ecology Consultants  

This EPD conforms with ISO 21930:2007
Product Information

Product Description

Sloped glazing is defined as any glazing system or material installed on a slope more than 15 degrees with curtain wall performance in a monumental sloped system.

Overhead Glazing featuring:
1600 Sloped Glazing and 2000 Skylight

Stick system -- fully factory fabricated silicone glazed purlin is standard flush grid exterior has a 2-1/2" (63.5) sightline, with overall mullion depths of 3-1/8" (79.4), 4-3/4" (120.7) and 6" (152.4) system accepts 3/16" to 1-5/16" (4.8 to 33.3) infill material. Handles inside and outside corner applications.

For thermal performance, a product is considered thermally broken if the separation between the interior and exterior metal is 0.21 inches or greater. Thermally improved systems are generally defined as having a separation between the interior and exterior metal of less than 0.21 inches but not less than 1/16 inch.

Performance Standards

Kawneer products are tested, certified and labeled for the following performance standards:

- AAMA/WDMA/CSA 101/IS2/A440 (NAFS-North American Fenestration Standard/Specification for windows, doors, and skylights) for the most current version
- AAMA E283/NFRC 400 Air Infiltration
- ASTM E330/1 and AAMA 501 Methods of Test
- AAMA 1503, AAMA 507 and NFRC 100 Thermal Transmittance – U-Factors
- AAMA 1503, CSA A440.2 and NFRC 500 Condensation Resistance (CRF,I,CR)
- AAMA 507 and NFRC 200 Overall Solar Heat Gain Coefficient and Visible Transmittance (SHGC) & (VT)
- AAMA 1801, ASTM E90 and ASTM E1425 Sound Transmission (STC, OITC)

Life Cycle Assessment

Declared Unit

The declared unit of the underlying life cycle assessment study was one square meter (1 m²) of window (including frame) meeting the performance standards noted below. The reference flow is 37.3 kg of window unit with framing, with a frame to glazing ration of 25.3% to 74.7% by mass. The 1.2m x 1.2m skylight standard size was used to derive the declared unit.
System Boundary

The system boundary for the declaration is cradle-to-gate per the guiding PCR. The product life cycle stages included within this boundary are illustrated in Figure 1.

![Figure 1: Life cycle stage diagram for cradle-to-gate production of overhead glazing by Kawneer](image)

Data Sources

To cover these requirements and to ensure reliable results, first-hand industry data were used in combination with consistent background LCA information from the GaBi ts 2014 database. The data for aluminum billet, as well as externally sourced aluminum extrusions, are based on 2010 Aluminum Association studies and are the best available. Other LCI datasets were sourced from the GaBi LCA databases and are representative of years 2010-2013.

Assumptions

The manufacturing process and end product is essentially the same in all manufacturing sites. Impacts and inventories for overhead glazing are calculated with a mass-based production-weighted average of each manufacturer’s impacts and inventories.

Float glass is insulated, laminated, or tempered and added to the finished assembly. At this time data does not include granularity to differentiate between insulate, laminated and tempered glass. As such, all glass is treated the same. Glass is only processed at the Cranberry facility. The remaining facilities produce and sell only the aluminum frames. For these facilities, the glass produced at the Cranberry facility was used as a proxy for the window glazing.
No significant assumptions have been made beyond the aforementioned. All of the raw materials and energy inputs have been modeled using processes and flows that closely follow actual production raw materials and processes. All of the material and energy flows have been accounted.

**Sensitivity Analysis**

Sensitivity analyses was performed because primary data from more than one location is averaged for a unit process. In order to better understand the variation of impacts across locations for the manufacturing process, the coefficient of variation was calculated for the environmental impact categories. As shown in Table 1, the impacts were seen to vary between 18% and 63%, depending on location for the production of overhead glazing. These variations are likely due primarily to the different scales of operations at each location, the different proportions of finishes used, as well as due to energy mixes used at each location.

<table>
<thead>
<tr>
<th>Impact Category</th>
<th>CoV</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRACI 2.1</td>
<td></td>
</tr>
<tr>
<td>Global warming potential</td>
<td>21%</td>
</tr>
<tr>
<td>Ozone depletion potential</td>
<td>63%</td>
</tr>
<tr>
<td>Acidification potential</td>
<td>42%</td>
</tr>
<tr>
<td>Eutrophication potential</td>
<td>18%</td>
</tr>
<tr>
<td>Smog formation potential</td>
<td>33%</td>
</tr>
</tbody>
</table>

The coefficient of variation for each impact category was calculated by first determining the weighted standard deviation (\(\sigma_w\)) and the weighted average (\(\bar{x}_w\)) and then applying

\[
CoV = \frac{\sigma_w}{\bar{x}_w}
\]

The weighted average was calculated via

\[
\bar{x}_w = \frac{\sum_{i=1}^{n} w_i x_i}{\sum_{i=1}^{n} w_i}
\]

while the weighted standard deviation is determined by
Overhead Glazing
Aluminum Sloped Curtain Wall

According to ISO 14025

\[ \sigma_w = \sqrt{\frac{\sum_{i=1}^{n} w_i (x_i - \bar{x}_w)^2}{\sum_{i=1}^{n} w_i}}, \]

where \( w_i \) is the weight, i.e. annual production, for each company and \( x_i \) is the particular input or output for each location.
## Life Cycle Impact Assessment Results

### Table 1: Cradle-to-gate (manufacturing, glazing and frame) LCIA results of Kawneer Overhead Glazing

<table>
<thead>
<tr>
<th>Units (per 1m²)</th>
<th>Manufacturing Impact (cradle to gate)</th>
<th>Glazing Impact (cradle to gate)</th>
<th>Frame Impact (cradle to gate)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Global Climate Change Potential (excluding biogenic carbon)</strong></td>
<td>kg CO₂ equivalent</td>
<td>1.64E+02</td>
<td>1.15E+02</td>
</tr>
<tr>
<td><strong>Acidification Potential</strong></td>
<td>kg SO₂ equivalents</td>
<td>9.70E-01</td>
<td>5.86E-01</td>
</tr>
<tr>
<td><strong>Eutrophication Potential</strong></td>
<td>kg N equivalents</td>
<td>2.57E-02</td>
<td>1.48E-02</td>
</tr>
<tr>
<td><strong>Stratospheric Ozone Depletion Potential</strong></td>
<td>kg CFC-11 equivalents</td>
<td>2.80E-08</td>
<td>1.86E-08</td>
</tr>
<tr>
<td><strong>Photochemical Smog Formation Potential</strong></td>
<td>kg O₃ equivalents</td>
<td>8.60E+00</td>
<td>5.51E+00</td>
</tr>
</tbody>
</table>

### Use of Material and Energy Resources

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Units</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Fresh Water Consumption (excluding 143 L rain water)</strong></td>
<td>Liters</td>
<td>2.26E+03</td>
<td>2.01E+03</td>
<td>2.46E+02</td>
</tr>
<tr>
<td><strong>Non-Renewable Primary Energy Demand</strong></td>
<td>MJ (HHV)</td>
<td>2.09E+03</td>
<td>1.42E+03</td>
<td>6.70E+02</td>
</tr>
<tr>
<td><strong>Renewable Primary Energy Demand</strong></td>
<td>MJ (HHV)</td>
<td>5.60E+02</td>
<td>4.71E+02</td>
<td>8.91E+01</td>
</tr>
<tr>
<td><strong>Non-Renewable Material Resources</strong></td>
<td>kg</td>
<td>5.90E+02</td>
<td>4.97E+02</td>
<td>9.31E+01</td>
</tr>
<tr>
<td><strong>Renewable Material Resources</strong></td>
<td>kg</td>
<td>6.61E+05</td>
<td>5.10E+05</td>
<td>1.51E+05</td>
</tr>
</tbody>
</table>

### Waste Production

<table>
<thead>
<tr>
<th></th>
<th>Units</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Non-hazardous Waste Generated</strong></td>
<td>kg</td>
<td>3.38E+01</td>
</tr>
<tr>
<td><strong>Hazardous Waste Generated</strong></td>
<td>kg</td>
<td>8.05E-03</td>
</tr>
</tbody>
</table>
Additional Information

Disclosure of Windows Hazardous Content

There are no materials present in at least 0.1% of the overhead glazing that are known to be hazardous to human health and the environment nor on the Candidate List Substances of Very High Concern [IERE 2015].

Recyclable Content

Aluminum is a highly efficient sustainable building material. Aluminum is 100% recyclable and can be recycled repeatedly. Recycled aluminum is identical to smelted aluminum but requires only 1/20 of the energy to manufacture. In building and construction aluminum scrap has a recycling rate of 95% [AA]. The remaining 5% is sent to landfill.

References

<table>
<thead>
<tr>
<th>Reference</th>
<th>Description</th>
</tr>
</thead>
</table>

The Life Cycle Assessment was conducted by thinkstep (formerly PE INTERNATIONAL) using GaBi data.