



Innotech Windows + Doors

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006 and EN 15804:2012
+A2:2019



ASTM INTERNATIONAL

Innotech Windows + Doors is pleased to present this Environmental Product Declaration (EPD) for their Defender 76TS and Defender 88PH+ Windows and Doors Series. This EPD was developed in compliance with ISO 14025 and EN 15804:2012+A2:2019 and has been verified by Lindita Bushi, from the Athena Sustainable Materials Institute.

The LCA and the EPD were prepared by Vertima Inc. The EPD includes cradle-to-grave life cycle assessment (LCA) results.

For more information about Innotech, visit innotech-windows.com.

For any explanatory material regarding this EPD, please contact the program operator.

1. GENERAL INFORMATION

PCR GENERAL INFORMATION			
Reference PCR	Product Category Rules (PCR) for Construction Product and Complementary Product Category Rules (c-PCR-007) for Windows and Doors (EN 17213:2020) International EPD System from 12-2019 to 12-2024		
The PCR review was conducted by:	<i>Martin Erlandsson</i> IVL Swedish Environmental Research Institute, martin.erlandsson@ivl.se	IVL Swedish Environmental Research Institute Secretariat of the International EPD® System	
EPD GENERAL INFORMATION			
Program Operator	ASTM International 100 Barr Harbor Drive West Conshohocken (PA) 19428 USA www.astm.org		
Declared Products	Defender 76TS Fixed Window – Double Defender 76TS Operable Window – Double Defender 76TS Terrace Door – Double Defender 76TS Fixed Window – Triple Defender 76TS Operable Window – Triple Defender 76TS Terrace Door – Triple Defender 88PH+ Pro Fixed Window Defender 88PH+ Pro Operable Window Defender 88PH+ Pro Terrace Door		
EPD Registration Number 743	EPD Date of Issue August 2024	EPD Period of Validity August 2024 – August 2029	
EPD Recipient Organization	Innotech Windows + Doors 27452 52nd Avenue L angley, BC V2W 4B2 Canada www.innotech-windows.com		
EPD Type/Scope and Functional Unit Product-specific cradle-to-grave EPD for 1m ² of windows and door with varied components with a double or triple glazing system for a reference service life (RSL) of 40 years.			Year of Reported Manufacturer Primary Data 2022
Geographical Scope North America	LCA Software OpenLCA v.1.11.0	LCI Databases Ecoinvent 3.9.1 and US LCI	LCIA Methodology EN 15804+A2
This LCA and EPD were prepared by:		Gatien Geraud Essoua Essoua, Ph.D. Eng. Forestry Vertima Inc. www.vertima.ca	
This EPD and LCA were independently verified in accordance with ISO 14025:2006, ISO 14040:2006 and ISO 14044:2006, as well as the International EPD System PCR “Product Category Rules (PCR) for Construction Product and Complementary Product Category Rules (c-PCR-007) for Windows and Doors (EN 17213:2020)”, which is based on EN 15804:2012+A2:2019. <input type="checkbox"/> Internal <input checked="" type="checkbox"/> External		 Lindita Bushi, Ph.D. Athena Sustainable Materials Institute	



LIMITATIONS

The EPD owner has the sole ownership, liability and responsibility of the EPD. Environmental declarations from different programs (ISO 14025) may not be comparable [1]. 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, as the EPD results may not be entirely comparable. Any EPD comparison must be carried out at the building level per EN 15804 guidelines [2]. The results of this EPD reflect an average performance by the product and its actual impacts may vary on a case-by-case basis.

2 PRODUCT DEFINITION AND INFORMATION

2.1 DESCRIPTION OF THE COMPANY

Innotech Windows + Doors was established at the turn of the century with the vision of manufacturing German-engineered windows and doors that reach beyond industry standards. Today, Innotech Windows + Doors is proud to offer to their customers a full line of high performance, energy-efficient and long-lasting windows and doors that are specifically designed and tested for our North American climate, building codes and energy requirements. The factory is located at 27452 52nd Avenue, Langley, BC Canada.

2.2 PRODUCT DESCRIPTION

The nine products manufactured by Innotech Windows + Doors can be put into two groups: Defender 76TS System and Defender 88PH+ System.

The Defender 76TS System is a high-performance hybrid steel and uPVC window and door system that is specified by leading building professionals. Manufactured in Canada by Innotech Windows + Doors, it is engineered, tested and manufactured to deliver outstanding thermal insulation, air, water and sound resistance, and durability for highly sustainable custom residences and multi-family developments throughout North America. This group includes Defender 76TS Fixed Window - Double, Defender 76TS Operable Window – Double, Defender 76TS Terrace Door – Double, Defender 76TS Fixed Window – Triple, Defender 76TS Operable Window – Triple and Defender 76TS Terrace Door – Triple windows and doors products.

The Defender 88PH+ System combines decades of fenestration knowledge to deliver a Passive House Institute certified window and door system. Manufactured in Canada by Innotech Windows + Doors, it is engineered to provide exceptional thermal performance, structural properties and dimensional stability, air and water resistance, and durability for Passive House, net-zero energy and other deeply sustainable projects in North America. This group includes Defender 88PH+ Pro Fixed Window, Defender 88PH+ Pro Operable Window and Defender 88PH+ Pro Terrace Door windows and doors products.

The primary United Nations Standard Products and Services Code (UNSPSC) for windows and doors is 4212 and the Construction Specifications Institute (CSI) code is 08 50 00 for windows and 08 10 00 for doors. Figure 1 shows a room scene of Innotech window products.



Figure 1: Representation of a room scene with Innotech window products.

2.2.1 Product Average

The weighted average product profile is calculated based on 2022 annual production data (on mass).

2.2.1.1 Product-Specific EPD

In the context of the growing popularity of sustainable building and LEED v4 and v4.1 rating systems, developing Type III Environmental Product Declarations (EPDs) would allow Innotech Windows + Doors to increase visibility for its windows and doors products. The EPD for windows and doors products has been developed according to the PCR for construction products, complementary c-PCR for windows and doors from International EPD systems, EN 17213:2020 [3 ,4, 5]. The EPD was also prepared according to the Program Operator Rules, Version: 8.0, Revised 04/29/20 [6]. The EPD was published by the program operator, ASTM.

2.3 APPLICATION

Innotech Windows + Doors manufactures a wide range of high-performance windows and doors for single-family and multi-family residences, including low to high-rise buildings, for projects throughout North America. They are committed to very high standards of quality as evidenced by their elaborate third-party testing, certification and labeling program to ensure that all their products meet or exceed North American building codes and regulations, including the following standards:

- AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS 2017—North American Fenestration Standard/Specification for windows, doors and skylights

- CSA A440S1-17, Canadian Supplement to AAMA/WDMA/CSA 101/I.S.2/A440-11, NAFS—North American Fenestration Standard/Specification for windows, doors and skylights
- CSA A440.2-14/A440.3-14, Fenestration Energy Performance/User’s Guide to CSA A440.2-14, Fenestration Energy Performance
- NFRC 100-2010, Procedure for Determining Fenestration Product Ufactors
- NFRC 200-2010, Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence
- NFRC 500-2010, Procedure for Determining Fenestration Product Condensation Resistance Values
- NFRC 700-2010, Product Certification Program
- All standards applicable to windows and doors as defined in the Canadian National Building Code, including: ASTM E2190, ASTM F476, CGSB 12.1, CGSB 12.2, CGSB 12.3, CGSB 12.4, CGSB 12.8, CGSB 12.10, CGSB 12.11, CGSB 12.20, NAFS and the Canadian Supplement for NAFS, A440S1, A440.2/.3. A440.4. and A440.6.
- Product certification conducted by the Passive House Institute (64283 Darmstadt Germany)
- Product certification conducted by PHIUS (Chicago Illinois)

2.4 DECLARATION OF METHODOLOGICAL FRAMEWORK

This LCA study is cradle-to-grave plus Module D. For this analysis, the attributional approach was followed and impacts of infrastructure have been excluded.

Life cycle stages included in the analysis are production, construction, use and end-of-life and Module D, and were performed according to the c-PCR and EN 17213 [4,5] for windows and doors.

According to the PCR allocation procedure, mass should be used as the primary basis for co-product allocation. OpenLCA software v1.11 [7], an open-source software, was used to calculate the inventory and to assess potential environmental impacts associated with the inventoried emissions.

2.5 TECHNICAL DATA

For specific properties and performance data for Innotech Windows + Doors , please consult the following link: <https://www.innotech-windows.com>. Table 1 presents technical data for the products under study with standard dimensions.

Table 1: Technical data for Innotech Windows + Doors products studied

Product	Dimensions	Weight	Units	Functional Unit	Unit	FU Weight	Units
76TS Fixed Window, Double Glazed	1.23 m x 1.48 m	44.31	kg	1	m ²	24.34	kg
76TS Operable Window, Double Glazed	1.23 m x 1.48 m	55.95	kg	1	m ²	30.73	kg
76TS Terrace Swing, Double Glazed	1 m x 2 m	79.86	kg	1	m ²	39.93	kg
76TS Fixed Window, Triple Glazed	1.23 m x 1.48 m	58.59	kg	1	m ²	32.18	kg
76TS Operable Window, Triple Glazed	1.23 m x 1.48 m	68.90	kg	1	m ²	37.85	kg
76TS Terrace Swing, Triple Glazed	1.23 m x 1.48 m	93.06	kg	1	m ²	51.12	kg
88PH+ Fixed Window	1.23 m x 1.48 m	52.54	kg	1	m ²	28.86	kg
88PH+ Operable Window	1 m x 2 m	61.19	kg	1	m ²	30.60	kg
88PH+ Terrace Swing	1 m x 2 m	86.00	kg	1	m ²	43.00	kg

2.6 PRODUCT COMPOSITION

The composition of each window and door included in the study is presented in Table 2. The composition is quite similar although the rates are different based on each paint.

Table 2: Material composition for each window and door

Products	Materials	Rate (%)
76TS Fixed Window, Double Glazed	uPCV Profiles	22.70%
	Reinforcement Steel	11.26%
	Glazing Blocks	0.09%
	Sealant, Spectrem® 2	0.02%
	Insulated Glazing Unit	65.88%
	Screws	0.03%
	Miscellaneous Plastic Pieces	0.01%
76TS Operable Window, Double Glazed	uPCV Profiles	29.74%
	Reinforcement Steel	17.48%
	Glazing Blocks	0.27%
	Sealant, Spectrem® 2	0.02%
	Insulated Glazing Unit	47.17%
	Operating Hardware, Steel	5.02%
	Screws	0.27%
Miscellaneous Plastic Pieces	0.03%	
76TS Terrace	uPCV Profiles	27.66%

Products	Materials	Rate (%)
Swing, Double Glazed	Reinforcement Steel	34.80%
	Glazing Blocks	0.23%
	Sealant, Spectrem® 2	0.01%
	Insulated Glazing Unit	31.18%
	Operating Hardware, Steel	5.75%
	Screws	0.08%
	Sill Adapter, Large Aluminium	0.29%
	Miscellaneous Plastic Pieces	0.00%
	Rubber Gasket Sets	0.00%
76TS Fixed Window, Triple Glazed	uPCV Profiles	16.64%
	Reinforcement Steel	8.52%
	Glazing Blocks	0.07%
	Sealant, Spectrem® 2	0.02%
	Insulated Glazing Unit	74.73%
	Screws	0.02%
	Miscellaneous Plastic Pieces	0.01%
76TS Operable Window, Triple Glazed	uPCV Profiles	23.79%
	Reinforcement Steel	14.19%
	Glazing Blocks	0.22%
	Sealant, Spectrem® 2	0.01%
	Insulated Glazing Unit	57.45%
	Operating Hardware, Steel	4.17%
	Screws	0.14%
	Miscellaneous Plastic Pieces	0.03%
76TS Terrace Swing, Triple Glazed	uPCV Profiles	23.46%
	Reinforcement Steel	29.86%
	Glazing Blocks	0.19%
	Sealant, Spectrem® 2	0.01%
	Insulated Glazing Unit	40.12%
	Operating Hardware, Steel	5.74%
	Screws	0.10%
	Sill Adapter, Large Aluminium	0.51%
	Miscellaneous Plastic Pieces	0.01%
	Rubber Gaskets	0.00%
88PH+ Fixed Window	uPCV Profiles	20.78%
	Structural Insulating Foam	0.65%
	Glazing Blocks	0.06%
	Sealant, Spectrem® 2	0.02%



Product	Materials	Rate (%)
	Insulated Glazing Unit	78.49%
	Miscellaneous Plastic Pieces	0.01%
88PH+ Operable Window	uPCV Profiles	30.75%
	Structural Insulating Foam	3.81%
	Glazing Blocks	0.13%
	Sealant, Dow 995 Black	0.02%
	Insulated Glazing Unit	59.66%
	Operating Hardware, Steel	5.39%
	Screws	0.23%
	Miscellaneous Plastic Pieces	0.01%
	88PH+ Terrace Swing	uPCV Profiles
Reinforcement Steel		25.79%
Structural Insulating EPS Foam		0.29%
Glazing Blocks		0.18%
Sealant, Spectrem® 2		0.01%
Insulated Glazing Unit		40.63%
Operating Hardware, Steel		5.37%
Screws		0.05%
Sill Adapter, Fiberglass		0.51%
Miscellaneous Plastic Pieces		0.01%
Foam Gaskets		0.00%

2.7 MANUFACTURING

Innotech products are manufactured using different components, mainly uPVC profiles, reinforcement steel, glazing blocks, sealants, insulated glazing units, screws, gaskets, operating hardware and miscellaneous plastic pieces. Figure 2 shows the flow diagram for the manufacturing stage.

The manufactured windows and doors products are packaged in plastic film with foam blocks and plywood, placed on wood pallets and tied with polyethylene strapping. The packaging materials used are presented in Section 2.8 below.

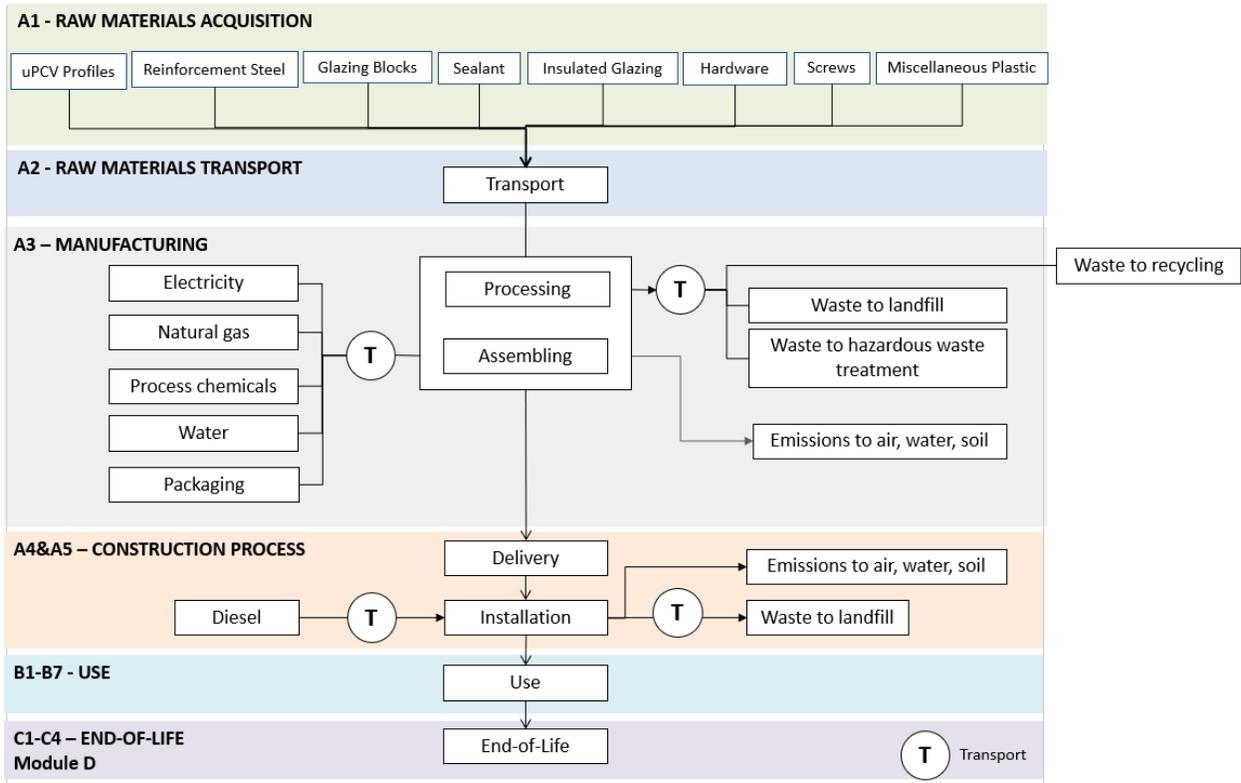


Figure 2: Flow Diagram for Innotech Windows + Doors products.

2.8 PACKAGING

Innotech Windows + Doors products are packaged using the materials presented in Table 3.

Table 3: Packaging materials used per one square meter (1 m²) of window or door products.

Materials	Defender 76TS Fixed Window - Double	Defender 76TS Operable Window - Double	Defender 76TS Terrace Door - Double	Defender 76TS Fixed Window - Triple	Defender 76TS Operable Window - Triple	Defender 76TS Terrace Door - Triple	Defender 88PH+ Pro Fixed Window	Defender 88PH+ Pro Operable Window	Defender 88PH+ Pro Terrace Door	Units
Poly Wrap	5.40E-02	6.82E-02	8.87E-02	7.15E-02	8.40E-02	1.14E-01	6.41E-02	6.79E-02	9.55E-02	Kg
Polystyrene Foam Blocks	3.22E-02	4.07E-02	5.29E-02	4.26E-02	5.01E-02	6.77E-02	3.82E-02	4.05E-02	5.69E-02	Kg
Shrink Wrap (LDPE film)	1.02E-02	1.29E-02	1.68E-02	1.35E-02	1.59E-02	2.15E-02	1.21E-02	1.29E-02	1.81E-02	Kg
Plywood	1.66E-04	6.70E-05	5.41E-05	2.75E-04	1.14E-04	9.94E-05	1.47E-05	5.71E-06	2.08E-06	ton
Softwood	1.80E-05	2.28E-05	2.96E-05	2.38E-05	2.80E-05	3.79E-05	2.14E-05	2.27E-05	3.19E-05	ton

2.9 DISTRIBUTION OF THE PRODUCT

The manufactured Innotech Windows + Doors are installed in Canada and the USA. Based on the North American area covered by the study, the transportation distance was considered to be 800 km by truck.

2.10 PRODUCT INSTALLATION

According to information received from Innotech Windows + Doors, different ancillary materials can be used to install the windows and doors. In this analysis, steel attachments, fasteners and polyurethane foam were considered for the installation. Transportation of ancillary materials was assumed to be 50 km. A drill is used to install windows and doors in the building.

As windows and doors are customized or manufactured with precise dimensions, there is no installation product loss in module A5.

At the end of the module, it was assumed that waste from packaging was 100% sent to landfill. The average distance to the landfill site was assumed to be 161 km given the average distances in North America.

2.11 MAINTENANCE

During the use stage, the manufacturer recommends using a lubricating oil to maintain good hardware functioning. The amount of lubrication oil used during the reference service life (RSL) of the product was estimated at 2 grams per kg of the product. The dataset used for the model is "lubricating oil production | lubricating oil | Cutoff, U – RoW."

During the RSL of Innotech Windows + Doors products, glazing system and sealants have to be replaced. The glazing system should be replaced once and the sealant product should be replaced three times. In this module, and for each product replaced, the environmental burden of Modules A1 to A5 and C1 to C4 are accounted for once for the glazing system and three times for the sealant material. A distance of 10 km was assumed as the supplied distance for glazing system and sealants. For the packaging material supplied, the same distance was assumed as in the A3 module.

Reference Service Life, according to the c-PCR 007, PCR-2019:14 and EN 15804:2012 [5, 4, 3], the RSL shall be provided by the manufacturer. Based on the manufacturer warranties, the RSL of windows and doors are 40 years and these also correspond to the RSL mentioned in the standard EN 17213 [6].

2.12 TRANSPORTATION TO THE LANDFILL SITE (C2)

Transportation of product waste after deconstruction to the landfill site (C2 Module) is made by truck. As mentioned in section 4.1.5, the average transport distance was assumed to be 161 km. Table 6 presents the modelling for the C2 module.

2.13 DISPOSAL (C4)

Innotech Windows + Doors products are sent to landfills or recycling. It was assumed that aluminum materials are 95% recycled and 5% sent to landfill. Exactly 100% of other metal materials are 80% recycled and 20% are sent to landfill. All other materials, including packaging materials, are 100% landfilled at the end of life.

2.14 REUSE, RECYCLING, AND ENERGY RECOVERY

During the life cycle of the Innotech Windows + Doors products, all materials sent to the recycling centre are considered as input in the manufacturing process of new materials. This means that use post-consumer or pre-consumer material (as waste) avoids the extraction of raw material for a positive environmental impact.

2.15 FURTHER INFORMATION

Further information about Innotech Windows + Doors products is available at <https://www.innotech-windows.com/>

As part of the process, Innotech Windows + Doors include Health Product Declarations (HPD) that are certified by a third-party (Vertima inc).

3 LIFE CYCLE ASSESSMENT CALCULATION RULES

3.1 FUNCTIONAL UNIT

The FU analyzed is 1 m² of windows and doors installed for a reference service life of 40 years.

The reference service life (RSL) of 40 years as provided by the manufacturer and the manufacturer in accordance with the EN 17213:2020 [5]. Table 4 presents all products covered by this report and their respective FUs.

Table 4: FU of assessed products.

Items	Defender 76TS Fixed Window - Double	Defender 76TS Operable Window - Double	Defender 76TS Terrace Door - Double	Defender 76TS Fixed Window - Triple	Defender 76TS Operable Window - Triple	Defender 76TS Terrace Door - Triple	Defender 88PH+ Pro Fixed Window	Defender 88PH+ Pro Operable Window	Defender 88PH+ Pro Terrace Door	Units
FU	1	1	1	1	1	1	1	1	1	m ²
Product dimensions	1.23 m x 1.48 m	1.23 m x 1.48 m	1 m x 2 m	1.23 m x 1.48 m	1.23 m x 1.48 m	1.23 m x 1.48 m	1.23 m x 1.48 m	1 m x 2 m	1 m x 2 m	m
Product surface	1.8204	1.8204	2	1.8204	1.8204	1.8204	1.8204	2	2	m ²
Factors per FU	1.82	1.82	2.00	1.82	1.82	1.82	1.82	2.00	2.00	-
Average weight per product	44.31	55.95	79.86	58.59	68.90	93.06	52.54	61.19	86.00	Kg

3.2 SYSTEM BOUNDARIES

According to c-PCR [4], the LCA is cradle-to-grave and includes module D (A + B + C + D). All life cycle stages are included in the analysis: production, construction, use and end-of-life. The production stage includes the following modules: A1) Extraction and upstream production; A2) Raw materials transportation to the manufacturing site; and, A3) Manufacturing. The construction stage includes the following modules: A4) Transportation of Innotech products from manufacturing sites to the warehouse in sites in North America (Canada and the USA) and A5) Installation of the product. The use stage includes the B1 to B7 modules. The End-of-Life (EoL) stage includes the C1 to C4 modules and D modules. **Figure 3** presents the life cycle stages and their modules included in the system boundaries.

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage	
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	DEU-CAN-USA	DEU-CAN-USA	DEU-CAN-USA	North America	North America	North America	North America	North America	North America	North America	North America	North America	North America	North America	North America	North America	North America	
Specific data used	>90% for A1 to A5					-	-	-	-	-	-	-	-	-	-	-	-	
Variation – products	>10%					-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not relevant					-	-	-	-	-	-	-	-	-	-	-	-	-

Figure 3: presents the life cycle stages and their modules, included in the system boundaries.

Extraction and upstream production (module A1): This stage includes the extraction and manufacturing of raw materials needed to produce the window and door products.

Raw materials transportation to manufacturing site (module A2): Materials for Innotech Windows + Doors product manufacturing are purchased from several suppliers located in Europe (Germany), Canada (British Columbia, or B.C.) and the USA (Ohio, Oregon). Transportation from Germany to British Columbia is made by Euro freight truck from the German factory to the German port and then by boat from the German port to the Montreal port. At the Montreal port, the container is transported to the B.C. factory by long-haul truck. Materials transportation in Canada and USA was performed by truck.

Manufacturing of windows and doors (module A3): This stage includes water and energy (electricity, diesel and propane) consumption for the manufacturing processes. Chemicals are also used in the process as well as in their

transport to the site. Hazardous waste treatment has been counted as well. Finally, packaging materials to make products ready for shipment are covered by this stage.

Design and construction stage (modules A4 - A5): The design and construction process start with the packaged and finished coating leaving the production site and ends with the installation of window and door products in a building site. Products are transported and distributed by truck in North America.

Use and maintenance stage (B1 to B7): During the use stage, it is recommended by the manufacturer to use a lubricating oil to maintain good hardware functioning. The amount of lubrication oil used during the RSL of the product was estimated at 2 grams per kg of the product.

During the use stage, there are no resources and energy used for module B1. There are no repair (Module B3) activities during the service life of the products. In the maintenance stage during Module (B2), a negligible quantity of water or spray glass cleaning products can be used one or two times per year for the cleaning purposes. No energy consumption is required as the cleaning is performed manually. The environmental impacts for the cleaning purpose are negligible. However, based on information from the manufacturer information, around two grams of lubricating oil can be used for hardware maintenance during the product's RSL (Module B2). During the products RSL, the components such as sealing, gaskets and glazing system have to be replaced. It amounts to three times for sealing and gaskets materials (lasting 10 years each) and once for the glazing system (each lasting for 20 years). Based on the hardware testing report, we assume that there is no replacement of hardware during the RSL of the product. The replacement of the window and door components are accounted for in Module B2 as mentioned in the standard EN 17213. There is no replacement (Module B4) of the complete window or door products and refurbishment (B5) during the RSL of the products. Also, during the RSL, the product does not require operational energy (Module B6) or water consumption (Module B7). In this analysis, the environmental impacts of these modules (B1, B3, B4, B5, B6 and B7) are therefore considered as nil.

End-of-life stage (C1 to C4): The transportation of product waste after deconstruction to the landfill site (C2 Module) is done by truck. As mentioned in Section 4.1.5, the average transportation distance was assumed to be 161 km. Innotech Windows + Doors products are sent to landfills or recycling. It was assumed that aluminum materials are 95% recycled and 5% landfilled. A total of 100% of other metal materials are 80% recycled and 20% are landfilled. All other materials including packaging materials are 100% landfilled at the end of life.

Module D is accounted for beyond the system boundaries for the next product system. In the system boundary studied, there is no secondary materials or energy used as input. The net output corresponds to the amount at the end of life. The environmental burden for recycling material (aluminum, plastic, glass, paperboard and all other metal) at the end of life of the window and door products is accounted for in module D. The potential loads and benefits from the net useable output flows in module D are calculated by the software as potential avoided future use of primary materials.

3.3 CUT-OFF CRITERIA

According to Section 6.3.3 of the EN 15804 standard [2], if a mass flow or energy flow represents less than 1% of the cumulative mass or energy flows of the system, it may be excluded from the system boundaries. However, these flows should not have a significant environmental contribution. Also, at least 95% of the total energy and mass flows shall be included and the cumulative mass or environmental impacts of the excluded flows shall not exceed 5% of the total mass and energy flows or potential environmental impacts.

In this study, no primary data (input material, energy consumption) was excluded from the system boundaries. Water consumption was assumed to be 100% dedicated to the employees. Therefore, this water consumption was estimated as negligible by the manufacturer. No primary data on the construction, maintenance or dismantling of the company’s capital assets was included in the model. Also, the primary data from daily transport of the employees, office work, business trips and other activities from manufacturer’s employees was not included in the model.

3.4 DATA SOURCES

This study is specific to the Innotech Windows + Doors manufacturer. Primary data, obtained from the manufacturer, is representative of the current technologies and materials used by this company. As primary data was collected directly from the factory, it can be stated that it is 100% representative of the technologies and of geographical areas under study accordingly with ISO 14040/44 [8, 9]. Primary data was collected so as to be representative of the entire 2022 year.

When primary data was not available, unit processes were selected from the ecoinvent database v3.9.1 or from the US LCI database, the most comprehensive LCI databases currently available [10, 11].

3.5 DATA QUALITY

Data Quality Parameter	Data Quality Discussion
Source of manufacturing data: Description sources of data	Manufacturing data was collected from Innotech Windows + Doors manufacturing site located at Langley, British Columbia, Canada, for the 2022 production year. Data included the total production mass of products produced at the manufacturing plant, as well as the total production mass of products under study; raw materials entering the production of the products under study; losses of materials; transport modes and distance of materials; energy consumption; water consumption; emissions to the environment at the manufacturing plant; waste treatment; packaging material and acoustic products distribution.
Source of secondary data: Description sources of raw material, energy source, transport, waste and packaging data	When appropriate, the grid mix was changed for the grid mix of the province or country where the process takes place. Otherwise, ecoinvent datasets representative of the BC or RNA market or “RoW” were mainly selected as proxies.
Geographical	Manufacturing site is located in Langley, BC, Canada; hence, electricity

Data Quality Parameter	Data Quality Discussion
representativeness	consumption is based on the British Columbia grid mix. Geographical correlation of the material supply and the selected datasets are representative of each specific area or a larger area.
Temporal representativeness	Primary data were collected to be representative of the full year 2022, while this was not always the case for ecoinvent and US LCI datasets. Nevertheless, ecoinvent and US LCI remain reference LCI databases used in this study.
Technological representativeness	Primary data, obtained from the manufacturer, are representative of the current technologies and materials used by the company.
Completeness	All relevant process steps were considered and modelled to satisfy the goal and scope. Cut-off criteria were respected.

3.6 PERIOD UNDER REVIEW

The period under review is the year 2022.

3.7 ALLOCATION

According to the PCR [3], the allocation approach used as the primary basis for co-product allocation is mass allocation. In this study, mass allocation was used for the manufacturing input and output flow and the yearly production mass of each product under study was used as a basis. Data relative to material and energy consumption were provided for all co-products by the manufacturer.

Materials undergoing recycling/reuse processes are excluded from the system boundary. A cut-off approach was used because recycled/reused material is part of raw material preparation for another product system. The transportation to the recycling center was accounting for during this process.

4 LIFE CYCLE ASSESSMENT RESULTS

4.1 RESULTS TABLES

The life cycle assessment results are presented per FU. According to the c-PCR requirements, the results presented derive from the life cycle impact assessment (LCIA) and the life cycle inventory (LCI).

According to the c-PCR, Table 3, the life cycle impact assessment shall, as a minimum, report the set of impact categories. These impact categories are globally deemed mature enough to be included in Type III environmental declarations. Other categories are being developed and defined and LCA should continue making advances in their development. However, the EPD users shall not use additional measures for comparative purposes.

The LCA results are presented from Table 5 to Table 13 for windows and doors products, respectively.

Table 5: Environmental impact Results of 76TS Fixed Window, Double Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100) ^{1,2}	kg CO2-Eq	3.32E+01	3.88E+00	2.16E+01	1.86E+00	1.58E+00	0.00E+00	3.36E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.24E-01	0.00E+00	6.34E-02	-2.15E-02
climate change: biogenic - global warming potential (GWP100) ^{1,3}	kg CO2-Eq	1.34E-01	1.91E-02	3.56E+00	1.66E-02	1.30E-02	0.00E+00	1.36E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.78E-03	0.00E+00	1.31E-05	-1.15E-04
climate change: fossil - global warming potential (GWP100) ¹	kg CO2-Eq	3.30E+01	3.86E+00	1.80E+01	1.84E+00	1.56E+00	0.00E+00	3.34E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.21E-01	0.00E+00	6.34E-02	-2.13E-02
climate change: land use and land use change - global warming potential (GWP100) ¹	kg CO2-Eq	3.36E-02	1.47E-03	1.46E-02	4.01E-04	1.35E-03	0.00E+00	3.36E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.15E-05	0.00E+00	7.53E-06	-2.62E-05
acidification - accumulated exceedance (AE) ¹	mol H+-Eq	2.75E-01	2.98E-02	8.75E-02	1.22E-02	8.66E-03	0.00E+00	2.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.50E-03	0.00E+00	5.72E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P) ¹	kg PO4-Eq	7.42E-03	1.32E-04	4.34E-03	2.92E-06	3.49E-04	0.00E+00	7.44E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.67E-07	0.00E+00	3.22E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N) ¹	kg N-Eq	4.72E-02	1.04E-02	2.79E-02	5.64E-03	2.79E-03	0.00E+00	4.83E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E-03	0.00E+00	2.57E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE) ¹	mol N-Eq	5.38E-01	1.14E-01	1.73E-01	6.17E-02	2.31E-02	0.00E+00	5.49E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.25E-02	0.00E+00	2.79E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP) ¹	kg CFC-11-Eq	1.48E-06	3.67E-08	6.18E-07	6.37E-09	4.84E-08	0.00E+00	1.50E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.46E-09	0.00E+00	9.54E-10	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels ^{1*}	MJ, net calorific value	3.66E+02	5.58E+01	2.62E+02	2.64E+01	2.67E+01	0.00E+00	3.75E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.03E+00	0.00E+00	8.17E-01	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves) ^{1*}	kg Sb-Eq	3.33E-04	4.34E-06	2.28E-04	1.37E-08	1.54E-05	0.00E+00	3.34E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-09	0.00E+00	2.32E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase ¹	kg NMVOC-Eq	1.55E-01	3.28E-02	6.28E-02	1.61E-02	8.12E-03	0.00E+00	1.59E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.29E-03	0.00E+00	8.40E-04	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption) ^{1*}	m3 world eq. deprived	1.04E+01	1.34E-01	1.65E+01	1.41E-02	9.87E-01	0.00E+00	1.05E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-03	0.00E+00	2.11E-03	-3.46E-03

Table 6: Environmental impact Results of 76TS Operable Window, Double Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100)1,2	kg CO2-Eq	3.15E+01	6.84E+00	2.94E+01	2.36E+00	1.29E+00	0.00E+00	3.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.42E-01	0.00E+00	7.43E-02	-2.17E-02
climate change: biogenic - global warming potential (GWP100)1,3	kg CO2-Eq	1.71E-01	3.56E-02	5.85E+00	2.50E-02	1.12E-02	0.00E+00	1.65E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.74E-03	0.00E+00	1.80E-05	-1.17E-04
climate change: fossil - global warming potential (GWP100)1	kg CO2-Eq	3.13E+01	6.80E+00	2.35E+01	2.34E+00	1.28E+00	0.00E+00	3.14E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.37E-01	0.00E+00	7.42E-02	-2.16E-02
climate change: land use and land use change - global warming potential (GWP100)1	kg CO2-Eq	3.16E-02	2.71E-03	1.65E-02	5.03E-04	1.28E-03	0.00E+00	3.11E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.16E-04	0.00E+00	8.61E-06	-2.62E-05
acidification - accumulated exceedance (AE)1	mol H+-Eq	2.55E-01	5.25E-02	1.10E-01	1.53E-02	6.64E-03	0.00E+00	2.55E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.16E-03	0.00E+00	6.50E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P)1	kg PO4-Eq	6.84E-03	2.56E-04	5.47E-03	3.67E-06	3.49E-04	0.00E+00	6.86E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.43E-07	0.00E+00	3.66E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N)1	kg N-Eq	4.38E-02	1.77E-02	3.50E-02	7.09E-03	1.87E-03	0.00E+00	4.45E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.44E-03	0.00E+00	2.92E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE)1	mol N-Eq	4.98E-01	1.93E-01	2.16E-01	7.75E-02	1.31E-02	0.00E+00	5.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-02	0.00E+00	3.17E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP)1	kg CFC-11-Eq	1.37E-06	6.87E-08	7.78E-07	8.01E-09	4.72E-08	0.00E+00	1.39E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.84E-09	0.00E+00	1.08E-09	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels1*	MJ, net calorific value	3.38E+02	9.66E+01	3.35E+02	3.32E+01	2.19E+01	0.00E+00	3.46E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.63E+00	0.00E+00	9.28E-01	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves)1*	kg Sb-Eq	3.07E-04	8.49E-06	2.87E-04	1.72E-08	1.54E-05	0.00E+00	3.08E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.96E-09	0.00E+00	2.64E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	1.43E-01	5.65E-02	7.86E-02	2.03E-02	5.46E-03	0.00E+00	1.47E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.16E-03	0.00E+00	9.54E-04	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption)1*	m3 world eq. deprived	9.60E+00	2.56E-01	2.05E+01	1.77E-02	9.84E-01	0.00E+00	9.65E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.06E-03	0.00E+00	2.39E-03	-3.46E-03

Table 7: Environmental impact Results of 76TS Terrace Swing, Double Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100) _{1,2}	kg CO2-Eq	2.80E+01	1.09E+01	3.96E+01	3.07E+00	1.30E+00	0.00E+00	2.80E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.07E-01	0.00E+00	7.96E-02	-1.98E-02
climate change: biogenic - global warming potential (GWP100) _{1,3}	kg CO2-Eq	1.53E-01	5.36E-02	7.67E+00	3.24E-02	1.12E-02	0.00E+00	1.46E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-03	0.00E+00	1.93E-05	-1.06E-04
climate change: fossil - global warming potential (GWP100) ₁	kg CO2-Eq	2.78E+01	1.09E+01	3.19E+01	3.03E+00	1.29E+00	0.00E+00	2.79E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.99E-01	0.00E+00	7.95E-02	-1.96E-02
climate change: land use and land use change - global warming potential (GWP100) ₁	kg CO2-Eq	2.83E-02	4.43E-03	2.13E-02	6.53E-04	1.26E-03	0.00E+00	2.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-04	0.00E+00	9.22E-06	-2.38E-05
acidification - accumulated exceedance (AE) ₁	mol H+-Eq	2.27E-01	8.44E-02	1.51E-01	1.99E-02	6.69E-03	0.00E+00	2.26E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.12E-03	0.00E+00	6.96E-04	-8.22E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P) ₁	kg PO4-Eq	6.09E-03	4.31E-04	7.11E-03	4.76E-06	3.52E-04	0.00E+00	6.08E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.10E-06	0.00E+00	3.92E-06	-1.16E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N) ₁	kg N-Eq	3.89E-02	2.80E-02	4.91E-02	9.20E-03	1.88E-03	0.00E+00	3.94E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.88E-03	0.00E+00	3.13E-04	-2.13E-05
eutrophication: terrestrial - accumulated exceedance (AE) ₁	mol N-Eq	4.42E-01	3.06E-01	3.20E-01	1.01E-01	1.32E-02	0.00E+00	4.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-02	0.00E+00	3.39E-03	-2.10E-04
ozone depletion - ozone depletion potential (ODP) ₁	kg CFC-11-Eq	1.21E-06	1.14E-07	1.02E-06	1.04E-08	4.73E-08	0.00E+00	1.23E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-09	0.00E+00	1.16E-09	-1.42E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels ₁ *	MJ, net calorific value	3.01E+02	1.54E+02	4.54E+02	4.31E+01	2.20E+01	0.00E+00	3.08E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.94E+00	0.00E+00	9.94E-01	-1.92E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves) ₁ *	kg Sb-Eq	2.72E-04	1.43E-05	3.73E-04	2.23E-08	1.54E-05	0.00E+00	2.73E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.15E-09	0.00E+00	2.83E-08	-1.23E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	1.27E-01	9.00E-02	1.13E-01	2.63E-02	5.52E-03	0.00E+00	1.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.43E-03	0.00E+00	1.02E-03	-6.13E-05
water use - user deprivation potential (deprivation-weighted water consumption) ₁ *	m3 world eq. deprived	8.53E+00	4.27E-01	2.66E+01	2.29E-02	9.99E-01	0.00E+00	8.56E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-03	0.00E+00	2.56E-03	-3.15E-03

Table 8: Environmental impact Results of 76TS Fixed Window, Triple Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100)1,2	kg CO2-Eq	4.91E+01	4.23E+00	2.85E+01	2.46E+00	1.23E+00	0.00E+00	7.98E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.61E-01	0.00E+00	8.59E-02	-2.15E-02
climate change: biogenic - global warming potential (GWP100)1,3	kg CO2-Eq	2.42E-01	2.26E-02	4.62E+00	2.19E-02	9.93E-03	0.00E+00	3.93E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-03	0.00E+00	1.78E-05	-1.15E-04
climate change: fossil - global warming potential (GWP100)1	kg CO2-Eq	4.88E+01	4.21E+00	2.39E+01	2.44E+00	1.22E+00	0.00E+00	7.93E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.56E-01	0.00E+00	8.58E-02	-2.13E-02
climate change: land use and land use change - global warming potential (GWP100)1	kg CO2-Eq	6.06E-02	1.53E-03	2.01E-02	5.30E-04	1.28E-03	0.00E+00	9.78E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.21E-04	0.00E+00	1.02E-05	-2.62E-05
acidification - accumulated exceedance (AE)1	mol H+-Eq	3.89E-01	3.20E-02	1.16E-01	1.61E-02	6.64E-03	0.00E+00	6.31E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.31E-03	0.00E+00	7.75E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P)1	kg PO4-Eq	1.22E-02	1.30E-04	5.75E-03	3.86E-06	3.49E-04	0.00E+00	1.97E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.82E-07	0.00E+00	4.36E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N)1	kg N-Eq	6.75E-02	1.15E-02	3.71E-02	7.46E-03	1.87E-03	0.00E+00	1.10E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.51E-03	0.00E+00	3.48E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE)1	mol N-Eq	7.67E-01	1.26E-01	2.31E-01	8.16E-02	1.31E-02	0.00E+00	1.25E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.65E-02	0.00E+00	3.78E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP)1	kg CFC-11-Eq	6.88E-07	3.74E-08	8.16E-07	8.43E-09	4.72E-08	0.00E+00	1.13E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-09	0.00E+00	1.29E-09	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels1*	MJ, net calorific value	5.55E+02	6.07E+01	3.52E+02	3.50E+01	2.19E+01	0.00E+00	9.08E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.98E+00	0.00E+00	1.11E+00	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves)1*	kg Sb-Eq	3.81E-04	4.26E-06	3.01E-04	1.81E-08	1.54E-05	0.00E+00	6.15E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-09	0.00E+00	3.15E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	2.19E-01	3.59E-02	8.37E-02	2.14E-02	5.46E-03	0.00E+00	3.59E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.36E-03	0.00E+00	1.14E-03	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption)1*	m3 world eq. deprived	1.28E+01	1.35E-01	2.19E+01	1.86E-02	9.84E-01	0.00E+00	2.08E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.25E-03	0.00E+00	2.85E-03	-3.46E-03

Table 9: Environmental impact Results of 76TS Operable Window, Triple Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100) _{1,2}	kg CO2-Eq	7.29E+01	7.04E+00	3.40E+01	2.87E+00	1.23E+00	0.00E+00	7.32E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.61E-01	0.00E+00	9.23E-02	-2.15E-02
climate change: biogenic - global warming potential (GWP100) _{1,3}	kg CO2-Eq	3.63E-01	3.27E-02	5.85E+00	2.56E-02	9.93E-03	0.00E+00	3.60E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.89E-03	0.00E+00	1.91E-05	-1.15E-04
climate change: fossil - global warming potential (GWP100) ₁	kg CO2-Eq	7.25E+01	7.00E+00	2.81E+01	2.85E+00	1.22E+00	0.00E+00	7.28E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.55E-01	0.00E+00	9.23E-02	-2.13E-02
climate change: land use and land use change - global warming potential (GWP100) ₁	kg CO2-Eq	9.02E-02	2.75E-03	2.08E-02	6.19E-04	1.28E-03	0.00E+00	8.97E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.42E-04	0.00E+00	1.10E-05	-2.62E-05
acidification - accumulated exceedance (AE) ₁	mol H ⁺ -Eq	5.78E-01	5.46E-02	1.36E-01	1.88E-02	6.64E-03	0.00E+00	5.79E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.89E-03	0.00E+00	8.33E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P) ₁	kg PO4-Eq	1.81E-02	2.55E-04	6.77E-03	4.51E-06	3.49E-04	0.00E+00	1.81E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.04E-06	0.00E+00	4.69E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N) ₁	kg N-Eq	1.00E-01	1.87E-02	4.32E-02	8.72E-03	1.87E-03	0.00E+00	1.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.77E-03	0.00E+00	3.74E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE) ₁	mol N-Eq	1.14E+00	2.04E-01	2.67E-01	9.53E-02	1.31E-02	0.00E+00	1.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.94E-02	0.00E+00	4.06E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP) ₁	kg CFC-11-Eq	1.02E-06	6.94E-08	9.61E-07	9.86E-09	4.72E-08	0.00E+00	1.04E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.27E-09	0.00E+00	1.39E-09	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels ₁ *	MJ, net calorific value	8.22E+02	1.01E+02	4.13E+02	4.09E+01	2.19E+01	0.00E+00	8.34E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.39E+00	0.00E+00	1.19E+00	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves) ₁ *	kg Sb-Eq	5.64E-04	8.42E-06	3.55E-04	2.12E-08	1.54E-05	0.00E+00	5.65E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.87E-09	0.00E+00	3.39E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	3.25E-01	5.94E-02	9.72E-02	2.50E-02	5.46E-03	0.00E+00	3.30E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.13E-03	0.00E+00	1.22E-03	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption) ₁ *	m3 world eq. deprived	1.90E+01	2.57E-01	2.54E+01	2.18E-02	9.84E-01	0.00E+00	1.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-03	0.00E+00	3.07E-03	-3.46E-03

Table 10: Environmental impact Results of 76TS Terrace Swing, Triple Glazed

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100) _{1,2}	kg CO2-Eq	7.09E+01	1.22E+01	4.78E+01	3.88E+00	1.26E+00	0.00E+00	7.38E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.93E-01	0.00E+00	1.05E-01	-2.15E-02
climate change: biogenic - global warming potential (GWP100) _{1,3}	kg CO2-Eq	3.54E-01	5.21E-02	8.15E+00	3.45E-02	1.16E-02	0.00E+00	5.25E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.95E-03	0.00E+00	2.16E-05	-1.15E-04
climate change: fossil - global warming potential (GWP100) ₁	kg CO2-Eq	7.04E+01	1.21E+01	3.96E+01	3.84E+00	1.25E+00	0.00E+00	7.32E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.85E-01	0.00E+00	1.05E-01	-2.13E-02
climate change: land use and land use change - global warming potential (GWP100) ₁	kg CO2-Eq	8.78E-02	4.95E-03	2.69E-02	8.36E-04	1.32E-03	0.00E+00	9.07E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.92E-04	0.00E+00	1.24E-05	-2.62E-05
acidification - accumulated exceedance (AE) ₁	mol H+-Eq	5.61E-01	9.58E-02	1.93E-01	2.54E-02	6.93E-03	0.00E+00	5.90E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E-03	0.00E+00	9.44E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P) ₁	kg PO4-Eq	1.76E-02	4.78E-04	9.10E-03	6.09E-06	3.49E-04	0.00E+00	1.76E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.40E-06	0.00E+00	5.31E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N) ₁	kg N-Eq	9.72E-02	3.21E-02	6.28E-02	1.18E-02	1.94E-03	0.00E+00	1.06E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.40E-03	0.00E+00	4.24E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE) ₁	mol N-Eq	1.10E+00	3.50E-01	4.10E-01	1.29E-01	1.39E-02	0.00E+00	1.20E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.62E-02	0.00E+00	4.60E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP) ₁	kg CFC-11-Eq	9.86E-07	1.27E-07	1.30E-06	1.33E-08	4.79E-08	0.00E+00	1.08E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.06E-09	0.00E+00	1.57E-09	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels _{1*}	MJ, net calorific value	7.99E+02	1.75E+02	5.82E+02	5.52E+01	2.48E+01	0.00E+00	1.11E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.27E+01	0.00E+00	1.35E+00	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves) _{1*}	kg Sb-Eq	5.46E-04	1.59E-05	4.77E-04	2.86E-08	1.54E-05	0.00E+00	5.48E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.59E-09	0.00E+00	3.84E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	3.15E-01	1.03E-01	1.44E-01	3.37E-02	5.82E-03	0.00E+00	3.58E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E-03	0.00E+00	1.39E-03	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption) _{1*}	m3 world eq. deprived	1.85E+01	4.76E-01	3.40E+01	2.94E-02	9.86E-01	0.00E+00	1.86E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.76E-03	0.00E+00	3.48E-03	-3.46E-03

Table 11: Environmental impact Results of 88PH+ Fixed Window

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100)1,2	kg CO2-Eq	7.53E+01	2.28E+00	2.59E+01	2.19E+00	1.23E+00	0.00E+00	7.52E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.04E-01	0.00E+00	8.26E-02	-2.15E-02
climate change: biogenic - global warming potential (GWP100)1,3	kg CO2-Eq	3.73E-01	8.77E-03	4.61E+00	1.95E-02	9.93E-03	0.00E+00	3.70E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.49E-03	0.00E+00	1.71E-05	-1.15E-04
climate change: fossil - global warming potential (GWP100)1	kg CO2-Eq	7.48E+01	2.27E+00	2.13E+01	2.17E+00	1.22E+00	0.00E+00	7.47E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-01	0.00E+00	8.25E-02	-2.13E-02
climate change: land use and land use change - global warming potential (GWP100)1	kg CO2-Eq	9.20E-02	9.66E-04	1.48E-02	4.72E-04	1.28E-03	0.00E+00	9.21E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.09E-04	0.00E+00	9.81E-06	-2.62E-05
acidification - accumulated exceedance (AE)1	mol H+-Eq	5.94E-01	1.82E-02	1.03E-01	1.44E-02	6.64E-03	0.00E+00	5.95E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.97E-03	0.00E+00	7.45E-04	-9.03E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P)1	kg PO4-Eq	1.86E-02	9.74E-05	5.13E-03	3.44E-06	3.49E-04	0.00E+00	1.86E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-07	0.00E+00	4.19E-06	-1.27E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N)1	kg N-Eq	1.03E-01	5.91E-03	3.27E-02	6.65E-03	1.87E-03	0.00E+00	1.04E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.35E-03	0.00E+00	3.35E-04	-2.34E-05
eutrophication: terrestrial - accumulated exceedance (AE)1	mol N-Eq	1.17E+00	6.45E-02	2.01E-01	7.27E-02	1.31E-02	0.00E+00	1.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.48E-02	0.00E+00	3.63E-03	-2.31E-04
ozone depletion - ozone depletion potential (ODP)1	kg CFC-11-Eq	1.05E-06	2.53E-08	7.30E-07	7.51E-09	4.72E-08	0.00E+00	1.07E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.73E-09	0.00E+00	1.24E-09	-1.57E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels1*	MJ, net calorific value	8.59E+02	3.29E+01	3.14E+02	3.11E+01	2.19E+01	0.00E+00	8.55E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.16E+00	0.00E+00	1.06E+00	-2.11E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves)1*	kg Sb-Eq	5.79E-04	3.24E-06	2.69E-04	1.61E-08	1.54E-05	0.00E+00	5.80E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-09	0.00E+00	3.03E-08	-1.35E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	3.34E-01	1.91E-02	7.33E-02	1.90E-02	5.46E-03	0.00E+00	3.39E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.91E-03	0.00E+00	1.09E-03	-6.73E-05
water use - user deprivation potential (deprivation-weighted water consumption)1*	m3 world eq. deprived	2.00E+01	9.57E-02	1.92E+01	1.66E-02	9.84E-01	0.00E+00	1.96E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.81E-03	0.00E+00	2.74E-03	-3.46E-03

Table 12: Environmental impact Results of 88PH+ Operable Window

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100) ^{1,2}	kg CO2-Eq	6.50E+01	4.53E+00	2.76E+01	2.32E+00	1.25E+00	0.00E+00	6.13E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.34E-01	0.00E+00	8.36E-02	-1.95E-02
climate change: biogenic - global warming potential (GWP100) ^{1,3}	kg CO2-Eq	3.39E-01	1.74E-02	4.92E+00	2.07E-02	9.96E-03	0.00E+00	3.01E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.75E-03	0.00E+00	1.73E-05	-1.05E-04
climate change: fossil - global warming potential (GWP100) ¹	kg CO2-Eq	6.46E+01	4.51E+00	2.27E+01	2.30E+00	1.23E+00	0.00E+00	6.09E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.29E-01	0.00E+00	8.36E-02	-1.94E-02
climate change: land use and land use change - global warming potential (GWP100) ¹	kg CO2-Eq	7.52E-02	1.92E-03	1.56E-02	5.00E-04	1.26E-03	0.00E+00	7.50E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.15E-04	0.00E+00	9.93E-06	-2.38E-05
acidification - accumulated exceedance (AE) ¹	mol H+-Eq	4.97E-01	3.61E-02	1.10E-01	1.52E-02	6.69E-03	0.00E+00	4.84E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.15E-03	0.00E+00	7.54E-04	-8.22E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P) ¹	kg PO4-Eq	1.52E-02	1.94E-04	5.46E-03	3.64E-06	3.52E-04	0.00E+00	1.51E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.38E-07	0.00E+00	4.24E-06	-1.16E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N) ¹	kg N-Eq	8.59E-02	1.17E-02	3.48E-02	7.04E-03	1.88E-03	0.00E+00	8.48E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	0.00E+00	3.39E-04	-2.13E-05
eutrophication: terrestrial - accumulated exceedance (AE) ¹	mol N-Eq	9.74E-01	1.28E-01	2.14E-01	7.69E-02	1.32E-02	0.00E+00	9.62E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.57E-02	0.00E+00	3.68E-03	-2.10E-04
ozone depletion - ozone depletion potential (ODP) ¹	kg CFC-11-Eq	8.97E-07	5.02E-08	7.77E-07	7.95E-09	4.73E-08	0.00E+00	8.71E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.83E-09	0.00E+00	1.26E-09	-1.42E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels ^{1*}	MJ, net calorific value	7.85E+02	6.52E+01	3.34E+02	3.30E+01	2.20E+01	0.00E+00	6.98E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.59E+00	0.00E+00	1.08E+00	-1.92E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves) ^{1*}	kg Sb-Eq	4.72E-04	6.44E-06	2.87E-04	1.71E-08	1.54E-05	0.00E+00	4.72E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.94E-09	0.00E+00	3.07E-08	-1.23E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	2.84E-01	3.79E-02	7.80E-02	2.01E-02	5.52E-03	0.00E+00	2.76E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.14E-03	0.00E+00	1.11E-03	-6.13E-05
water use - user deprivation potential (deprivation-weighted water consumption) ^{1*}	m3 world eq. deprived	1.92E+01	1.90E-01	2.03E+01	1.76E-02	9.99E-01	0.00E+00	1.60E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.04E-03	0.00E+00	2.78E-03	-3.15E-03

Table 13: Environmental impact Results of 88PH+ Terrace Swing

Impacts Categories	Units	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4	D
climate change - global warming potential (GWP100)1,2	kg CO2-Eq	6.07E+01	9.34E+00	4.03E+01	3.26E+00	1.25E+00	0.00E+00	6.04E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.48E-01	0.00E+00	9.23E-02	-1.95E-02
climate change: biogenic - global warming potential (GWP100)1,3	kg CO2-Eq	3.05E-01	3.61E-02	6.93E+00	2.90E-02	9.96E-03	0.00E+00	2.97E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.66E-03	0.00E+00	1.91E-05	-1.05E-04
climate change: fossil - global warming potential (GWP100)1	kg CO2-Eq	6.03E+01	9.30E+00	3.33E+01	3.23E+00	1.23E+00	0.00E+00	6.00E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.41E-01	0.00E+00	9.23E-02	-1.94E-02
climate change: land use and land use change - global warming potential (GWP100)1	kg CO2-Eq	7.47E-02	3.95E-03	2.21E-02	7.02E-04	1.26E-03	0.00E+00	7.40E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.61E-04	0.00E+00	1.10E-05	-2.38E-05
acidification - accumulated exceedance (AE)1	mol H+-Eq	4.79E-01	7.43E-02	1.63E-01	2.14E-02	6.69E-03	0.00E+00	4.77E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.41E-03	0.00E+00	8.33E-04	-8.22E-05
eutrophication: freshwater - fraction of nutrients reaching freshwater end compartment (P)1	kg PO4-Eq	1.50E-02	3.97E-04	7.67E-03	5.11E-06	3.52E-04	0.00E+00	1.49E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.17E-06	0.00E+00	4.69E-06	-1.16E-05
eutrophication: marine - fraction of nutrients reaching marine end compartment (N)1	kg N-Eq	8.30E-02	2.42E-02	5.28E-02	9.88E-03	1.88E-03	0.00E+00	8.35E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.01E-03	0.00E+00	3.74E-04	-2.13E-05
eutrophication: terrestrial - accumulated exceedance (AE)1	mol N-Eq	9.41E-01	2.64E-01	3.44E-01	1.08E-01	1.32E-02	0.00E+00	9.48E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.19E-02	0.00E+00	4.06E-03	-2.10E-04
ozone depletion - ozone depletion potential (ODP)1	kg CFC-11-Eq	8.44E-07	1.03E-07	1.10E-06	1.12E-08	4.73E-08	0.00E+00	8.60E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.56E-09	0.00E+00	1.39E-09	-1.42E-10
energy resources: non-renewable - abiotic depletion potential (ADP): fossil fuels1*	MJ, net calorific value	6.90E+02	1.34E+02	4.90E+02	4.63E+01	2.20E+01	0.00E+00	6.89E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E+01	0.00E+00	1.19E+00	-1.92E-01
material resources: metals/minerals - abiotic depletion potential (ADP): elements (ultimate reserves)1*	kg Sb-Eq	4.65E-04	1.32E-05	4.02E-04	2.40E-08	1.54E-05	0.00E+00	4.66E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.51E-09	0.00E+00	3.39E-08	-1.23E-07
photochemical oxidant formation: human health - tropospheric ozone concentration increase	kg NMVOC-Eq	2.69E-01	7.82E-02	1.21E-01	2.83E-02	5.52E-03	0.00E+00	2.73E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.80E-03	0.00E+00	1.22E-03	-6.13E-05
water use - user deprivation potential (deprivation-weighted water consumption)1*	m3 world eq. deprived	1.61E+01	3.91E-01	2.85E+01	2.47E-02	9.99E-01	0.00E+00	1.57E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.66E-03	0.00E+00	3.07E-03	-3.15E-03

(1): Calculated as per EN 15804+A2 [3] methodology and OpenLCA v 1.11 [8].

(2): GWP 100a, excludes biogenic CO₂ removals and emissions associated with biobased products and packaging; 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5). Results of biogenic carbon are presented in a separate line.

(3): Global warming potential biogenic carbon. A negative represents a biogenic carbon GWP impact.

*The results of ADP-fossil and ADP-minerals environmental impact indicators shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Environmental Product Declaration (EPD) # 743

According to the c-PCR and American Center for Life Cycle Assessment (ACLCA), the life cycle inventory (LCI) shall be presented for resources used and output flows, waste categories and carbon removals and emissions [4, 12]. The environmental parameters used for inventory analysis describes the use of renewable and non-renewable material resources, renewable and non-renewable primary energy and water.

The LCI results are presented from table 14 to table 22 for window and door products.

Table 14: Life Cycle Inventory Results of 76TS Fixed Window, Double Glazed

Resource use													
Parameter	Unit	Production stage	Construction stage		Use stage			End-fo-Life				Resource recovery stage	
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D	
RPRE(4)	MJ, LHV	7.29E+01	5.03E-02	1.13E+00	0.00E+00	2.47E+01	0.00E+00	0.00E+00	1.15E-02	0.00E+00	6.69E-03	-1.37E+02	
RPRM(5)	MJ, LHV	2.58E+00	0.00E+00	0.00E+00	0.00E+00	6.21E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.37E+02	
PERT(6)	MJ, LHV	7.55E+01	5.03E-02	1.13E+00	0.00E+00	2.47E+01	0.00E+00	0.00E+00	1.15E-02	0.00E+00	6.69E-03	-1.28E-02	
NRPRE(7)	MJ, LHV	4.35E+02	2.73E+01	1.89E+01	0.00E+00	3.69E+02	0.00E+00	0.00E+00	6.22E+00	0.00E+00	2.35E+02	-1.96E+00	
NRPRM(8)	MJ, LHV	2.39E+02	0.00E+00	7.64E+00	0.00E+00	9.89E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.36E+02	-1.75E+00	
PENRT(9)	MJ, LHV	6.75E+02	2.73E+01	2.66E+01	0.00E+00	3.69E+02	0.00E+00	0.00E+00	6.22E+00	0.00E+00	8.11E-01	-2.09E-01	
SM(10)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF(11)	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF(12)	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW(13)	m³	2.70E+01	1.41E-02	9.87E-01	0.00E+00	1.05E+01	0.00E+00	0.00E+00	3.21E-03	0.00E+00	2.11E-03	-3.46E-03	
Output Flows and Waste													
HWD(14)	kg	5.30E+01	1.69E-02	1.72E+00	0.00E+00	2.67E+01	0.00E+00	0.00E+00	3.86E-03	0.00E+00	1.56E-02	-6.22E-02	
NHWD(15)	kg	1.25E+01	2.52E-02	7.78E-02	0.00E+00	1.97E+01	0.00E+00	0.00E+00	5.75E-03	0.00E+00	7.01E-04	-2.32E-03	
HLRW(16)	m³	1.93E-08	1.94E-12	8.64E-10	0.00E+00	1.02E-08	0.00E+00	0.00E+00	4.44E-13	0.00E+00	5.04E-12	-1.80E-11	
ILLRW(17)	m³	9.85E-08	1.15E-11	4.09E-09	0.00E+00	4.99E-08	0.00E+00	0.00E+00	2.63E-12	0.00E+00	2.73E-11	-3.29E-11	
CRU(18)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR(18)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER(18)	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity(18)	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal(18)	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 15: Life Cycle Inventory Results of 76TS Operable Window, Double Glazed

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-of-Life				Resource recovery stage
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D	
RPR _E ⁽⁴⁾	MJ, LHV	7.86E+01	6.32E-02	1.12E+00	0.00E+00	2.27E+01	0.00E+00	0.00E+00	1.45E-02	0.00E+00	7.61E-03	-1.73E+02	
RPR _M ⁽⁵⁾	MJ, LHV	1.26E+00	0.00E+00	0.00E+00	0.00E+00	6.92E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.73E+02	
PERT ⁽⁶⁾	MJ, LHV	7.98E+01	6.32E-02	1.12E+00	0.00E+00	2.27E+01	0.00E+00	0.00E+00	1.45E-02	0.00E+00	7.61E-03	-1.28E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	3.67E+02	3.43E+01	1.39E+01	0.00E+00	3.41E+02	0.00E+00	0.00E+00	7.87E+00	0.00E+00	3.91E+02	1.54E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	3.98E+02	0.00E+00	7.64E+00	0.00E+00	2.85E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.92E+02	-1.75E+00	
PENRT ⁽⁹⁾	MJ, LHV	7.65E+02	3.43E+01	2.15E+01	0.00E+00	3.41E+02	0.00E+00	0.00E+00	7.87E+00	0.00E+00	9.22E-01	-2.09E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	3.04E+01	1.77E-02	9.84E-01	0.00E+00	9.65E+00	0.00E+00	0.00E+00	4.06E-03	0.00E+00	2.39E-03	-3.46E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	5.84E+01	2.12E-02	1.71E+00	0.00E+00	2.46E+01	0.00E+00	0.00E+00	4.87E-03	0.00E+00	1.77E-02	-6.22E-02	
NHWD ⁽¹⁵⁾	kg	1.59E+01	3.16E-02	7.31E-02	0.00E+00	1.79E+01	0.00E+00	0.00E+00	7.26E-03	0.00E+00	7.97E-04	-2.32E-03	
HLRW ⁽¹⁶⁾	m ³	2.10E-08	2.44E-12	8.63E-10	0.00E+00	9.37E-09	0.00E+00	0.00E+00	5.61E-13	0.00E+00	5.73E-12	-1.80E-11	
ILLRW ⁽¹⁷⁾	m ³	1.08E-07	1.45E-11	4.09E-09	0.00E+00	4.60E-08	0.00E+00	0.00E+00	3.33E-12	0.00E+00	3.10E-11	-3.29E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 16: Life Cycle Inventory Results of 76TS Terrace Swing, Double Glazed

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-fo-Life				Resource recovery stage
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D	
RPR _E ⁽⁴⁾	MJ, LHV	9.19E+01	8.20E-02	1.13E+00	0.00E+00	2.02E+01	0.00E+00	0.00E+00	1.89E-02	0.00E+00	8.15E-03	-2.25E+02	
RPR _M ⁽⁵⁾	MJ, LHV	1.17E+00	0.00E+00	0.00E+00	0.00E+00	7.09E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.25E+02	
PERT ⁽⁶⁾	MJ, LHV	9.31E+01	8.20E-02	1.13E+00	0.00E+00	2.02E+01	0.00E+00	0.00E+00	1.89E-02	0.00E+00	8.15E-03	-1.16E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	4.22E+02	4.45E+01	1.40E+01	0.00E+00	3.03E+02	0.00E+00	0.00E+00	1.03E+01	0.00E+00	4.72E+02	-1.40E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	4.82E+02	0.00E+00	7.64E+00	0.00E+00	4.07E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.73E+02	-1.59E+00	
PENRT ⁽⁹⁾	MJ, LHV	9.04E+02	4.45E+01	2.17E+01	0.00E+00	3.03E+02	0.00E+00	0.00E+00	1.03E+01	0.00E+00	9.87E-01	-1.90E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	3.56E+01	2.29E-02	9.99E-01	0.00E+00	8.56E+00	0.00E+00	0.00E+00	5.29E-03	0.00E+00	2.56E-03	-3.15E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	6.64E+01	2.75E-02	1.73E+00	0.00E+00	2.18E+01	0.00E+00	0.00E+00	6.35E-03	0.00E+00	1.90E-02	-5.66E-02	
NHWD ⁽¹⁵⁾	kg	2.06E+01	4.10E-02	7.37E-02	0.00E+00	1.54E+01	0.00E+00	0.00E+00	9.46E-03	0.00E+00	8.54E-04	-2.11E-03	
HLRW ⁽¹⁶⁾	m ³	2.37E-08	3.17E-12	8.71E-10	0.00E+00	8.33E-09	0.00E+00	0.00E+00	7.31E-13	0.00E+00	6.14E-12	-1.63E-11	
ILLRW ⁽¹⁷⁾	m ³	1.24E-07	1.88E-11	4.13E-09	0.00E+00	4.09E-08	0.00E+00	0.00E+00	4.34E-12	0.00E+00	3.32E-11	-2.99E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 17: Life Cycle Inventory Results of 76TS Fixed Window, Triple Glazed

Parameter	Unit	Resource use										
		Production stage	Construction stage		Use stage			End-fo-Life				Resource recovery stage
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D
RPR _E ⁽⁴⁾	MJ, LHV	1.11E+02	6.66E-02	1.12E+00	0.00E+00	7.24E+01	0.00E+00	0.00E+00	1.52E-02	0.00E+00	9.07E-03	-1.81E+02
RPR _M ⁽⁵⁾	MJ, LHV	4.18E+00	0.00E+00	0.00E+00	0.00E+00	9.08E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.81E+02
PERT ⁽⁶⁾	MJ, LHV	1.15E+02	6.66E-02	1.12E+00	0.00E+00	7.24E+01	0.00E+00	0.00E+00	1.52E-02	0.00E+00	9.07E-03	-1.28E-02
NRPR _E ⁽⁷⁾	MJ, LHV	7.22E+02	3.61E+01	1.39E+01	0.00E+00	8.94E+02	0.00E+00	0.00E+00	8.23E+00	0.00E+00	2.28E+02	-1.54E+00
NRPR _M ⁽⁸⁾	MJ, LHV	2.31E+02	0.00E+00	7.64E+00	0.00E+00	1.18E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.29E+02	-1.75E+00
PENRT ⁽⁹⁾	MJ, LHV	9.53E+02	3.61E+01	2.15E+01	0.00E+00	8.94E+02	0.00E+00	0.00E+00	8.23E+00	0.00E+00	1.10E+00	-2.09E-01
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW ⁽¹³⁾	m ³	3.49E+01	1.86E-02	9.84E-01	0.00E+00	2.08E+01	0.00E+00	0.00E+00	4.25E-03	0.00E+00	2.85E-03	-3.46E-03
Output Flows and Waste												
HWD ⁽¹⁴⁾	kg	9.58E+01	2.23E-02	1.71E+00	0.00E+00	9.85E+01	0.00E+00	0.00E+00	5.10E-03	0.00E+00	2.11E-02	-6.22E-02
NHWD ⁽¹⁵⁾	kg	1.68E+01	3.33E-02	7.31E-02	0.00E+00	3.30E+01	0.00E+00	0.00E+00	7.60E-03	0.00E+00	9.50E-04	-2.32E-03
HLRW ⁽¹⁶⁾	m ³	4.58E-08	2.57E-12	8.63E-10	0.00E+00	5.45E-08	0.00E+00	0.00E+00	5.87E-13	0.00E+00	6.83E-12	-1.80E-11
ILLRW ⁽¹⁷⁾	m ³	2.45E-07	1.53E-11	4.09E-09	0.00E+00	2.92E-07	0.00E+00	0.00E+00	3.48E-12	0.00E+00	3.70E-11	-3.29E-11
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 18: Life Cycle Inventory Results of 76TS Operable Window, Triple Glazed

Parameter	Unit	Resource use										Resource recovery stage	
		Production stage	Construction stage			Use stage			End-fo-Life				
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4		D
RPR _E ⁽⁴⁾	MJ, LHV	1.36E+02	7.78E-02	1.12E+00	0.00E+00	6.64E+01	0.00E+00	0.00E+00	1.79E-02	0.00E+00	9.75E-03	-2.13E+02	
RPR _M ⁽⁵⁾	MJ, LHV	1.99E+00	0.00E+00	0.00E+00	0.00E+00	9.52E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.13E+02	
PERT ⁽⁶⁾	MJ, LHV	1.38E+02	7.78E-02	1.12E+00	0.00E+00	6.64E+01	0.00E+00	0.00E+00	1.79E-02	0.00E+00	9.75E-03	-1.28E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	9.32E+02	4.22E+01	1.39E+01	0.00E+00	8.21E+02	0.00E+00	0.00E+00	9.69E+00	0.00E+00	3.85E+02	1.54E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	3.91E+02	0.00E+00	7.64E+00	0.00E+00	3.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.87E+02	-1.75E+00	
PENRT ⁽⁹⁾	MJ, LHV	1.32E+03	4.22E+01	2.15E+01	0.00E+00	8.21E+02	0.00E+00	0.00E+00	9.69E+00	0.00E+00	1.18E+00	-2.09E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	4.47E+01	2.18E-02	9.84E-01	0.00E+00	1.91E+01	0.00E+00	0.00E+00	5.00E-03	0.00E+00	3.07E-03	-3.46E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	1.32E+02	2.61E-02	1.71E+00	0.00E+00	9.04E+01	0.00E+00	0.00E+00	6.00E-03	0.00E+00	2.27E-02	-6.22E-02	
NHWD ⁽¹⁵⁾	kg	2.28E+01	3.89E-02	7.31E-02	0.00E+00	2.99E+01	0.00E+00	0.00E+00	8.95E-03	0.00E+00	1.02E-03	-2.32E-03	
HLRW ⁽¹⁶⁾	m ³	6.43E-08	3.00E-12	8.63E-10	0.00E+00	5.00E-08	0.00E+00	0.00E+00	6.91E-13	0.00E+00	7.34E-12	-1.80E-11	
ILLRW ⁽¹⁷⁾	m ³	3.44E-07	1.78E-11	4.09E-09	0.00E+00	2.68E-07	0.00E+00	0.00E+00	4.10E-12	0.00E+00	3.98E-11	-3.29E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 19: Life Cycle Inventory Results of 76TS Terrace Swing, Triple Glazed

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-of-Life				Resource recovery stage
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D	
RPR _E ⁽⁴⁾	MJ, LHV	1.54E+02	1.05E-01	1.13E+00	0.00E+00	1.12E-01	6.47E+01	0.00E+00	2.42E-02	0.00E+00	1.10E-02	-2.88E+02	
RPR _M ⁽⁵⁾	MJ, LHV	1.92E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.02E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.88E+02	
PERT ⁽⁶⁾	MJ, LHV	1.56E+02	1.05E-01	1.13E+00	0.00E+00	1.12E-01	6.47E+01	0.00E+00	2.42E-02	0.00E+00	1.10E-02	-1.28E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	1.01E+03	5.69E+01	1.69E+01	0.00E+00	6.41E+00	1.10E+03	0.00E+00	1.31E+01	0.00E+00	5.13E+02	-1.54E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	5.31E+02	0.00E+00	7.64E+00	0.00E+00	0.00E+00	4.57E-08	0.00E+00	0.00E+00	0.00E+00	5.14E+02	-1.75E+00	
PENRT ⁽⁹⁾	MJ, LHV	1.54E+03	5.69E+01	2.45E+01	0.00E+00	6.41E+00	1.10E+03	0.00E+00	1.31E+01	0.00E+00	1.34E+00	-2.09E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	5.30E+01	2.94E-02	9.86E-01	0.00E+00	4.22E-02	1.86E+01	0.00E+00	6.76E-03	0.00E+00	3.48E-03	-3.46E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	1.44E+02	3.52E-02	1.71E+00	0.00E+00	1.96E-01	8.76E+01	0.00E+00	8.11E-03	0.00E+00	2.57E-02	-6.22E-02	
NHWD ⁽¹⁵⁾	kg	2.95E+01	5.25E-02	7.58E-02	0.00E+00	8.48E-03	2.87E+01	0.00E+00	1.21E-02	0.00E+00	1.16E-03	-2.32E-03	
HLRW ⁽¹⁶⁾	m ³	6.81E-08	4.06E-12	8.63E-10	0.00E+00	9.89E-11	4.84E-08	0.00E+00	9.34E-13	0.00E+00	8.32E-12	-1.80E-11	
ILLRW ⁽¹⁷⁾	m ³	3.65E-07	2.40E-11	4.09E-09	0.00E+00	5.05E-10	2.59E-07	0.00E+00	5.54E-12	0.00E+00	4.51E-11	-3.29E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 20: Life Cycle Inventory Results of 88PH+ Fixed Window

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-fo-Life				Resource recovery stage
			A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	
RPR _E ⁽⁴⁾	MJ, LHV	1.18E+02	5.93E-02	1.12E+00	0.00E+00	6.82E+01	0.00E+00	0.00E+00	1.36E-02	0.00E+00	8.72E-03	-1.63E+02	
RPR _M ⁽⁵⁾	MJ, LHV	5.04E-01	0.00E+00	0.00E+00	0.00E+00	1.93E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.63E+02	
PERT ⁽⁶⁾	MJ, LHV	1.19E+02	5.93E-02	1.12E+00	0.00E+00	6.82E+01	0.00E+00	0.00E+00	1.36E-02	0.00E+00	8.72E-03	-1.28E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	9.28E+02	3.21E+01	1.39E+01	0.00E+00	8.42E+02	0.00E+00	0.00E+00	7.39E+00	0.00E+00	2.63E+02	1.54E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	2.58E+02	0.00E+00	7.64E+00	0.00E+00	1.86E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.64E+02	-1.75E+00	
PENRT ⁽⁹⁾	MJ, LHV	1.19E+03	3.21E+01	2.15E+01	0.00E+00	8.42E+02	0.00E+00	0.00E+00	7.39E+00	0.00E+00	1.06E+00	-2.09E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	3.93E+01	1.66E-02	9.84E-01	0.00E+00	1.96E+01	0.00E+00	0.00E+00	3.81E-03	0.00E+00	2.74E-03	-3.46E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	1.24E+02	1.99E-02	1.71E+00	0.00E+00	9.28E+01	0.00E+00	0.00E+00	4.58E-03	0.00E+00	2.03E-02	-6.22E-02	
NHWD ⁽¹⁵⁾	kg	1.82E+01	2.97E-02	7.31E-02	0.00E+00	3.10E+01	0.00E+00	0.00E+00	6.82E-03	0.00E+00	9.13E-04	-2.32E-03	
HLRW ⁽¹⁶⁾	m ³	6.19E-08	2.29E-12	8.63E-10	0.00E+00	5.13E-08	0.00E+00	0.00E+00	5.27E-13	0.00E+00	6.57E-12	-1.80E-11	
ILLRW ⁽¹⁷⁾	m ³	3.32E-07	1.36E-11	4.09E-09	0.00E+00	2.75E-07	0.00E+00	0.00E+00	3.12E-12	0.00E+00	3.56E-11	-3.29E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 21: Life Cycle Inventory Results of 88PH+ Operable Window

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-of-Life				Resource recovery stage
		A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	D	
RPR _E ⁽⁴⁾	MJ, LHV	1.09E+02	6.28E-02	1.13E+00	0.00E+00	6.72E-02	5.55E+01	0.00E+00	1.45E-02	0.00E+00	8.83E-03	-1.72E+02	
RPR _M ⁽⁵⁾	MJ, LHV	3.97E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.19E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-1.72E+02	
PERT ⁽⁶⁾	MJ, LHV	1.10E+02	6.28E-02	1.13E+00	0.00E+00	6.72E-02	5.55E+01	0.00E+00	1.45E-02	0.00E+00	8.83E-03	-1.16E-02	
NRPR _E ⁽⁷⁾	MJ, LHV	7.63E+02	3.40E+01	1.40E+01	0.00E+00	3.83E+00	6.83E+02	0.00E+00	7.83E+00	0.00E+00	4.50E+02	1.40E+00	
NRPR _M ⁽⁸⁾	MJ, LHV	4.05E+02	0.00E+00	7.64E+00	0.00E+00	0.00E+00	4.14E-07	0.00E+00	0.00E+00	0.00E+00	4.51E+02	-1.59E+00	
PENRT ⁽⁹⁾	MJ, LHV	1.17E+03	3.40E+01	2.17E+01	0.00E+00	3.83E+00	6.83E+02	0.00E+00	7.83E+00	0.00E+00	1.07E+00	-1.90E-01	
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
FW ⁽¹³⁾	m ³	3.97E+01	1.76E-02	9.99E-01	0.00E+00	2.52E-02	1.59E+01	0.00E+00	4.04E-03	0.00E+00	2.78E-03	-3.15E-03	
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	1.09E+02	2.11E-02	1.73E+00	0.00E+00	1.17E-01	7.55E+01	0.00E+00	4.85E-03	0.00E+00	2.05E-02	-5.66E-02	
NHWD ⁽¹⁵⁾	kg	1.85E+01	3.14E-02	7.38E-02	0.00E+00	5.06E-03	2.51E+01	0.00E+00	7.23E-03	0.00E+00	9.25E-04	-2.11E-03	
HLRW ⁽¹⁶⁾	m ³	5.33E-08	2.42E-12	8.71E-10	0.00E+00	5.90E-11	4.18E-08	0.00E+00	5.58E-13	0.00E+00	6.65E-12	-1.63E-11	
ILLRW ⁽¹⁷⁾	m ³	2.86E-07	1.44E-11	4.13E-09	0.00E+00	3.02E-10	2.24E-07	0.00E+00	3.31E-12	0.00E+00	3.60E-11	-2.99E-11	
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	

Table 22: Life Cycle Inventory Results of 88PH+ Terrace Swing

Parameter	Unit	Resource use											
		Production stage	Construction stage			Use stage			End-of-Life				Resource recovery stage
			A1-A3	A4	A5	B1-B3-B5-B6-B7	B2	B4	C1	C2	C3	C4	
RPR _e ⁽⁴⁾	MJ, LHV	1.30E+02	8.82E-02	1.13E+00	0.00E+00	5.48E+01	0.00E+00	0.00E+00	0.00E+00	2.03E-02	0.00E+00	9.75E-03	-2.42E+02
RPR _m ⁽⁵⁾	MJ, LHV	4.75E-01	0.00E+00	0.00E+00	0.00E+00	1.03E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	-2.42E+02
PERT ⁽⁶⁾	MJ, LHV	1.30E+02	8.82E-02	1.13E+00	0.00E+00	5.48E+01	0.00E+00	0.00E+00	0.00E+00	2.03E-02	0.00E+00	9.75E-03	-1.16E-02
NRPR _e ⁽⁷⁾	MJ, LHV	7.88E+02	4.78E+01	1.40E+01	0.00E+00	6.78E+02	0.00E+00	0.00E+00	1.10E+01	0.00E+00	5.04E+02	1.40E+00	
NRPR _m ⁽⁸⁾	MJ, LHV	5.13E+02	0.00E+00	7.64E+00	0.00E+00	1.57E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.05E+02	-1.59E+00
PENRT ⁽⁹⁾	MJ, LHV	1.30E+03	4.78E+01	2.17E+01	0.00E+00	6.78E+02	0.00E+00	0.00E+00	1.10E+01	0.00E+00	1.18E+00	1.18E+00	-1.90E-01
SM ⁽¹⁰⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF ⁽¹¹⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF ⁽¹²⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
FW ⁽¹³⁾	m ³	4.50E+01	2.47E-02	9.99E-01	0.00E+00	1.57E+01	0.00E+00	0.00E+00	5.66E-03	0.00E+00	3.07E-03	3.07E-03	-3.15E-03
Output Flows and Waste													
HWD ⁽¹⁴⁾	kg	1.22E+02	2.96E-02	1.73E+00	0.00E+00	7.46E+01	0.00E+00	0.00E+00	6.79E-03	0.00E+00	2.27E-02	2.27E-02	-5.66E-02
NHWD ⁽¹⁵⁾	kg	2.49E+01	4.41E-02	7.38E-02	0.00E+00	2.42E+01	0.00E+00	0.00E+00	1.01E-02	0.00E+00	1.02E-03	1.02E-03	-2.11E-03
HLRW ⁽¹⁶⁾	m ³	5.77E-08	3.41E-12	8.71E-10	0.00E+00	4.12E-08	0.00E+00	0.00E+00	7.82E-13	0.00E+00	7.35E-12	7.35E-12	-1.63E-11
ILLRW ⁽¹⁷⁾	m ³	3.09E-07	2.02E-11	4.13E-09	0.00E+00	2.21E-07	0.00E+00	0.00E+00	4.64E-12	0.00E+00	3.98E-11	3.98E-11	-2.99E-11
CRU ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MR ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MER ⁽¹⁸⁾	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE, electricity ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EE, thermal ⁽¹⁸⁾	MJ, LHV	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*In the calculation of RPR_m and NRPR_m, packaging materials were included.

(4): RPR_e = RPRT - RPR_m, where RPR_e⁽⁴⁾ is equal to the value for renewable energy obtained using the CED LHV.

(5): RPR_m is calculated by multiplying of the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of this input as per ACLCA ISO 21930 Guidance [12]. In the calculation of RPR_m, packaging materials were included.

(7): NRPR_e = NRPR_T - NRPR_m, where NRPR_T⁽⁷⁾ is equal to the value for non-renewable energy obtained using the CED LHV methodology (both non-renewable energy fossil fuel and nuclear).

(8): NRPR_m is calculated by multiplying of the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of this input as per ACLCA ISO 21930 Guidance [12]. In the calculation of NRPR_m, packaging materials were included.

(10): Calculated as per ACLCA ISO 21930 Guidance [12], 6.5 Secondary material, SM: There is SM involved in Innotech Windows + Doors.

(11): Calculated as per ACLCA ISO 21930 Guidance [12], 6.6 Renewable secondary fuels, RSF: There is no RSF involved in the Innotech Windows + Doors manufacturing process.

(12): Calculated as per ACLCA ISO 21930 Guidance [12], 6.7 Non-renewable secondary fuels, NRSF: There is no NRSF involved in the Innotech Windows + Doors manufacturing process.

(13): There is no water used in the Innotech Windows + Doors manufacturing process. Water mentioned comes from the upstream process.

(14): Calculated from life cycle inventory results, based on datasets marked as "hazardous."

(15): Calculated from life cycle inventory results, based on waste "non-hazardous."

(16): Calculated as per ACLCA ISO 21930 Guidance [12], 10.3 High-level radioactive waste, conditioned, to final repository. It should be noted that the Innotech Windows + Doors manufacturing process does not generate any HLRW (High-level radioactive waste), e.g., when generated by electricity production, consists mostly of spent fuel from reactors." (ISO 21930:2017, clause 7.2.14).

(17): Calculated as per ACLCA ISO 21930 Guidance [12], 10.4 Intermediate- and low-level radioactive waste, conditioned, to final repository. It should be noted that the Innotech Windows + Doors manufacturing process does not generate any ILLRW (Low- and intermediate-level radioactive wastes,) e.g., when generated by electricity production, arise mainly from routine facility maintenance and operations (ISO 21930:2017, clause 7.2.14).

(18): Reused components (CRU), materials for recycling (MR), materials for energy recovery (MER), exported energy electricity (EEE) and exported energy thermal (EET) are nil in this analysis.

5 LCA: INTERPRETATION

The aim of this section is to present more details on the contribution to the impacts and resource use of the different life cycle modules of each Innotech Windows + Doors products studied.

The relative impacts of the window and door products with double or triple glazing systems present the same tendency. The modules A1 (extraction and upstream production), A3 (manufacturing) and B2 (maintenance) are the major contributors. For the A1 and B2 modules, the production of the double or triple glazing systems is responsible for up to 99% of the total environmental impacts. In the case of module A3, heating burning natural gas and silicon spray used as chemicals during the manufacturing process are major contributors with up to 70% of the total impacts. The contribution analysis is presented in the figure 4 and figure 5 below.

Figure 4: Contribution of each life cycle module for 76TS Fixed Window, Double Glazed

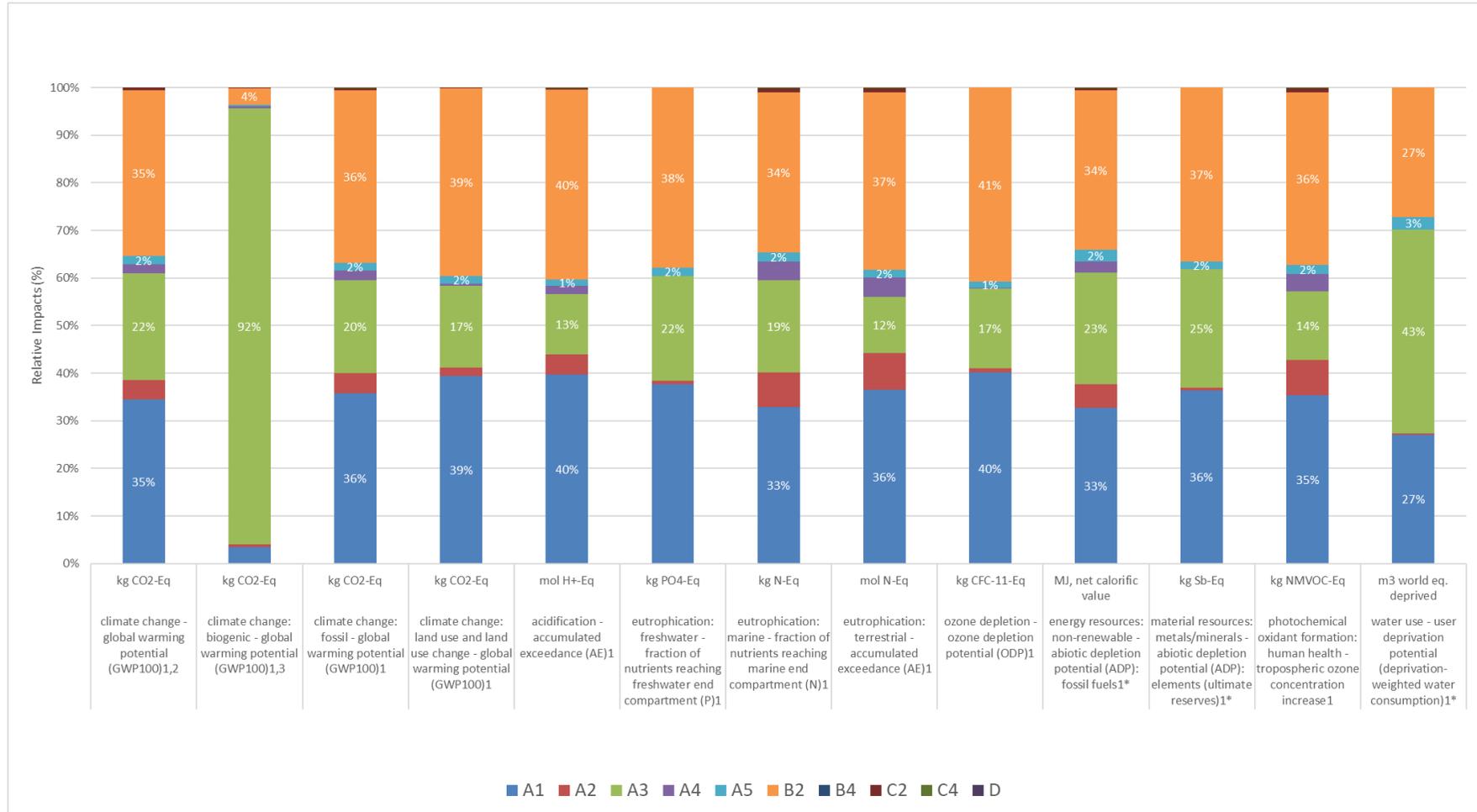
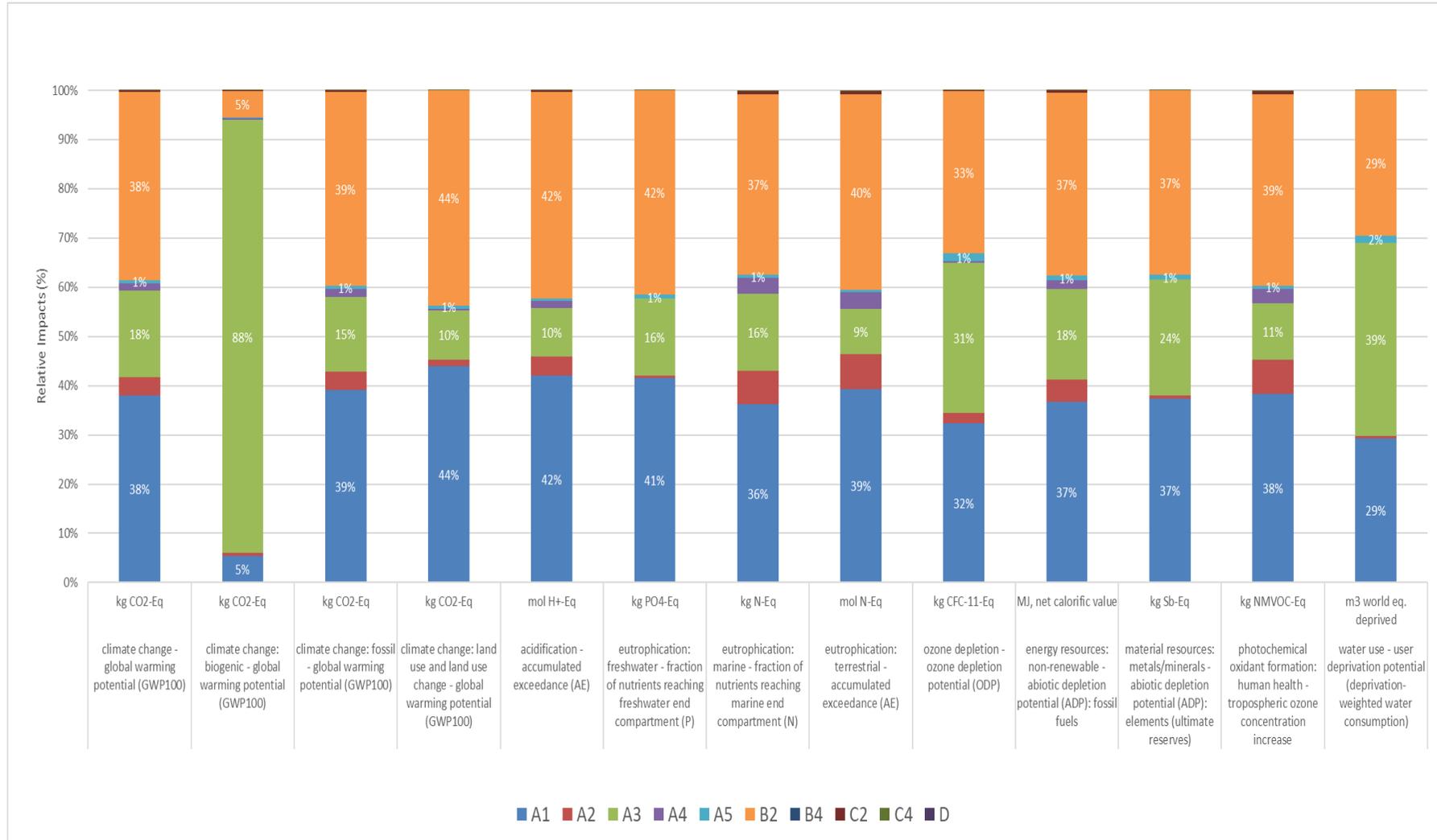


Figure 5: Contribution of each life cycle module for 76TS Fixed Window, Triple Glazed



6 ADDITIONAL ENVIRONMENTAL INFORMATION

6.1 ENVIRONMENTAL ACTIVITIES AND CERTIFICATION

In addition, Innotech has engaged a third-party preparer (Vertima inc.) to prepare the Health Product Declaration (HPD) for their window and door products.

6.2 EXTRAORDINARY EFFECTS

There are no extraordinary effects for Innotech Windows + Doors products.

7 REFERENCES

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Innotech Windows + Doors

27452 52 avenue Langley,

BC V2W 4B2.

Canada

<https://www.innotech-windows.com/>



This LCA and EPD were prepared by Vertima Inc.

604 Saint Viateur Street,
Quebec, QC
(418) 990-2800
G2L 2K8 CANADA

