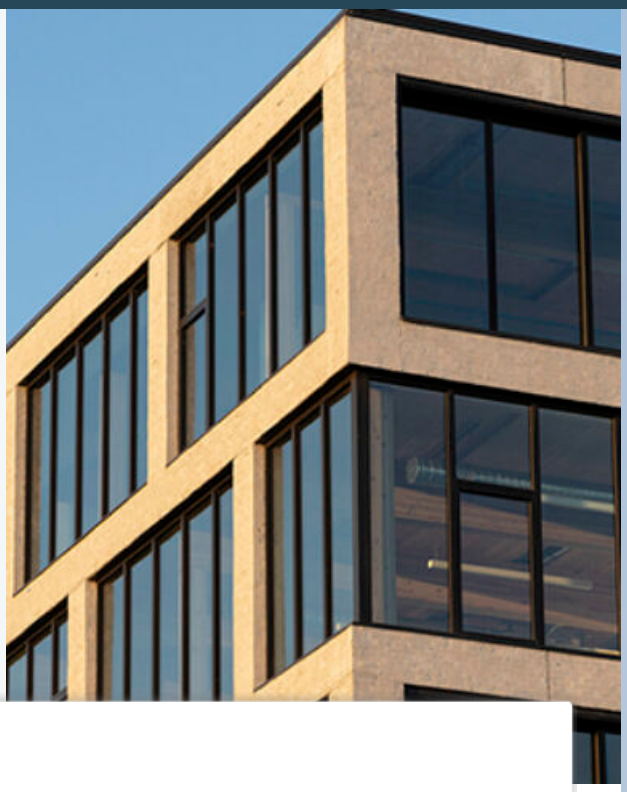
CASCADIA WINDOWS & DOORS

# Cascadia Universal Series™ Fixed & Operable Windows and Doors

The Universal Series™ Fixed & Operable Windows and Doors offers a patented, high-performance fiberglass solution for fixed and operable windows, as well as doors, storefront and window wall. Designed and manufactured in North America, the Universal Series™ windows feature an innovative, commercial-grade fiberglass frame boasting up to 250% improved thermal performance compared to traditional aluminum windows. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames also contain roughly 58% recycled content.



## Performance dashboard

### Features & functionality

Boasts 100%-250% improved thermal performance compared to traditional aluminum windows, lowering heating and cooling costs

Made from high resin-to-glass, thermoset fiberglass, the windows will not sag, weaken or creep over time

Can withstand extreme temperatures (-40°F through 350°F, and higher) without becoming brittle or soft

Made from non-organic, chemically inert pultruded fiberglass, the windows are not susceptible to corrosion, rot, insect damage or UV degradation

Modelled lifespan of up to 80 years

**Visit Cascadia Windows for more product information:**

Cascadia Universal Series™ Fixed & Operable Windows and Doors

**MasterFormat® 08 16 13, 08 54 13**
Universal Series™ Fixed & Operable Windows and Doors Guide Spec

Universal Series™ Fixed & Operable Windows and Doors Technical Data Sheet

Universal Series™ Fixed & Operable Windows and Doors Warranty Information

For spec help, contact us or call 604-857-4600

### Environment & materials

**Improved by:**

Available with double & triple-glazed Low-E insulated glass units (IGUs)

European-engineered, multi-point locking hardware

Low-VOC standard & custom colors exceed AAMA 625 performance criteria (Hydro Tuff water-borne urethane coatings)

**Certifications, rating systems & disclosures:**

Passive House Institute (PHI) & Passive House Institute US (PHIUS) certified configurations

Living Building Challenge

Declare, Red List Free

Energy-Star rated

See LCA, interpretation & rating systems

# SM Transparency Report (EPD)™

| EPD | LCA |
|---|---|
| 3rd-party reviewed | ✔ |
| Transparency Report (EPD) | |
| 3rd-party verified | ✔ |

Validity: 09/05/24 – 09/04/29
CAS – 090524 – 001

**This environmental product declaration (EPD) was externally verified by Ecoform, LLC, in accordance with ISO 14025:2006. ISO 21930:2017 serves as the core PCR. NSF sub-category PCR: Fenestration Assembly Product Category Rules.**

**In accordance with ISO 14044 and the referenced PCR, the life cycle assessment was conducted by Sustainable Minds and critically reviewed by Ecoform, LLC.**

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## SUMMARY

**Reference PCR**
PCR for Fenestration Assemblies, NSF International, 2023

**Regions; system boundaries**
North America; cradle-to-gate

**Declared unit**
One square meter (1 $m^2$) of fenestration assemblies (including frame and glass)

**LCIA methodology; LCA software; LCI databases**
TRACI 2.1; SimaPro Analyst 9.5; ecoinvent v3.10, and US-EI 2.2

**Public LCA**
Cascadia LCA report of Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Window Wall

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Contact us

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Fixed Window offers a patented, high-performance fiberglass solution designed and manufactured in North America. It features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum windows. Fixed windows consist of a singular frame around a transparent glazing unit that remains in one position and cannot be opened. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, providing structural support and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 1,200mm × 1,500mm (47in × 59in) fixed window normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Fixed window | 28.1 | 9.96 | 18.2 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** Fixed window configurations require less manufacturing activity for the window frame when compared to operable windows and doors, highlighting the larger contribution from A1. The upstream transportation stage is the next highest contributor to most impact categories including global warming and ecotoxicity. Manufacturing is the smallest contributor to all impacts except for fossil fuel depletion, due to fabrication and waste disposal activities.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up 80-90% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass window frame generated 27.1% of total GWP results, whereas the glazing generated 72.9% of the total. The glazing unit contains two 4mm glass panes, which are manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials accounts for a notable contribution to impacts at around 10-20% for many categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) is the smallest contributor to impact categories except for fossil fuel depletion.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

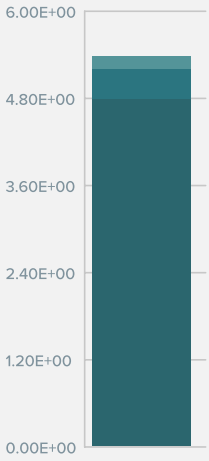
### Sensitivity analysis

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

## Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Glazing | 64.6% |
| Fiberglass lineals | 30.1% |
| Sill angle | 0.970% |
| Insulation | 0.740% |
| Paint | 0.590% |
| Shear block | 0.570% |
| Strap anchor | 0.550% |
| Screws | 0.120% |
| Sealant | 0.070% |
| Gaskets | 0.050% |
| Packaging (wood crate) | 1.64% |

## Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 4.80E+00 |
| Transportation | 4.25E-01 |
| Manufacturing | 1.72E-01 |

Total impacts = 5.40E+00 mPts

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:** **Included (X)** \| Excluded (MND)* *Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 4.80E+00 mPts | 4.25E-01 mPts | 1.72E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Fixed Window (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| **− Ecological damage** | | | |
| Impact category / Unit | | | |
| **Acidification** / **kg $SO_2$ eq** | 3.51E-01 | 8.98E-03 | 3.00E-03 |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Eutrophication | kg N eq | 3.40E-02 | 6.42E-04 | 2.86E-04 |
| Global warming | kg $CO_2$ eq | 5.59E+01 | 7.24E+00 | 5.10E+00 |
| Ozone depletion | kg CFC-11 eq | 3.63E-06 | 1.12E-07 | 4.63E-08 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.21E-06 | 4.61E-09 | 1.04E-09 |
| Non-carcinogenics | $CTU_h$ | 5.51E-06 | 9.13E-07 | 6.94E-08 |
| Respiratory effects | kg $PM_{2.5}$ eq | 3.28E-02 | 2.27E-03 | 3.68E-04 |
| Smog | kg $O_3$ eq | 4.10E+00 | 1.40E-01 | 6.96E-02 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 8.20E+01 | 1.38E+01 | 1.22E+01 |
| Ecotoxicity | $CTU_e$ | 3.71E+01 | 1.86E+01 | 1.18E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Fixed Window (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 4.34E-02 | 7.18E-03 | 1.07E-03 |
| Eutrophication | kg N eq | 9.45E-03 | 5.10E-04 | 1.02E-04 |
| Global warming | kg $CO_2$ eq | 1.10E+01 | 5.73E+00 | 1.82E+00 |
| Ozone depletion | kg CFC-11 eq | 3.69E-07 | 8.88E-08 | 1.66E-08 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.96E-07 | 3.65E-09 | 3.73E-10 |
| Non-carcinogenics | $CTU_h$ | 1.16E-06 | 7.21E-07 | 2.48E-08 |
| Respiratory effects | kg $PM_{2.5}$ eq | 6.53E-03 | 1.80E-03 | 1.32E-04 |
| Smog | kg $O_3$ eq | 5.72E-01 | 1.12E-01 | 2.49E-02 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 2.10E+01 | 1.09E+01 | 4.36E+00 |
| Ecotoxicity | $CTU_e$ | 2.54E+00 | 3.53E-01 | 1.50E-03 |

## TRACI v2.1 results per declared unit of Universal Series™ Fixed Window (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 3.08E-01 | 1.80E-03 | 1.92E-03 |
| Eutrophication | kg N eq | 2.45E-02 | 1.32E-04 | 1.83E-04 |
| Global warming | kg $CO_2$ eq | 4.49E+01 | 1.52E+00 | 3.28E+00 |
| Ozone depletion | kg CFC-11 eq | 3.26E-06 | 2.36E-08 | 2.97E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 1.01E-06 | 9.67E-10 | 6.69E-10 |
| **Non-carcinogenics** | **$CTU_h$** | 4.35E-06 | 1.92E-07 | 4.46E-08 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 2.63E-02 | 4.73E-04 | 2.37E-04 |
| **Smog** | **kg $O_3$ eq** | 3.53E+00 | 2.77E-02 | 4.47E-02 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 6.09E+01 | 2.90E+00 | 7.83E+00 |
| **Ecotoxicity** | **$CTU_e$** | 1.86E+01 | 3.92E+00 | 7.57E-02 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

**ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"**

**ISO 21930:2017, "Sustainability in Building Construction — Environmental Declaration of Building Products" serves as the core PCR.**

**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


**Download PDF** SM Transparency Report / EPD

**SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. Environmental declarations of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines, use the same sub-category PCR where applicable, include all relevant information modules, be limited to EPDs applying a functional unit, and be based on equivalent scenarios with respect to the context of construction works. The results of this EPD reflect an average performance by the product, and its actual impacts may vary on a case-to-case basis. Some LCA impact categories and inventory items are still under development and can have high levels of uncertainty. To promote uniform guidance on the data collection, calculation, and reporting of results, the ACLCA methodology (ACLCA 2019) was used.

## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| | |
|---|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell | |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs | |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Casement Window offers a patented, high-performance fiberglass solution designed and manufactured in North America. It features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum windows. Casement windows consist of an operable sash frame around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the window to remain stationary in a closed position, and swing to open. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, providing structural support and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 600mm × 1,500mm (24in × 59in) casement window normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Casement window | 39.7 | 26.9 | 12.8 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The upstream transportation stage is the next highest contributor to most impact categories including ozone depletion, smog, acidification, eutrophication, carcinogenics, non-carcinogenics, respiratory effects, and ecotoxicity. The manufacturing stage is the next highest contributor to global warming and fossil fuel depletion, due to fabrication and waste disposal activities.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up on average 80-85% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass window frame generated 62.2% of total global warming results, whereas the glazing generated 37.8% of the total. The glazing unit contains two 4mm glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials is the next highest contributor to most impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) accounts for a notable contribution to impacts at around 20% for Global Warming Potentials (GWP) and Fossil Fuel Depletion.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

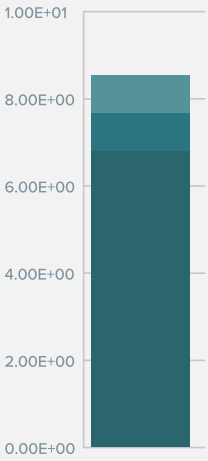
### Sensitivity analysis

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Fiberglass lineals | 50.1% |
| Glazing | 32.2% |
| Hardware | 7.12% |
| Shear block | 2.27% |
| Sill angle | 1.34% |
| Insulation | 1.27% |
| Paint | 1.02% |
| Screws | 1.00% |
| Strap anchor | 0.760% |
| Gaskets | 0.430% |
| Sealant | 0.180% |
| Packaging (wood crate) | 2.28% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 7.02E+00 |
| Transportation | 8.78E-01 |
| Manufacturing | 7.71E-01 |

Total impacts = **8.67E+00 mPts**

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 7.02E+00 mPts | 8.78E-01 mPts | 7.71E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panels. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Casement Window (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| − Ecological damage | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 3.59E-01 | 2.69E-02 | 1.35E-02 |
| Eutrophication | kg N eq | 5.11E-02 | 1.60E-03 | 1.16E-03 |
| Global warming | kg $CO_2$ eq | 6.81E+01 | 1.49E+01 | 2.29E+01 |
| Ozone depletion | kg CFC-11 eq | 3.30E-06 | 2.31E-07 | 2.08E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.64E-06 | 9.47E-09 | 4.67E-09 |
| Non-carcinogenics | $CTU_h$ | 8.02E-06 | 1.84E-06 | 3.12E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 4.19E-02 | 5.08E-03 | 1.66E-03 |
| Smog | kg $O_3$ eq | 4.44E+00 | 4.45E-01 | 3.13E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.06E+02 | 2.84E+01 | 5.48E+01 |
| Ecotoxicity | $CTU_e$ | 1.42E+02 | 3.76E+01 | 5.29E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Casement Window (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.42E-01 | 2.56E-02 | 9.12E-03 |
| Eutrophication | kg N eq | 3.38E-02 | 1.51E-03 | 7.89E-04 |
| Global warming | kg $CO_2$ eq | 3.65E+01 | 1.38E+01 | 1.55E+01 |
| Ozone depletion | kg CFC-11 eq | 1.00E-06 | 2.15E-07 | 1.41E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 9.24E-07 | 8.79E-09 | 3.17E-09 |
| Non-carcinogenics | $CTU_h$ | 4.96E-06 | 1.71E-06 | 2.11E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.34E-02 | 4.75E-03 | 1.12E-03 |
| Smog | kg $O_3$ eq | 1.96E+00 | 4.26E-01 | 2.12E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 6.36E+01 | 2.64E+01 | 3.72E+01 |
| Ecotoxicity | $CTU_e$ | 1.29E+02 | 3.48E+01 | 3.58E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Casement Window (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 2.17E-01 | 1.27E-03 | 4.33E-03 |
| Eutrophication | kg N eq | 1.73E-02 | 9.28E-05 | 3.75E-04 |
| Global warming | kg $CO_2$ eq | 3.16E+01 | 1.07E+00 | 7.36E+00 |
| Ozone depletion | kg CFC-11 eq | 2.30E-06 | 1.66E-08 | 6.69E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 7.11E-07 | 6.81E-10 | 1.50E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 3.06E-06 | 1.35E-07 | 1.00E-07 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 1.85E-02 | 3.33E-04 | 5.33E-04 |
| **Smog** | **kg $O_3$ eq** | 2.48E+00 | 1.95E-02 | 1.01E-01 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 4.29E+01 | 2.04E+00 | 1.77E+01 |
| **Ecotoxicity** | **$CTU_e$** | 1.31E+01 | 2.76E+00 | 1.70E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

**ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"**

**ISO 21930:2017, "Sustainability in Building Construction — Environmental Declaration of Building Products" serves as the core PCR.**

**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


**Download PDF** SM Transparency Report / EPD

**SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. Environmental declarations of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines, use the same sub-category PCR where applicable, include all relevant information modules, be limited to EPDs applying a functional unit, and be based on equivalent scenarios with respect to the context of construction works. The results of this EPD reflect an average performance by the product, and its actual impacts may vary on a case-to-case basis. Some LCA impact categories and inventory items are still under development and can have high levels of uncertainty. To promote uniform guidance on the data collection, calculation, and reporting of results, the ACLCA methodology (ACLCA 2019) was used.

## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| |
|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Awning Window offers a patented, high-performance fiberglass solution designed and manufactured in North America. It features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum windows. Awning windows consist of an operable sash frame around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the window to remain stationary in a closed position, and swing at the top of the window to open. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, providing structural support and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 1,500mm × 600mm (59in × 24in) awning window normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Awning window | 40.29 | 27.5 | 12.8 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The manufacturing stage is the next highest contributor to the global warming and fossil fuel depletion impact categories. The upstream transportation stage has the next highest contribution for the remaining categories including ozone depletion, smog, acidification, eutrophication, carcinogenics, non-carcinogenics, respiratory effects, and ecotoxicity.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up 80-90% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw materials acquisition stage. The fiberglass window frame generated 62.4% of total global warming results, whereas the glazing generated 37.6% of the total. The glazing unit contains two 4mm glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials has the second highest contribution to many impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) of raw materials accounts for a notable contribution to Global Warming Potentials (GWP) at around 21% and Fossil Fuel Depletion at around 28%, with relatively low contributions to the remaining impact categories.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

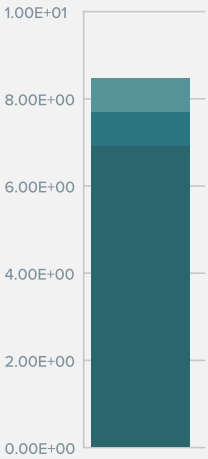
### Sensitivity analysis

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Fiberglass lineals | 49.4% |
| Glazing | 31.8% |
| Hardware | 5.89% |
| Shear block | 2.53% |
| Insulation | 1.26% |
| Paint | 1.00% |
| Screws | 0.990% |
| Sill angle | 0.800% |
| Strap anchor | 0.750% |
| Gaskets | 0.430% |
| Sealant | 0.180% |
| Packaging (wood crate) | 4.99% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 6.88E+00 |
| Transportation | 8.76E-01 |
| Manufacturing | 7.60E-01 |

Total impacts = **8.52E+00 mPts**

analysis was conducted to examine the sensitivity of the different available glazing configurations.

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 6.88E+00 mPts | 8.76E-01 mPts | 7.60E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Awning Window (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| − Ecological damage | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 3.60E-01 | 2.60E-02 | 1.33E-02 |
| Eutrophication | kg N eq | 5.26E-02 | 1.57E-03 | 1.20E-03 |
| Global warming | kg $CO_2$ eq | 6.86E+01 | 1.49E+01 | 2.25E+01 |
| Ozone depletion | kg CFC-11 eq | 3.30E-06 | 2.31E-07 | 2.05E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.61E-06 | 9.45E-09 | 4.61E-09 |
| Non-carcinogenics | $CTU_h$ | 7.87E-06 | 1.84E-06 | 3.07E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 4.09E-02 | 5.03E-03 | 1.63E-03 |
| Smog | kg $O_3$ eq | 4.45E+00 | 4.29E-01 | 3.08E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.09E+02 | 2.84E+01 | 5.40E+01 |
| Ecotoxicity | $CTU_e$ | 1.29E+02 | 3.76E+01 | 5.21E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Awning Window (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.44E-01 | 2.47E-02 | 9.05E-03 |
| Eutrophication | kg N eq | 3.54E-02 | 1.48E-03 | 8.17E-04 |
| Global warming | kg $CO_2$ eq | 3.70E+01 | 1.38E+01 | 1.54E+01 |
| Ozone depletion | kg CFC-11 eq | 1.00E-06 | 2.14E-07 | 1.40E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 8.95E-07 | 8.77E-09 | 3.14E-09 |
| Non-carcinogenics | $CTU_h$ | 4.80E-06 | 1.71E-06 | 2.10E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.25E-02 | 4.70E-03 | 1.11E-03 |
| Smog | kg $O_3$ eq | 1.97E+00 | 4.09E-01 | 2.10E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 6.61E+01 | 2.63E+01 | 3.68E+01 |
| Ecotoxicity | $CTU_e$ | 1.16E+02 | 3.48E+01 | 3.56E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Awning Window (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 2.17E-01 | 1.27E-03 | 4.21E-03 |
| Eutrophication | kg N eq | 1.73E-02 | 9.28E-05 | 3.80E-04 |
| Global warming | kg $CO_2$ eq | 3.16E+01 | 1.07E+00 | 7.16E+00 |
| Ozone depletion | kg CFC-11 eq | 2.30E-06 | 1.66E-08 | 6.50E-08 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 7.11E-07 | 6.81E-10 | 1.46E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 3.06E-06 | 1.35E-07 | 9.75E-08 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 1.85E-02 | 3.33E-04 | 5.18E-04 |
| **Smog** | **kg $O_3$ eq** | 2.48E+00 | 1.95E-02 | 9.77E-02 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 4.29E+01 | 2.04E+00 | 1.71E+01 |
| **Ecotoxicity** | **$CTU_e$** | 1.31E+01 | 2.76E+00 | 1.65E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

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**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


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## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| |
|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Hopper Window offers a patented, high-performance fiberglass solution designed and manufactured in North America. It features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum windows. Hopper windows consist of an operable sash frame around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the window to remain stationary in a closed position, and tilt the window inward to an open. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, providing structural support and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 1,500mm × 600mm (59in × 24in) hopper window normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Hopper window | 40.1 | 27.0 | 13.0 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The manufacturing activities contribute to a higher contribution to global warming and fossil fuel depletion when compared to the upstream transportation stage. Upstream transportation is the next highest contributor to the remaining impact categories.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up on average 80-85% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass window frame generated 61.2% of total global warming results, whereas the glazing generated 38.8% of the total. The glazing unit contains two 4mm glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials accounts for a notable contribution to impacts at around 10-20% for many impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) is the smallest contributor to impact categories except for fossil fuel depletion.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

### Sensitivity analysis

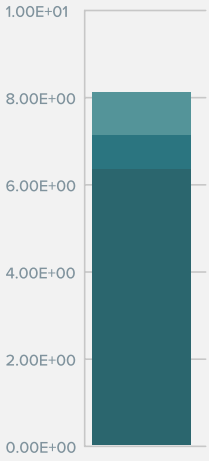
Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Fiberglass lineals | 50.3% |
| Glazing | 32.6% |
| Hardware | 3.17% |
| Shear block | 1.95% |
| Sill angle | 1.66% |
| Insulation | 1.27% |
| Paint | 1.01% |
| Screws | 0.990% |
| Strap anchor | 0.750% |
| Gaskets | 0.430% |
| Sealant | 0.180% |
| Packaging (wood crate) | 5.71% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 6.36E+00 |
| Transportation | 8.77E-01 |
| Manufacturing | 8.66E-01 |

Total impacts = **8.10E+00 mPts**

window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

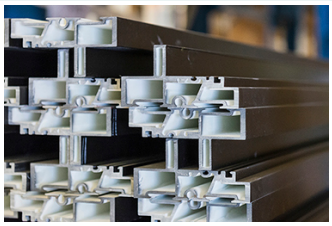
### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 6.36E+00 mPts | 8.77E-01 mPts | 8.66E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Hopper Window (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| ⊖ Ecological damage | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 3.57E-01 | 2.29E-02 | 1.51E-02 |
| Eutrophication | kg N eq | 4.83E-02 | 1.47E-03 | 1.39E-03 |
| Global warming | kg $CO_2$ eq | 6.71E+01 | 1.49E+01 | 2.57E+01 |
| Ozone depletion | kg CFC-11 eq | 3.53E-06 | 2.32E-07 | 2.33E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.48E-06 | 9.49E-09 | 5.25E-09 |
| Non-carcinogenics | $CTU_h$ | 7.18E-06 | 1.86E-06 | 3.50E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 4.04E-02 | 4.89E-03 | 1.86E-03 |
| Smog | kg $O_3$ eq | 4.34E+00 | 3.70E-01 | 3.51E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.05E+02 | 2.85E+01 | 6.15E+01 |
| Ecotoxicity | $CTU_e$ | 1.05E+02 | 3.80E+01 | 5.94E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Hopper Window (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.35E-01 | 2.16E-02 | 1.02E-02 |
| Eutrophication | kg N eq | 3.06E-02 | 1.38E-03 | 9.35E-04 |
| Global warming | kg $CO_2$ eq | 3.48E+01 | 1.38E+01 | 1.73E+01 |
| Ozone depletion | kg CFC-11 eq | 1.18E-06 | 2.15E-07 | 1.57E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 7.57E-07 | 8.80E-09 | 3.54E-09 |
| Non-carcinogenics | $CTU_h$ | 4.05E-06 | 1.72E-06 | 2.36E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.15E-02 | 4.55E-03 | 1.25E-03 |
| Smog | kg $O_3$ eq | 1.80E+00 | 3.50E-01 | 2.36E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 6.16E+01 | 2.64E+01 | 4.14E+01 |
| Ecotoxicity | $CTU_e$ | 9.16E+01 | 3.52E+01 | 4.00E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Hopper Window (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 2.21E-01 | 1.30E-03 | 4.92E-03 |
| Eutrophication | kg N eq | 1.76E-02 | 9.48E-05 | 4.52E-04 |
| Global warming | kg $CO_2$ eq | 3.23E+01 | 1.09E+00 | 8.38E+00 |
| Ozone depletion | kg CFC-11 eq | 2.35E-06 | 1.69E-08 | 7.60E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 7.27E-07 | 6.96E-10 | 1.71E-09 |
| Non-carcinogenics | $CTU_h$ | 3.13E-06 | 1.38E-07 | 1.14E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 1.89E-02 | 3.40E-04 | 6.06E-04 |
| Smog | kg $O_3$ eq | 2.54E+00 | 1.99E-02 | 1.14E-01 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 4.38E+01 | 2.09E+00 | 2.00E+01 |
| Ecotoxicity | $CTU_e$ | 1.34E+01 | 2.82E+00 | 1.94E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

**ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"**

**ISO 21930:2017, "Sustainability in Building Construction — Environmental Declaration of Building Products" serves as the core PCR.**

**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


**Download PDF** SM Transparency Report / EPD

**SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. Environmental declarations of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines, use the same sub-category PCR where applicable, include all relevant information modules, be limited to EPDs applying a functional unit, and be based on equivalent scenarios with respect to the context of construction works. The results of this EPD reflect an average performance by the product, and its actual impacts may vary on a case-to-case basis. Some LCA impact categories and inventory items are still under development and can have high levels of uncertainty. To promote uniform guidance on the data collection, calculation, and reporting of results, the ACLCA methodology (ACLCA 2019) was used.

## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| |
|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Tilt & Turn Window offers a patented, high-performance fiberglass solution designed and manufactured in North America. It features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum windows. Tilt & turn windows consist of an operable sash frame around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the window to remain stationary in a closed position, tilt the window, and turn the window open. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, providing structural support and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 1,200mm × 1,500mm (47in × 59in) Tilt & Turn window normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Tilt & Turn window | 33.0 | 17.5 | 15.5 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The upstream transportation stage is the next highest contributor to most impact categories including ozone depletion, smog, acidification, eutrophication, carcinogenics, non-carcinogenics, respiratory effects, and ecotoxicity. The manufacturing stage is the next highest contributor to global warming and fossil fuel depletion, due to fabrication and waste disposal activities.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up on average 80-85% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass window frame generated 44.2% of total global warming results, whereas the glazing generated 55.8% of the total. The glazing unit contains two 4mm glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials has the second highest contributions to many impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) of raw materials accounts for a notable contribution to Global Warming Potentials (GWP) at around 15%, with relatively low contributions to the remaining impact categories.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

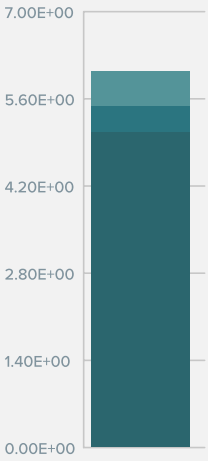
### Sensitivity analysis

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Glazing | 47.1% |
| Fiberglass lineals | 40.3% |
| Hardware | 3.43% |
| Shear block | 1.21% |
| Insulation | 1.01% |
| Sill angle | 0.830% |
| Paint | 0.700% |
| Screws | 0.610% |
| Strap anchor | 0.470% |
| Sealant | 0.450% |
| Gaskets | 0.350% |
| Packaging (wood crate) | 3.54% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 5.10E+00 |
| Transportation | 6.13E-01 |
| Manufacturing | 4.39E-01 |

Total impacts = 6.15E+00 mPts

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 5.10E+00 mPts | 6.13E-01 mPts | 4.39E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Tilt & Turn Window (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| − Ecological damage | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 3.41E-01 | 1.62E-02 | 7.66E-03 |
| Eutrophication | kg N eq | 3.87E-02 | 1.04E-03 | 6.46E-04 |
| Global warming | kg $CO_2$ eq | 5.88E+01 | 1.04E+01 | 1.30E+01 |
| Ozone depletion | kg CFC-11 eq | 3.49E-06 | 1.62E-07 | 1.18E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.16E-06 | 6.63E-09 | 2.66E-09 |
| Non-carcinogenics | $CTU_h$ | 5.67E-06 | 1.30E-06 | 1.78E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 3.53E-02 | 3.43E-03 | 9.42E-04 |
| Smog | kg $O_3$ eq | 4.08E+00 | 2.63E-01 | 1.78E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 8.92E+01 | 1.99E+01 | 3.12E+01 |
| Ecotoxicity | $CTU_e$ | 7.16E+01 | 2.65E+01 | 3.01E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Tilt & Turn Window (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 7.78E-02 | 1.47E-02 | 4.05E-03 |
| Eutrophication | kg N eq | 1.77E-02 | 9.22E-04 | 3.42E-04 |
| Global warming | kg $CO_2$ eq | 2.03E+01 | 9.13E+00 | 6.88E+00 |
| Ozone depletion | kg CFC-11 eq | 6.95E-07 | 1.42E-07 | 6.25E-08 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 2.93E-07 | 5.80E-09 | 1.41E-09 |
| Non-carcinogenics | $CTU_h$ | 1.94E-06 | 1.14E-06 | 9.39E-08 |
| Respiratory effects | kg $PM_{2.5}$ eq | 1.28E-02 | 3.03E-03 | 4.98E-04 |
| Smog | kg $O_3$ eq | 1.06E+00 | 2.39E-01 | 9.41E-02 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 3.70E+01 | 1.74E+01 | 1.65E+01 |
| Ecotoxicity | $CTU_e$ | 5.57E+01 | 2.32E+01 | 1.59E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Tilt & Turn Window (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 2.63E-01 | 1.54E-03 | 3.61E-03 |
| Eutrophication | kg N eq | 2.10E-02 | 1.13E-04 | 3.04E-04 |
| Global warming | kg $CO_2$ eq | 3.85E+01 | 1.30E+00 | 6.13E+00 |
| Ozone depletion | kg CFC-11 eq | 2.79E-06 | 2.02E-08 | 5.57E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 8.65E-07 | 8.28E-10 | 1.25E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 3.72E-06 | 1.64E-07 | 8.37E-08 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 2.25E-02 | 4.04E-04 | 4.44E-04 |
| **Smog** | **kg $O_3$ eq** | 3.02E+00 | 2.37E-02 | 8.38E-02 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 5.21E+01 | 2.48E+00 | 1.47E+01 |
| **Ecotoxicity** | **$CTU_e$** | 1.59E+01 | 3.35E+00 | 1.42E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

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December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


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## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| |
|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Swing Doors offers a patented, high-performance fiberglass solution designed and manufactured in North America. The swing door features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum doors. Swing doors consist of an operable door frame around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the door to remain stationary in a closed position, and swing to open. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, allow occupant egress, provide structural support, and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 960mm × 2090mm (38in × 82in) swing door normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Swing door | 41.2 | 25.3 | 15.9 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** Swing door configurations require fewer manufacturing activities for the frame as compared to windows, resulting in a larger contribution to A1. The upstream transportation stage is the next highest contributor to most impact categories including global warming and ecotoxicity. Manufacturing is the smallest contributor to all impacts except for fossil fuel depletion, due to fabrication and waste disposal activities.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up 80-90% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass door frame generated 43% of total global warming results, whereas the glazing generated 57% of the total. The glazing unit contains two 5mm tempered glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials is the next highest contributor to most impact categories at around 10-20%.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) of raw materials accounts for a notable contribution to Global Warming Potentials (GWP) at around 16% and Fossil Fuel Depletion at around 23%, with relatively low contributions to the remaining impact categories.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

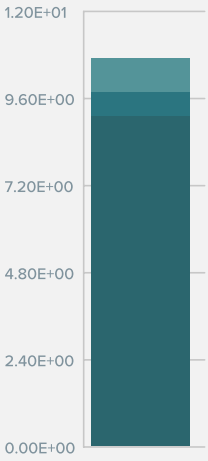
### Sensitivity analysis

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| **Fiberglass lineals** | 45.8% |
| **Glazing** | 38.5% |
| **Hardware** | 4.85% |
| **Insulation** | 1.26% |
| **Aluminum lineals** | 1.25% |
| **Shear block** | 0.910% |
| **Polypropylene lineals** | 0.880% |
| **Paint** | 0.680% |
| **Strap anchor** | 0.440% |
| **Screws** | 0.440% |
| **Gaskets** | 0.270% |
| **Sealant** | 0.080% |
| **Packaging (wood crate)** | 4.69% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| **Raw material acquisition** | 9.19E+00 |
| **Transportation** | 8.41E-01 |
| **Manufacturing** | 7.29E-01 |

**Total impacts = 1.08E+01 mPts**

analysis was conducted to examine the sensitivity of the different available glazing configurations.

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | **(X) A1 Raw material supply** | **(X) A2 Transport** | **(X) A3 Manufacturing** |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 9.19E+00 mPts | 8.41E-01 mPts | 7.29E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Swing Door (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| ⊖ **Ecological damage** | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 5.75E-01 | 2.36E-02 | 1.27E-02 |
| Eutrophication | kg N eq | 6.04E-02 | 1.47E-03 | 9.87E-04 |
| Global warming | kg $CO_2$ eq | 9.99E+01 | 1.43E+01 | 2.16E+01 |
| Ozone depletion | kg CFC-11 eq | 5.71E-06 | 2.22E-07 | 1.96E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 2.34E-06 | 9.09E-09 | 4.41E-09 |
| Non-carcinogenics | $CTU_h$ | 1.04E-05 | 1.78E-06 | 2.95E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 6.07E-02 | 4.77E-03 | 1.57E-03 |
| Smog | kg $O_3$ eq | 6.76E+00 | 3.87E-01 | 2.96E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.48E+02 | 2.73E+01 | 5.19E+01 |
| Ecotoxicity | $CTU_e$ | 9.89E+01 | 3.62E+01 | 4.99E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Swing Door (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.53E-01 | 2.21E-02 | 7.83E-03 |
| Eutrophication | kg N eq | 2.80E-02 | 1.35E-03 | 6.07E-04 |
| Global warming | kg $CO_2$ eq | 3.78E+01 | 1.30E+01 | 1.33E+01 |
| Ozone depletion | kg CFC-11 eq | 1.49E-06 | 2.01E-07 | 1.21E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 1.05E-06 | 8.25E-09 | 2.71E-09 |
| Non-carcinogenics | $CTU_h$ | 4.79E-06 | 1.61E-06 | 1.82E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.45E-02 | 4.36E-03 | 9.64E-04 |
| Smog | kg $O_3$ eq | 1.88E+00 | 3.63E-01 | 1.82E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 6.23E+01 | 2.48E+01 | 3.20E+01 |
| Ecotoxicity | $CTU_e$ | 7.45E+01 | 3.28E+01 | 3.07E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Swing Door (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 4.22E-01 | 1.57E-03 | 4.89E-03 |
| Eutrophication | kg N eq | 3.25E-02 | 1.15E-04 | 3.79E-04 |
| Global warming | kg $CO_2$ eq | 6.21E+01 | 1.32E+00 | 8.30E+00 |
| Ozone depletion | kg CFC-11 eq | 4.22E-06 | 2.05E-08 | 7.55E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 1.29E-06 | 8.42E-10 | 1.69E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 5.62E-06 | 1.67E-07 | 1.13E-07 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 3.61E-02 | 4.11E-04 | 6.02E-04 |
| **Smog** | **kg $O_3$ eq** | 4.88E+00 | 2.41E-02 | 1.14E-01 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 8.56E+01 | 2.53E+00 | 2.00E+01 |
| **Ecotoxicity** | **$CTU_e$** | 2.44E+01 | 3.41E+00 | 1.92E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

**ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"**

**ISO 21930:2017, "Sustainability in Building Construction — Environmental Declaration of Building Products" serves as the core PCR.**

**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


**Download PDF** SM Transparency Report / EPD

**SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. Environmental declarations of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines, use the same sub-category PCR where applicable, include all relevant information modules, be limited to EPDs applying a functional unit, and be based on equivalent scenarios with respect to the context of construction works. The results of this EPD reflect an average performance by the product, and its actual impacts may vary on a case-to-case basis. Some LCA impact categories and inventory items are still under development and can have high levels of uncertainty. To promote uniform guidance on the data collection, calculation, and reporting of results, the ACLCA methodology (ACLCA 2019) was used.

## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| | |
|---|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell | |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs | |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door

Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Double Swing Doors offers a patented, high-performance fiberglass solution designed and manufactured in North America. The swing door features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum doors. Double swing doors consist of two operable door frames around a transparent glazing unit, placed withing a fixed frame and equipped with hardware that allows the each door to remain stationary in a closed position, and swing to open independently of each other. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, allow occupant egress, provide structural support, and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 1,920mm × 2,090mm (76in × 82in) double swing doors normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Double swing door | 36.6 | 20.1 | 16.3 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The upstream transportation stage is the next highest contributor to most impact categories including global warming and ecotoxicity. Manufacturing is the smallest contributor to all impacts except for global warming and fossil fuel depletion, due to fabrication and waste disposal activities.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up 80-90% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass door frame generated 43% of total global warming results, whereas the glazing generated 57% of the total. The glazing unit contains two 6mm tempered glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials accounts for a notable contribution to impacts at around 5-10% to many impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. Most of the ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

**Manufacturing (A3) is the second-highest contributor to many impact categories.** This module includes fabrication and the disposal of manufacturing waste. The fabrication process includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

### Sensitivity analysis

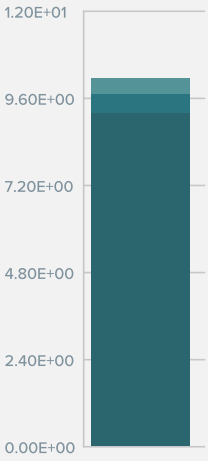
Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed

## Material composition by wt%

| MATERIAL | WT% |
|---|---|
| Glazing | 44.5% |
| Fiberglass lineals | 38.4% |
| Hardware | 5.45% |
| Insulation | 1.65% |
| Shear block | 1.27% |
| Polypropylene lineals | 1.03% |
| Aluminum lineals | 0.790% |
| Paint | 0.700% |
| Gaskets | 0.300% |
| Strap anchor | 0.280% |
| Screws | 0.250% |
| Sealant | 0.090% |
| Packaging (wood crate) | 5.28% |

## Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| Raw material acquisition | 8.99E+00 |
| Transportation | 6.55E-01 |
| Manufacturing | 7.29E-01 |

Total impacts = 1.04E+01 mPts

window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | (X) A1 Raw material supply | (X) A2 Transport | (X) A3 Manufacturing |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 8.99E+00 mPts | 6.55E-01 mPts | 7.29E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Double Swing Door (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| ⊖ Ecological damage | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 5.74E-01 | 2.01E-02 | 1.27E-02 |
| Eutrophication | kg N eq | 5.90E-02 | 1.20E-03 | 9.86E-04 |
| Global warming | kg $CO_2$ eq | 9.86E+01 | 1.11E+01 | 2.16E+01 |
| Ozone depletion | kg CFC-11 eq | 5.70E-06 | 1.73E-07 | 1.96E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 2.32E-06 | 7.07E-09 | 4.41E-09 |
| Non-carcinogenics | $CTU_h$ | 1.00E-05 | 1.37E-06 | 2.95E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 5.90E-02 | 3.79E-03 | 1.56E-03 |
| Smog | kg $O_3$ eq | 6.70E+00 | 3.33E-01 | 2.95E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.45E+02 | 2.12E+01 | 5.19E+01 |
| Ecotoxicity | $CTU_e$ | 8.89E+01 | 2.80E+01 | 4.99E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Double Swing Door (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.40E-01 | 1.85E-02 | 7.05E-03 |
| Eutrophication | kg N eq | 2.56E-02 | 1.08E-03 | 5.17E-04 |
| Global warming | kg $CO_2$ eq | 3.46E+01 | 9.77E+00 | 1.20E+01 |
| Ozone depletion | kg CFC-11 eq | 1.36E-06 | 1.52E-07 | 1.09E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 9.84E-07 | 6.20E-09 | 2.44E-09 |
| Non-carcinogenics | $CTU_h$ | 4.26E-06 | 1.20E-06 | 1.64E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.19E-02 | 3.37E-03 | 8.68E-04 |
| Smog | kg $O_3$ eq | 1.68E+00 | 3.08E-01 | 1.64E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 5.69E+01 | 1.86E+01 | 2.88E+01 |
| Ecotoxicity | $CTU_e$ | 6.38E+01 | 2.45E+01 | 2.76E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Double Swing Door (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 4.34E-01 | 1.62E-03 | 5.66E-03 |
| Eutrophication | kg N eq | 3.34E-02 | 1.18E-04 | 4.15E-04 |
| Global warming | kg $CO_2$ eq | 6.39E+01 | 1.36E+00 | 9.60E+00 |
| Ozone depletion | kg CFC-11 eq | 4.34E-06 | 2.11E-08 | 8.73E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 1.33E-06 | 8.67E-10 | 1.96E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 5.78E-06 | 1.72E-07 | 1.31E-07 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 3.72E-02 | 4.23E-04 | 6.97E-04 |
| **Smog** | **kg $O_3$ eq** | 5.02E+00 | 2.49E-02 | 1.32E-01 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 8.81E+01 | 2.60E+00 | 2.31E+01 |
| **Ecotoxicity** | **$CTU_e$** | 2.51E+01 | 3.51E+00 | 2.22E-01 |

## References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## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| |
|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# LCA results & interpretation

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Scope and summary

● **Cradle to gate** ○ Cradle to gate with options ○ Cradle to grave

### Application

The Cascadia Universal Series™ Sliding Door offers a patented, high-performance fiberglass solution designed and manufactured in North America. The sliding door features an innovative, commercial-grade fiberglass frame that boasts up to 250% improved thermal performance compared to traditional aluminum doors. Sliding doors consist of an operable door frame around a transparent glazing unit, and fixed door frame around a transparent glazing unit. These are placed withing a fixed frame and equipped with hardware that allows the operable door to remain stationary in a closed position, or to slide parallel to the fixed door. The primary function of these fenestration systems is to create a façade between the building's interior and exterior, allow occupant egress, provide structural support, and limiting thermal transfer through the building envelope.

### Declared unit

The declared unit is one 2,000mm × 2,000mm (79in × 79in) sliding door normalized to one square meter (1 $m^2$) of fenestration assemblies (including frame and glass). Glazing beads and stops, sealants, gaskets, and other parts that retain or support the glazing are considered part of the framing assembly, not the glazing assembly. The declared product meets the relevant performance standards in ANSI/NFRC 100 per the identified sub-type.

**Mass per declared unit:**

| Fenestration sub-type | Whole unit, kg | Frame only, kg | Glazing only, kg |
|---|---|---|---|
| Sliding door | 33.0 | 14.6 | 18.4 |

### Manufacturing data

**Reporting period:** May 2022 – April 2023
**Location:** British Columbia, Canada

## What's causing the greatest impacts

### All life cycle stages

**Activities during the acquisition and preprocessing of raw materials are responsible for the majority of the impacts in each impact category.** The raw material supply stage dominates the results for all impact categories. The next highest contributor to global warming and fossil fuel depletion is the manufacturing stage due to fabrication and waste disposal activities, which makes up 10.8% of global warming and 16.9% of fossil fuel depletion impacts. The upstream transportation stage is the next highest contributor to the remaining impact categories.

### Raw materials acquisition

**Raw materials acquisition (A1) dominates the results for all impact categories.** This module includes the raw materials acquired and preprocessed by the suppliers, including packaging. This stage makes up 80-90% of the total impacts for all impact categories. The glazing and frame are the two contributors calculated separately in the raw material acquisition stage. The fiberglass door frame generated 35.8% of total global warming results, whereas the glazing generated 64.2% of the total. The glazing unit contains two 6mm tempered glass panes manufactured by an upstream supplier and sourced in North America. The frame unit contains fiberglass lineals, insulation, hardware, and packaging. During the production of these fiberglass lineals, glass fibers and catalyzed polyester resin are combined in a pultrusion process. The fiberglass lineals make up most of the weight of the frame unit, and they dominate the environmental impacts over the other frame components.

### Transportation

**Transportation (A2) of raw materials accounts for a notable contribution to impacts at around 5-10% to many impact categories.** This module includes raw material transportation from suppliers to the Cascadia manufacturing facility. The transportation stage accounts for slightly higher percentages compared to the manufacturing stage in the following impact categories: ozone depletion, smog, acidification, eutrophication, carcinogenic, non-carcinogenic, respiratory effects, and ecotoxicity. Most ingredients sourced in North America are transported by semi-truck, whereas materials sourced from overseas use a mix of road transportation by semi-truck and sea transportation by ship.

### Manufacturing

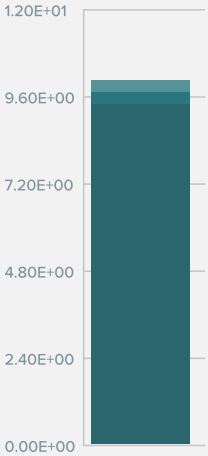
**Manufacturing (A3) is the second-highest contributor to many impact categories.** This module includes fabrication and the disposal of manufacturing waste. The fabrication includes cutting the fiberglass, drilling, packaging, and cleaning. Fiberglass production waste, incoming raw material packaging waste, and other non-hazardous wastes are transported to a landfill, and recyclable packaging wastes are transported to a recycling facility or reused within the plant.

### Sensitivity analysis

### Material composition by wt%

| MATERIAL | WT% |
|---|---|
| **Glazing** | 55.8% |
| **Fiberglass lineals** | 34.2% |
| **Aluminum lineals** | 1.82% |
| **Shear block** | 1.27% |
| **Insulation** | 1.23% |
| **Hardware** | 0.740% |
| **Paint** | 0.410% |
| **Strap anchor** | 0.350% |
| **Gaskets** | 0.310% |
| **Screws** | 0.270% |
| **Sealant** | 0.080% |
| **Packaging (wood crate)** | 3.54% |

### Total impacts by life cycle stage [mPts/decl unit]




| LIFE CYCLE STAGE | MPTS/DECL. UNIT |
|---|---|
| **Raw material acquisition** | 9.44E+00 |
| **Transportation** | 5.42E-01 |
| **Manufacturing** | 4.61E-01 |

**Total impacts = 1.04E+01 mPts**

Sensitivity analyses were performed to check the robustness of the results where the highest potential environmental impacts were occurring. Since the bulk of impacts were attributed to raw materials acquisition, a sensitivity analysis was conducted to examine the sensitivity of the different available glazing configurations.

Global warming potential was evaluated for sensitivity since Cascadia is interested in the potential $CO_2$-equivalent emissions of its products. The fixed window was evaluated as a worst case scenario, since it has the highest percentage of glazing and therefore provides the most conservative estimate of change. Choosing a triple-glazed product configuration rather than the double-glazed option resulted in a 32.9% increase in total life cycle impacts, highlighting the importance of this choice on total impacts.

### How we're making it greener

Fiberglass is an ideal structural material for window and door frames, which is why Cascadia has used a proprietary, high glass-fiber-to-resin formula for more than a decade. Beyond its high strength and thermal efficiency, Cascadia's pultruded, thermoset fiberglass frames contain roughly 58% recycled content, low VOC's, and represent less embodied energy compared to vinyl or aluminum.

Not susceptible to decay or corrosion, fiberglass also expands and contracts with temperature change at roughly the same rate as the adjacent IGU. This extends the longevity of window seals and gaskets, reducing maintenance costs. Combined with a modeled lifespan of up to 80 years, fiberglass represents the future of high-performance windows and doors.

See how we make it greener

## LCA results

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 UPSTREAM TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| | **(X) A1 Raw material supply** | **(X) A2 Transport** | **(X) A3 Manufacturing** |
| **Information modules:**<br>**Included (X)** \| Excluded (MND)*<br><br>*Modules A4, A5, B, C, and D are excluded. |  |  |  |

## SM Single Score

| Impacts per declared unit | 9.44E+00 mPts | 5.42E-01 mPts | 4.61E-01 mPts |
|---|---|---|---|
| **Materials or processes contributing >20% to total impacts in each life cycle stage** | Upstream manufacturing of the fiberglass lineals and glass panes. | Transportation of raw materials to the Cascadia facility. | Product fabrication including cutting, drilling, packaging, and cleaning. |

## TRACI v2.1 results per declared unit of Universal Series™ Sliding Door (total)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|
| ⊖ **Ecological damage** | | | |

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 6.21E-01 | 1.27E-02 | 8.04E-03 |
| Eutrophication | kg N eq | 6.02E-02 | 8.59E-04 | 6.06E-04 |
| Global warming | kg $CO_2$ eq | 1.04E+02 | 9.22E+00 | 1.36E+01 |
| Ozone depletion | kg CFC-11 eq | 6.06E-06 | 1.43E-07 | 1.24E-07 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 2.37E-06 | 5.87E-09 | 2.79E-09 |
| Non-carcinogenics | $CTU_h$ | 1.04E-05 | 1.16E-06 | 1.87E-07 |
| Respiratory effects | kg $PM_{2.5}$ eq | 6.46E-02 | 2.95E-03 | 9.90E-04 |
| Smog | kg $O_3$ eq | 7.25E+00 | 2.01E-01 | 1.87E-01 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 1.44E+02 | 1.76E+01 | 3.28E+01 |
| Ecotoxicity | $CTU_e$ | 1.13E+02 | 2.36E+01 | 3.15E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Sliding Door (frame only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 1.30E-01 | 1.09E-02 | 3.55E-03 |
| Eutrophication | kg N eq | 2.25E-02 | 7.26E-04 | 2.68E-04 |
| Global warming | kg $CO_2$ eq | 3.17E+01 | 7.69E+00 | 6.03E+00 |
| Ozone depletion | kg CFC-11 eq | 1.15E-06 | 1.19E-07 | 5.48E-08 |

### Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Carcinogenics | $CTU_h$ | 8.67E-07 | 4.89E-09 | 1.23E-09 |
| Non-carcinogenics | $CTU_h$ | 3.87E-06 | 9.62E-07 | 8.24E-08 |
| Respiratory effects | kg $PM_{2.5}$ eq | 2.26E-02 | 2.48E-03 | 4.37E-04 |
| Smog | kg $O_3$ eq | 1.57E+00 | 1.73E-01 | 8.26E-02 |

### Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| Fossil fuel depletion | MJ surplus | 4.46E+01 | 1.47E+01 | 1.45E+01 |
| Ecotoxicity | $CTU_e$ | 8.46E+01 | 1.96E+01 | 1.39E-01 |

## TRACI v2.1 results per declared unit of Universal Series™ Sliding Door (glazing only)

| LIFE CYCLE STAGE | A1 RAW MATERIAL SUPPLY | A2 TRANSPORT | A3 MANUFACTURING |
|---|---|---|---|

### Ecological damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| Acidification | kg $SO_2$ eq | 4.91E-01 | 1.83E-03 | 4.49E-03 |
| Eutrophication | kg N eq | 3.78E-02 | 1.34E-04 | 3.38E-04 |
| Global warming | kg $CO_2$ eq | 7.23E+01 | 1.54E+00 | 7.61E+00 |
| Ozone depletion | kg CFC-11 eq | 4.91E-06 | 2.39E-08 | 6.92E-08 |

## Human health damage

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Carcinogenics** | **$CTU_h$** | 1.51E-06 | 9.80E-10 | 1.55E-09 |
| **Non-carcinogenics** | **$CTU_h$** | 6.53E-06 | 1.94E-07 | 1.04E-07 |
| **Respiratory effects** | **kg $PM_{2.5}$ eq** | 4.20E-02 | 4.79E-04 | 5.52E-04 |
| **Smog** | **kg $O_3$ eq** | 5.67E+00 | 2.81E-02 | 1.04E-01 |

## Additional environmental information

| Impact category | Unit | | | |
|---|---|---|---|---|
| **Fossil fuel depletion** | **MJ surplus** | 9.96E+01 | 2.94E+00 | 1.83E+01 |
| **Ecotoxicity** | **$CTU_e$** | 2.84E+01 | 3.97E+00 | 1.76E-01 |

## References


**LCA Background Report**

Cascadia Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Windows Wall LCA Background Report, Cascadia 2024; SimaPro Analyst 9.6; ecoinvent v3.10 and US-EI 2.2 databases; TRACI 2.1.

**ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services"**

**ISO 21930:2017, "Sustainability in Building Construction — Environmental Declaration of Building Products" serves as the core PCR.**

**NSF PCR for Fenestration Assemblies, version 2**

December, 2023. PCR review conducted by Dr. Thomas P. Gloria, Ph.D (Industrial Ecology Consultants) t.gloria@industrial-ecology.com; Jack Geibig (Ecoform) jgeibig@ecoform.com; Bill Stough (Bill Stough, LLC) bill@billstough.net.


**Download PDF** SM Transparency Report / EPD

**SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis.** They are designed to present information transparently to make the limitations of comparability more understandable. Environmental declarations of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore cannot be used as comparative assertions unless the conditions as defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. In order to support comparative assertions, this EPD meets all comparability requirements stated in ISO 14025:2006. However, differences in certain assumptions, data quality, and variability between LCA data sets may still exist. As such, caution should be exercised when evaluating EPDs from different manufacturers or programs, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the construction works level per ISO 21930:2017 guidelines, use the same sub-category PCR where applicable, include all relevant information modules, be limited to EPDs applying a functional unit, and be based on equivalent scenarios with respect to the context of construction works. The results of this EPD reflect an average performance by the product, and its actual impacts may vary on a case-to-case basis. Some LCA impact categories and inventory items are still under development and can have high levels of uncertainty. To promote uniform guidance on the data collection, calculation, and reporting of results, the ACLCA methodology (ACLCA 2019) was used.

## Rating systems

The intent is to reward project teams for selecting products from manufacturers who have verified improved life-cycle environmental performance.

### LEED BD+C: New Construction | v4 - LEED v4

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | ½ product |
| ✓ Product-specific Type III EPD | 1 product |

### LEED BD+C: New Construction | v4.1 - LEED v4.1

Building product disclosure and optimization

**Environmental product declarations**

| | |
|---|---|
| ○ Industry-wide (generic) EPD | 1 product |
| ✓ Product-specific Type III EPD | 1.5 products |

### Collaborative for High Performance Schools National Criteria

**MW C5.1 – Environmental Product Declarations**

| | |
|---|---|
| ✓ Third-party certified type III EPD | 2 points |

### Green Globes for New Construction and Sustainable Interiors

**Materials and resources**

| | |
|---|---|
| ✓ NC 3.5.1.2 Path B: Prescriptive Path for Building Core and Shell | |
| ✓ NC 3.5.2.2 and SI 4.1.2 Path B: Prescriptive Path for Interior Fit-outs | |

### BREEAM New Construction 2018

Mat 02 - Environmental impacts from construction products

**Environmental Product Declarations (EPD)**

| | |
|---|---|
| ○ Industry-average EPD | .5 points |
| ○ Multi-product specific EPD | .75 points |
| ✓ Product-specific EPD | 1 point |

# EPD additional content

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Fixed Window | Casement Window | Awning Window | Hopper Window | Tilt & Turn Window | Swing Door | Double Swing Door | Sliding Door | EPD additional content

## Data

**Background** This product-specific declaration was created by collecting production data from the British Columbia, Canada location. Secondary data sources include those available in ecoinvent v3.10 and US-EI 2.2 databases. The materials, energy usage, and transportation to the point of usage of fenestration assemblies reported in this document include the production of the final fenestration assemblies, any other ancillary materials used during production, and the primary packaging of the final product.

**Allocation** The PCR prescribes where and how allocation occurs. Since only facility-level data were available, allocation among the facility's other products was necessary to determine the input and output flows associated with the product. To accurately allocate electricity and natural gas used at the facility to window, door, and window wall production, the total annual energy consumption was calculated through labor unit allocation, which proportionally assesses the percentage of manufacturing activities for each product type versus total annual labor activities. Additionally, no co-products were produced during the fabrication processes.

**Cut-off criteria** for the inclusion of mass and energy flows are 1% of renewable primary resource (energy) usage, 1% nonrenewable primary resource (energy) usage, 1% of the total mass input of that unit process, and 1% of environmental impacts. The total of neglected input flows per module does not exceed 5% of energy usage, mass, and environmental impacts. The only exceptions to these criteria are substances with hazardous and toxic properties, which must be listed even when the given process unit is under the cut-off criterion of 1% of the total mass.

No known flows are deliberately excluded from this declaration, and no substances considered to be hazardous or toxic according to the TRI or local regulations are present in the products. Therefore, these criteria have been met. Biogenic carbon is included in reported results.

**Quality** of inventory data is judged by its precision (measured, calculated, or estimated), completeness (e.g., unreported emissions), consistency (degree of uniformity of the methodology applied on a study serving as a data source), and representativeness (geographical, temporal, and technological).

To ensure reliable results, first-hand industry data in combination with consistent background LCA information from SimaPro and LCI databases were used. Primary data associated with the manufacturing process was collected and checked for mass balance and data inventory completeness. Background data were sourced primarily from the ecoinvent database, and other databases were used if data were not available in ecoinvent or the data set was judged to be more representative.

Other methodological choices were made consistently throughout the model. The data set is considered complete based on a review between the LCA team and key Cascadia stakeholders. Where country-specific data were unavailable, global or rest-of-world averages were used to represent transportation in those

## Scenarios and additional technical information

**Installation [A5]** Biogenic carbon emissions generated in the installation phase stem from wood crates used as packaging. While the impacts from installation are out of the scope of this cradle-to-gate study, ISO 21930:2017 requires that biogenic carbon emissions associated with packaging disposed after product installation be separately reported. The table below shows that the biogenic carbon removals from packaging in the manufacturing stage (A3) are then accounted for as biogenic carbon emissions from packaging in the installation stage (A5).

| Product | Biogenic carbon emissions associated with installation [A5] (kg $CO_2$) |
|---|---|
| Universal Series™ Fixed Window | 6.55E-02 |
| Universal Series™ Casement Window | 6.01E-01 |
| Universal Series™ Tilt &Turn Window | 7.76E-01 |
| Universal Series™ Awning Window | 1.34E+00 |
| Universal Series™ Hopper Window | 1.52E+00 |
| Universal Series™ Swing Door | 1.28E+00 |
| Universal Series™ Double Swing Door | 7.28E-01 |
| Universal Series™ Sliding Door | 2.44E+02 |

**Flow diagram**

locations. Additionally, no proxy data were used to represent materials and therefore did not have a significant impact of the results.

**The following data sets were used in the LCA for modeling glazing:**

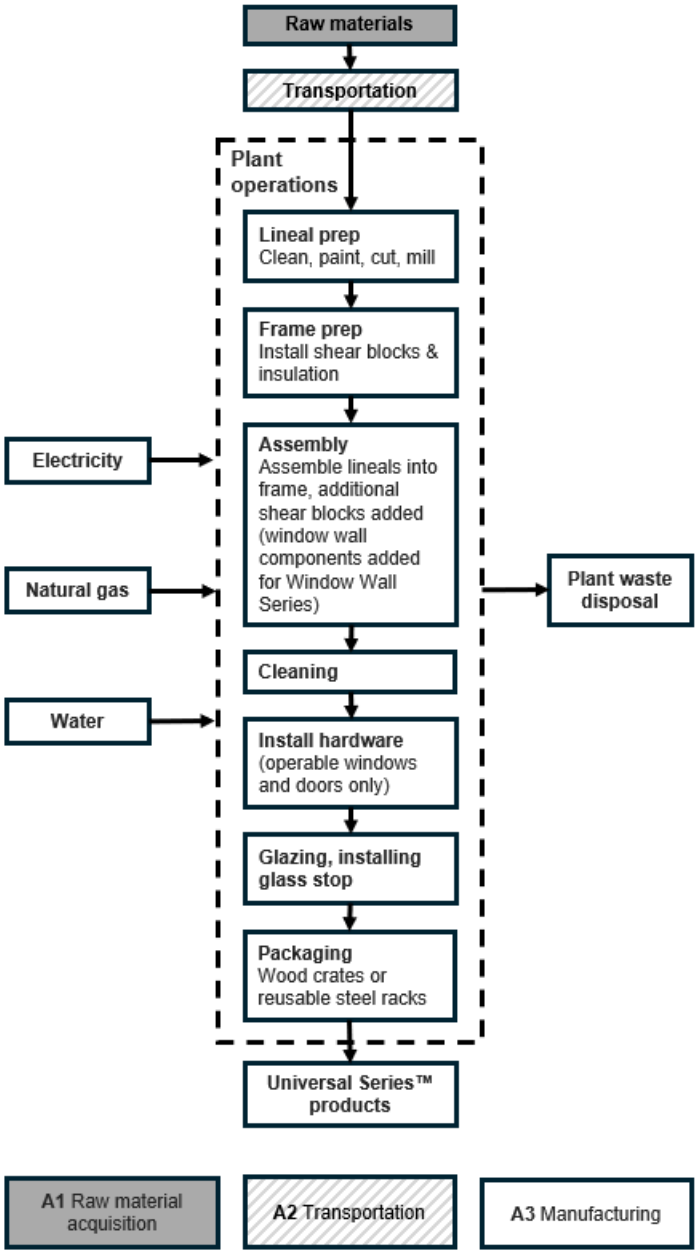
- Flat glass, uncoated, at plant/US- US-EI U
- Flat glass, coated, at plant/US- US-EI U
- Aluminum, production mix, at plant/US- US-EI U
- Sheet rolling, aluminium/US- US-EI U
- Argon, liquid, at plant/US- US-EI U
- Zeolite, powder, at plant/RER S
- Polybutadiene, at plant/US- US-EI U
- Polysulphide, sealing compound, at plant/US- US-EI

**Major system boundary exclusions:**

- Construction of major capital equipment & maintenance and operation of support equipment
- Human labor and employee transport
- Manufacture, transport, and disposal of packaging materials not associated with the final product
- Building operational energy and water use

**Major assumptions and limitations:**

- Primary data were modeled based on the information provided by Cascadia and supplemented by the technical and safety data sheets provided.
- Since energy inputs were not available on a per-product basis, electricity and natural gas consumption were allocated based on the percentage of labor units per product.
- Generic data sets used are considered good quality, but actual impacts from material suppliers, transport carriers, and waste processing may vary.




## Scaling factors: double-glazed to triple-glazed

Results in this EPD are presented assuming a default double-glazed option. In order to calculate results for triple-glazed products for the applicable product types, multiply the results in each impact category by their associated product-specific scaling factor shown here:

| Impact category | Fixed Window | Casement Window | Tilt & Turn Window | Awning Window | Hopper Window | Swing Door | Double Swing Door | Sliding Door |
|---|---|---|---|---|---|---|---|---|
| **Ozone depletion** | 1.43 | 1.31 | 1.37 | 1.31 | 1.31 | 1.34 | 1.36 | 1.43 |
| **Global warming** | 1.33 | 1.15 | 1.23 | 1.15 | 1.15 | 1.23 | 1.24 | 1.2 |
| **Smog** | 1.41 | 1.24 | 1.33 | 1.24 | 1.24 | 1.33 | 1.34 | 1.41 |
| **Acidification** | 1.42 | 1.27 | 1.36 | 1.27 | 1.27 | 1.34 | 1.36 | 1.45 |
| **Eutrophication** | 1.35 | 1.16 | 1.26 | 1.16 | 1.16 | 1.26 | 1.27 | 1.28 |
| **Carcinogenics** | 1.42 | 1.22 | 1.37 | 1.22 | 1.22 | 1.27 | 1.29 | 1.33 |
| **Non-carcinogenics** | 1.34 | 1.15 | 1.26 | 1.15 | 1.15 | 1.22 | 1.25 | 1.2 |
| **Respiratory effects** | 1.37 | 1.19 | 1.28 | 1.19 | 1.19 | 1.27 | 1.29 | 1.34 |
| **Ecotoxicity** | 1.17 | 1.04 | 1.08 | 1.04 | 1.04 | 1.09 | 1.11 | 1.11 |
| **Fossil fuel depletion** | 1.28 | 1.11 | 1.19 | 1.11 | 1.11 | 1.19 | 1.2 | 1.08 |

## Universal Series™ Fixed Window whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 6.45E+01 | 1.60E-01 | 4.73E+01 | **1.12E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 9.41E+00 | 0.00E+00 | 0.00E+00 | **9.41E+00** |
| Total use of renewable primary resources with energy content | MJ, NCV | 7.39E+01 | 1.60E-01 | 4.73E+01 | **1.21E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 7.22E+02 | 1.04E+02 | 9.06E+01 | **9.17E+02** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 8.76E+01 | 0.00E+00 | 0.00E+00 | **8.76E+01** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 8.10E+02 | 1.04E+02 | 9.06E+01 | **1.00E+03** |
| Secondary materials | kg | 4.96E+00 | 0.00E+00 | 4.62E-01 | **5.42E+00** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 1.64E+00 | **1.64E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 9.53E+00 | 4.31E-01 | 4.44E-01 | **1.04E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 6.63E+02 | 9.78E+01 | 8.14E+01 | **8.42E+02** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 2.36E+02 | 2.21E+01 | 4.56E-01 | **2.59E+02** |
| Non-hazardous waste disposed | kg | 3.47E+00 | 8.94E-02 | 6.76E-03 | **3.57E+00** |
| High-level radioactive waste, conditioned, to final repository | kg | 1.67E-05 | 1.17E-06 | 3.84E-06 | **2.17E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 6.00E-04 | 2.27E-06 | 2.00E-06 | **6.05E-04** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 4.62E-01 | **4.62E-01** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 1.31E-01 | **1.31E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 6.55E-02 | 0.00E+00 | 3.07E-01 | **3.72E-01** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 6.55E-02 | **6.55E-02** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for fixed window (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Output flows and waste category indicators** | | | | | |
| High-level radioactive waste, conditioned, to final repository | kg | 1.67E-05 | 9.23E-07 | 1.37E-06 | **1.90E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 1.21E-04 | 1.79E-06 | 7.15E-07 | **1.24E-04** |

## High- and low-level radioactive waste reported by A1-A3 modules for the fixed window (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Output flows and waste category indicators** | | | | | |
| High-level radioactive waste, conditioned, to final repository | kg | 0.00E+00 | 2.45E-07 | 2.46E-06 | **2.71E-06** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 4.79E-04 | 4.75E-07 | 1.40E-07 | **4.81E-04** |

## Universal Series™ Casement Window whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 1.06E+02 | 3.29E-01 | 2.13E+02 | **3.19E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 1.64E+01 | 0.00E+00 | 0.00E+00 | **1.64E+01** |
| Total use of renewable primary resources with energy content | MJ, NCV | 1.23E+02 | 3.29E-01 | 2.13E+02 | **3.36E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 8.29E+02 | 2.14E+02 | 4.08E+02 | **1.45E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 2.24E+02 | 0.00E+00 | 0.00E+00 | **2.24E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.05E+03 | 2.14E+02 | 4.08E+02 | **1.68E+03** |
| Secondary materials | kg | 1.17E+01 | 0.00E+00 | 9.05E-01 | **1.26E+01** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 1.84E+00 | **1.84E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 2.12E+01 | 5.79E-01 | 1.04E+00 | **2.18E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 8.83E+02 | 2.01E+02 | 3.66E+02 | **1.45E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 2.81E+00 | 4.46E-02 | 2.05E-03 | **2.86E+00** |
| Non-hazardous waste disposed | kg | 1.32E+01 | 1.83E-01 | 3.04E-02 | **1.34E+01** |
| High-level radioactive waste, conditioned, to final repository | kg | 7.63E-05 | 2.57E-06 | 1.43E-05 | **9.31E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 6.41E-04 | 6.81E-06 | 2.35E-05 | **6.72E-04** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 9.05E-01 | **9.05E-01** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 1.47E-01 | **1.47E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 7.35E-02 | 0.00E+00 | 6.01E-01 | **6.74E-01** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 7.35E-02 | **7.35E-02** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Casement Window (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 7.63E-05 | 2.24E-06 | 1.17E-05 | **9.02E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 3.04E-04 | 6.63E-06 | 1.76E-05 | **3.28E-04** |

## . High- and low-level radioactive waste reported by A1-A3 modules for Casement Window (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 0.00E+00 | 3.34E-07 | 2.58E-06 | **2.91E-06** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 3.37E-04 | 1.72E-07 | 5.86E-06 | **3.43E-04** |

## Universal Series™ Tilt & Turn Window whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 8.34E+01 | 2.30E-01 | 1.21E+02 | **2.05E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 9.41E+00 | 0.00E+00 | 0.00E+00 | **9.41E+00** |
| Total use of renewable primary resources with energy content | MJ, NCV | 9.29E+01 | 2.30E-01 | 1.21E+02 | **2.14E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 7.91E+02 | 1.50E+02 | 2.32E+02 | **1.17E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 8.76E+01 | 0.00E+00 | 0.00E+00 | **8.76E+01** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 8.78E+02 | 1.50E+02 | 2.32E+02 | **1.26E+03** |
| Secondary materials | kg | 4.96E+00 | 0.00E+00 | 4.62E-01 | **5.42E+00** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 1.64E+00 | **1.64E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 1.45E+01 | 4.95E-01 | 1.05E+00 | **1.60E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 7.29E+02 | 1.41E+02 | 2.09E+02 | **1.08E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 1.17E+00 | 3.14E-02 | 1.17E-03 | **1.20E+00** |
| Non-hazardous waste disposed | kg | 7.14E+00 | 1.28E-01 | 1.73E-02 | **7.28E+00** |
| High-level radioactive waste, conditioned, to final repository | kg | 3.12E-05 | 1.68E-06 | 9.83E-06 | **4.28E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 5.71E-04 | 3.30E-06 | 5.14E-06 | **5.79E-04** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 4.62E-01 | **4.62E-01** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 1.31E-01 | **1.31E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 6.55E-02 | 0.00E+00 | 7.76E-01 | **8.42E-01** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 6.55E-02 | **6.55E-02** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Tilt & Turn Window (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 3.12E-05 | 1.47E-06 | 5.20E-06 | **3.79E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 1.60E-04 | 2.87E-06 | 2.70E-06 | **1.65E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Tilt & Turn Window (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 0.00E+00 | 2.10E-07 | 4.63E-06 | **4.84E-06** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 4.10E-04 | 4.07E-07 | 2.53E-07 | **4.13E-04** |

## Universal Series™ Awning Window whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 8.78E+01 | 3.28E-01 | 2.09E+02 | **2.99E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 3.32E+01 | 0.00E+00 | 0.00E+00 | **3.32E+01** |

| | | | | | |
|---|---|---|---|---|---|
| Total use of renewable primary resources with energy content | MJ, NCV | 1.21E+02 | 3.28E-01 | 2.09E+02 | **3.32E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 8.32E+02 | 2.14E+02 | 4.01E+02 | **1.46E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 2.28E+02 | 0.00E+00 | 0.00E+00 | **2.28E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.06E+03 | 2.14E+02 | 4.01E+02 | **1.68E+03** |
| Secondary materials | kg | 1.17E+01 | 0.00E+00 | 2.01E+00 | **1.37E+01** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 2.00E+00 | **2.00E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 1.89E+01 | 5.77E-01 | 1.03E+00 | **2.14E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 8.87E+02 | 2.01E+02 | 3.61E+02 | **1.46E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 2.12E+00 | 4.46E-02 | 2.02E-03 | **2.50E+00** |
| Non-hazardous waste disposed | kg | 1.18E+01 | 1.83E-01 | 2.99E-02 | **1.28E+01** |
| High-level radioactive waste, conditioned, to final repository | kg | 7.18E-05 | 2.40E-06 | 1.70E-05 | **9.38E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 5.93E-04 | 4.68E-06 | 8.83E-06 | **6.07E-04** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 2.01E+00 | **2.01E+00** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 1.60E-01 | **1.60E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 2.93E-01 | 0.00E+00 | 1.34E+00 | **1.63E+00** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 2.93E-01 | **2.93E-01** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Awning Window (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 7.44E-05 | 2.23E-06 | 1.16E-05 | **8.82E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 2.56E-04 | 4.34E-06 | 6.03E-06 | **2.66E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Awning Window (glazing only) per declared unit (1m2)

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 0.00E+00 | 1.72E-07 | 5.40E-06 | **5.57E-06** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 3.37E-04 | 0.00E+00 | 3.01E-07 | **3.38E-04** |

## Universal Series™ Hopper Window whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 9.10E+01 | 3.29E-01 | 2.39E+02 | **3.30E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 3.72E+01 | 0.00E+00 | 0.00E+00 | **3.72E+01** |
| Total use of renewable primary resources with energy content | MJ, NCV | 1.28E+02 | 3.29E-01 | 2.39E+02 | **3.67E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 8.15E+02 | 2.14E+02 | 4.57E+02 | **1.49E+03** |

| | | | | | |
|---|---|---|---|---|---|
| Non-renewable primary resources with energy content used as material | MJ, NCV | 2.23E+02 | 0.00E+00 | 0.00E+00 | **2.23E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.04E+03 | 2.14E+02 | 4.57E+02 | **1.71E+03** |
| Secondary materials | kg | 1.18E+01 | 0.00E+00 | 2.29E+00 | **1.41E+01** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 1.84E+00 | **1.84E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 1.99E+01 | 6.56E-01 | 1.17E+00 | **2.17E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 8.67E+02 | 2.01E+02 | 4.11E+02 | **1.48E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 1.82E+00 | 4.50E-02 | 2.30E-03 | **1.87E+00** |
| Non-hazardous waste disposed | kg | 1.12E+01 | 1.84E-01 | 3.41E-02 | **1.14E+01** |
| High-level radioactive waste, conditioned, to final repository | kg | 5.80E-05 | 2.41E-06 | 1.94E-05 | **7.97E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 6.73E-04 | 4.73E-06 | 1.01E-05 | **6.88E-04** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 2.29E+00 | **2.29E+00** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 1.47E-01 | **1.47E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 2.70E-01 | 0.00E+00 | 1.52E+00 | **1.79E+00** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 2.70E-01 | **2.70E-01** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Hopper Window (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 5.80E-05 | 2.23E-06 | 1.30E-05 | **7.33E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 3.27E-04 | 4.34E-06 | 6.79E-06 | **3.38E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Hopper Window (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 0.00E+00 | 1.76E-07 | 6.31E-06 | **6.49E-06** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 3.45E-04 | 0.00E+00 | 3.54E-07 | **3.45E-04** |

## Universal Series™ Swing Door whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 1.28E+02 | 3.16E-01 | 2.02E+02 | **3.29E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 3.30E+01 | 0.00E+00 | 0.00E+00 | **3.30E+01** |
| Total use of renewable primary resources with energy content | MJ, NCV | 1.61E+02 | 3.16E-01 | 2.02E+02 | **3.62E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 1.26E+03 | 2.05E+02 | 3.86E+02 | **1.85E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 2.12E+02 | 0.00E+00 | 0.00E+00 | **2.12E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.47E+03 | 2.05E+02 | 3.86E+02 | **2.07E+03** |

| | | | | | |
|---|---|---|---|---|---|
| Secondary materials | kg | 1.10E+01 | 0.00E+00 | 1.93E+00 | **1.30E+01** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 2.00E+01 | **2.66E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 2.16E+01 | 5.36E-01 | 1.73E+00 | **2.39E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 1.22E+03 | 1.93E+02 | 3.47E+02 | **1.76E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 1.47E+00 | 4.30E-02 | 1.94E-03 | **1.51E+00** |
| Non-hazardous waste disposed | kg | 1.26E+01 | 1.76E-01 | 2.88E-02 | **1.28E+01** |
| High-level radioactive waste, conditioned, to final repository | kg | 5.78E-05 | 2.31E-06 | 1.64E-05 | **7.64E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 1.16E-03 | 4.53E-06 | 8.52E-06 | **1.17E-03** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 1.93E+00 | **1.93E+00** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 2.13E-01 | **2.13E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 3.91E-01 | 0.00E+00 | 1.28E+00 | **1.67E+00** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 3.91E-01 | **3.91E-01** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Swing Door (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 5.41E-05 | 2.09E-06 | 1.01E-05 | **6.63E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 5.42E-04 | 4.08E-06 | 5.21E-06 | **5.51E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Swing Door (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 3.68E-06 | 2.13E-07 | 6.29E-06 | **1.02E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 6.18E-04 | 4.14E-07 | 3.25E-06 | **6.22E-04** |

## Universal Series™ Double Swing Door whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 1.04E+02 | 2.46E-01 | 2.02E+02 | **3.06E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 3.64E+01 | 0.00E+00 | 0.00E+00 | **3.64E+01** |
| Total use of renewable primary resources with energy content | MJ, NCV | 1.41E+02 | 2.46E-01 | 2.02E+02 | **3.42E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 1.27E+03 | 1.60E+02 | 3.86E+02 | **1.81E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 1.77E+02 | 0.00E+00 | 0.00E+00 | **1.77E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.44E+03 | 1.60E+02 | 3.86E+02 | **1.99E+03** |
| Secondary materials | kg | 8.21E+00 | 0.00E+00 | 1.93E+00 | **1.01E+01** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 4.96E+00 | **4.96E+00** |

| | | | | | |
|---|---|---|---|---|---|
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Use of net fresh water resources | m3 | 1.99E+01 | 4.39E-01 | 1.74E+00 | **2.21E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 1.19E+03 | 1.50E+02 | 3.47E+02 | **1.69E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 1.33E+00 | 3.33E-02 | 1.94E-03 | **1.36E+00** |
| Non-hazardous waste disposed | kg | 1.09E+01 | 1.36E-01 | 2.88E-02 | **1.11E+01** |
| High-level radioactive waste, conditioned, to final repository | kg | 4.91E-05 | 1.80E-06 | 1.64E-05 | **6.73E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 1.13E-03 | 3.53E-06 | 8.52E-06 | **1.14E-03** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 1.93E+00 | **1.93E+00** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 3.97E-01 | **3.97E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 7.28E-01 | 0.00E+00 | 1.28E+00 | **2.01E+00** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 7.28E-01 | **7.28E-01** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Double Swing Door (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 4.54E-05 | 1.58E-06 | 9.07E-06 | **5.60E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 4.95E-04 | 3.08E-06 | 4.69E-06 | **5.03E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Double Swing Door (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 3.78E-06 | 2.19E-07 | 7.28E-06 | **1.13E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 6.36E-04 | 4.26E-07 | 3.76E-06 | **6.40E-04** |

## Universal Series™ Sliding Door whole system: LCIA results, resource use, output and waste flows, and carbon emissions & removals per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| **Resource use indicators** | | | | | |
| Renewable primary energy used as energy carrier (fuel) | MJ, NCV | 1.09E+02 | 2.03E-01 | 1.27E+02 | **2.37E+02** |
| Renewable primary resources with energy content used as material | MJ, NCV | 2.41E+01 | 0.00E+00 | 0.00E+00 | **2.41E+01** |
| Total use of renewable primary resources with energy content | MJ, NCV | 1.33E+02 | 2.03E-01 | 1.27E+02 | **2.61E+02** |
| Non-renewable primary resources used as an energy carrier (fuel) | MJ, NCV | 1.34E+03 | 1.33E+02 | 2.44E+02 | **1.71E+03** |
| Non-renewable primary resources with energy content used as material | MJ, NCV | 1.26E+02 | 0.00E+00 | 0.00E+00 | **1.26E+02** |
| Total use of non-renewable primary resources with energy content | MJ, NCV | 1.46E+03 | 1.33E+02 | 2.44E+02 | **1.84E+03** |
| Secondary materials | kg | 6.60E+00 | 0.00E+00 | 1.17E+00 | **7.77E+00** |
| Renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 4.38E+00 | **4.38E+00** |
| Non-renewable secondary fuels | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Recovered energy | MJ, NCV | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

| | | | | | |
|---|---|---|---|---|---|
| Use of net freshwater resources | m3 | 2.03E+01 | 3.48E-01 | 1.10E+00 | **2.17E+01** |
| Abiotic depletion (fossil fuels) | MJ, LHV | 1.20E+03 | 1.24E+02 | 2.19E+02 | **1.55E+03** |
| **Output flows and waste category indicators** | | | | | |
| Hazardous waste disposed | kg | 1.09E+02 | 2.80E-02 | 1.27E+02 | **2.35E+00** |
| Non-hazardous waste disposed | kg | 2.41E+01 | 1.14E-01 | 0.00E+00 | **8.78E+00** |
| High-level radioactive waste, conditioned, to final repository | kg | 4.39E-05 | 1.49E-06 | 1.03E-05 | **5.58E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 1.14E-03 | 2.92E-06 | 5.39E-06 | **1.15E-03** |
| Components for re-use | kg | 0.00E+00 | 0.00E+00 | 1.17E+00 | **1.17E+00** |
| Materials for recycling | kg | 0.00E+00 | 0.00E+00 | 3.50E-01 | **3.50E-01** |
| Materials for energy recovery | kg | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Exported energy | MJ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| **Carbon emissions and removals** | | | | | |
| Biogenic Carbon Removal from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Emission from Product | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Biogenic Carbon Removal from Packaging | kg $CO_2$ | 6.42E-01 | 0.00E+00 | 7.74E-01 | **1.42E+00** |
| Biogenic Carbon Emission from Packaging | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 6.42E-01 | **6.42E-01** |
| Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Calcination Carbon Emissions | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbonation Carbon Removals | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |
| Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes | kg $CO_2$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | **0.00E+00** |

## High and low-level radioactive waste reported by A1-A3 modules for Sliding Door (frame only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 3.96E-05 | 1.24E-06 | 4.57E-06 | **4.55E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 4.24E-04 | 2.41E-06 | 2.36E-06 | **4.29E-04** |

## High and low-level radioactive waste reported by A1-A3 modules for Sliding Door (glazing only) per declared unit

| Parameter | Unit | A1 | A2 | A3 | Total |
|---|---|---|---|---|---|
| High-level radioactive waste, conditioned, to final repository | kg | 4.28E-06 | 2.48E-07 | 5.77E-06 | **1.03E-05** |
| Intermediate- and low-level radioactive waste, conditioned, to final repository | kg | 7.19E-04 | 4.81E-07 | 2.98E-06 | **7.22E-04** |

Significant data limitations currently exist within the LCI data used to generate waste metrics for Life Cycle Assessments and Environmental Product Declarations. The waste metrics were calculated in a way conformant with the requirements of ISO 21930:2017, but these values represent rough estimates and are for informational purposes only. As such, no decisions regarding actual cradle-gate waste performance between products should be derived from these reported values.

# How we make it greener

Cascadia Universal Series™ Fixed & Operable Windows and Doors

Collapse all

## RAW MATERIALS ACQUISITION

Cascadia's windows and doors are designed and manufactured in North America, using resins and fiberglass rovings from domestic and foreign suppliers. These chemically inert materials are combined through pultrusion, creating a thermoset fiberglass that won't creep, sag, or decay over its 80-year modelled service life. Cascadia's pultruded, thermoset fiberglass frames also contain roughly 58% recycled content.

## MANUFACTURING

Efficiencies in manufacturing help Cascadia minimize their environmental impacts. Incoming fiberglass pultrusions are painted on an automatic paint line, cutting down on waste that would otherwise be generated using a manual process.

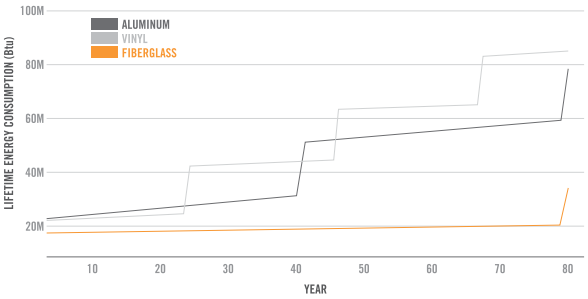
## DISTRIBUTION

Cascadia works with project stakeholders to optimize shipping and transportation methods, using a variety of shipping materials depending on project requirements, including reusable steel racks or custom-made reusable wood crates. The steel racks are returned to Cascadia via a return program and reused many times over several years and are used for about two thirds of all shipments, cutting down the need for one-time-use packaging.

## USE & END OF LIFE

With a modeled lifespan of up to 80 years, fiberglass windows are expected to consume less energy over their lifetime compared to aluminum and vinyl.

Fiberglass windows and doors are able to resist issues common with other materials like corrosion, rot, insect damage, or UV degradation. While windows and doors of all material types are commonly sent to the landfill, whether due to glazing tape contamination or wear and tear, the durability of fiberglass helps extend the longevity of these products, which means fewer replacements over the life of the building and ultimately fewer trips to the landfill.




Life cycle primary energy consumption of one window frame, including embodied energy, use phase energy loss, and disposal energy requirements. Sudden increases in energy consumption indicate window frame replacement and represent the energy required to dispose of the old frame as well as manufacture a new one.

*Broeckx-Smith, S., Suh, S. (2019). Comparative Life Cycle Energy and Greenhouse Gas Emission Performance of Window Frame Materials. Goleta, CA, USA: VitalMetrics (IERS LLC.).*

## SM Transparency Report (EPD)™

| EPD | LCA |
|---|---|
| 3rd-party reviewed | ✓ |
| Transparency Report (EPD) | |
| 3rd-party verified | ✓ |

Validity: 09/05/24 – 09/04/29
CAS – 090524 – 001

**This environmental product declaration (EPD) was externally verified by Ecoform, LLC, in accordance with ISO 14025:2006. ISO 21930:2017 serves as the core PCR. NSF sub-category PCR: Fenestration Assembly Product Category Rules.**

**In accordance with ISO 14044 and the referenced PCR, the life cycle assessment was conducted by Sustainable Minds and critically reviewed by Ecoform, LLC.**

**Ecoform, LLC**
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### SUMMARY

**Reference PCR**
PCR for Fenestration Assemblies, NSF International, 2023

**Regions; system boundaries**
North America; cradle-to-gate

**Declared unit**
One square meter (1 $m^2$ ) of fenestration assemblies (including frame and glass)

**LCIA methodology; LCA software; LCI databases**
TRACI 2.1; SimaPro Analyst 9.5; ecoinvent v3.10, and US-EI 2.2

**Public LCA**
Cascadia LCA report of Universal Series™ Fixed & Operable Windows and Doors, and Universal Series™ Window Wall

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