Maibec CanExel



Maibec

ENVIRONMENTAL PRODUCT DECLARATION

ISO 14025:2006 and ISO 21930:2017

Maibec is pleased to present this Environmental Product Declaration (EPD) for CanExel. This EPD was developed in compliance with ISO 14025 and ISO 21930 and has been verified by Jean-François Ménard from CIRAIG.

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 Maibec, visit https://maibec.com/en/products/canexel/.

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

Environmental Product Declaration

CSA Group Registered Based on ISO 14025 and Other Requirements
For more information visit csaregistries.ca/epd

7595-9714
November 2023-November 2028

1. GENERAL INFORMATION

PCR GENERAL INFORMATION			
Reference PCR	UL Environment PCR Guidance for Building-Related products and services in Part B: Structural and Architectural Wood Products EPD Requirements v1.0. UL Environment, October 2019 to October 2024		
The PCR review was conducted by:	*Dr. Thomas Gloria (chair)* *Industrial Ecology Consultants* *t.gloria@industrial-ecology.com*	*Dr. Indro Ganguly* *University of Washington*	*Dr. Sahoo* *University of Georgia*

EPD GENERAL INFORMATION		
Program Operator	CSA Group 178 Boulevard Rexdale, Toronto (ON), M9W 1R3, Canada www.csagroup.org	
Declared Product	**Maibec CanExel**	
EPD Registration Number 7595-9714	**EPD Date of Issue** **November 28, 2023**	**EPD Period of Validity** **November 28, 2023** - November 26, **2028**
EPD Recipient Organization	Maibec 1984, 5e Rue #202 Saint-Romuald, Quebec (QC) G6W 5M6 Canada https://maibec.com/en/products/canexel/	

EPD Type/Scope and Functional Unit	**Year of Reported Manufacturer Primary Data**
Product-specific type III, cradle-to grave EPD with a Functional unit of 1 m3 of installed Maibec CanExel Siding product over a period of 75 years.	2021

Geographical Scope	**LCA Software**	**LCI Databases**	**LCIA Methodology**
North-America	OpenLCA v.1.11	Ecoinvent 3.9 and US LCI	TRACI 2.1

This LCA and EPD were prepared by:	Gatien Geraud Essoua Essoua Ph.D., Forestry Eng. 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 PCR ULE "UL Environment PCR Guidance for Building-Related products and services in Part B: Structural and Architectural Wood Products EPD Requirements", which is based on ISO 21930:2017. ☐ Internal ☒ External	Jean-François Ménard CIRAIG

LIMITATIONS

Environmental declarations from different programs (ISO 14025) may not be comparable. [1]

Comparison of the environmental performance using EPD information shall consider all relevant information modules over the full life cycle of the products within the building.

This PCR allows EPD comparability only when the same functional requirements between products are ensured and the requirements of ISO 21930:2017 section 5.5 are met. It should be noted that different LCA software and background LCI datasets may lead to differences in results upstream or downstream of the life cycle stages declared.

2. PRODUCT SYSTEM DESCRIPTION

Maibec is a family-run business and a leader in North America in the production and marketing of building exterior siding systems. Maibec wood siding, CanExel and stone siding and shingles offer complete, innovative and complementary solutions with proven, superior quality. The headquarters are located at 1984 5e rue 202, Saint-Romuald, Quebec. Maibec conforms to the most stringent environmental standards. 100% of wood fibres used by Maibec in its CanExel manufacturing process comes from forestry residue. The CanExel products are manufactured at 2005 Highway 3, Hubbards, Nova Scotia.

In the context of a growing popularity of LEED certifications, developing Type III EPDs would allow Maibec to increase the visibility of its products. Maibec therefore engaged the services of Vertima Inc. to carry out a Life Cycle Assessment for their CanExel products, all manufactured at Maibec facilities sites located in Hubbards, Nova Scotia.

2.1. PRODUCT DESCRIPTION

The product studied in this report is CanExel siding.

2.1.1. Product specification

CanExel is the one and only high-density fibre (HDF) engineered siding. CanExel engineered siding is made with our exclusive premium thermoset paint. Wood grain patterns are not repeated endlessly. CanExel presents a wide variety of wood grain patterns that create an amazing, authentic and exclusive style.

The CanExel product profiles are VStyle, Ridgewood D-5, Ced'R-Vue and UltraPlank. The average density of the CanExel product is 960 kg/m3 and thicknesses vary from 0.95 cm to 1.11 cm. The products are manufactured in a range of dimensions (width x length), with a width ranging from 15.24 cm to 34.48 cm and a length of 366 cm. In addition, the collection comes with the most comprehensive complementary product system in the industry.

For specific properties and performance data in Maibec's CanExel siding, please consult the following link: https://maibec.com/en/resources/documentations/ .

The primary United Nations Standard Products and Services Code (UNSPSC) for these Maibec products is 30103605 and the Construction Specifications Institute (CSI) code is 07 46 26.



Figure 1: Representation of installed CanExel.

2.1.2. Product Average

The weighted average profile of each m^3 of the product is calculated based on annual 2021 production data (mass at 8% to 9% of moisture content).

2.1.3. Product-specific EPD

This EPD studies CanExel siding product manufactured by Maibec. The objective of this analysis is to carry out an LCA to produce an EPD. The manufacturing activities are performed at a single site in Nova Scotia, Canada. The data collected from the CanExel factory refers to the 2021 production year. The average weight of the installed product was calculated per m^3.

2.2. PRODUCT APPLICATION

CanExel siding is used as exterior siding in residential and non-residential buildings.

2.3. DECLARATION OF METHODOLOGICAL FRAMEWORK

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

Life cycle stages included in the analysis are production (A1, A2 and A3), construction (A4 and A5), use (B1-B7) and end-of-life (C1-C4) modules. In accordance with the PCR, the reference service life (RSL) is 75 years. The study was verified by a third party. According to UL Environment's PCR – Part A [2], if a mass flow or energy flow represents less than 1% of the cumulative mass or energy flow of the system, it may be excluded from system boundaries. No known flows are deliberately excluded from this EPD. According to PCR, part B [3] section 3.10 allocation rules, mass should be used as the primary basis for co-product allocation. OpenLCA software v1.11, an open-source software, was used

to calculate the inventory and to assess potential environmental impacts associated with the inventoried emissions. [4]

2.3.1. Technical requirements

For specific properties and performance data on Maibec's CanExel siding product, please consult the following link: https://maibec.com/en/resources/documentations/

The manufacturer provides a 25-year warranty for structural wood components and a 15-year warranty for paint components.

2.4. MARKET POSITIONING/APPLICATION RULES

Maibec's CanExel siding respects the following standards:

- ASTM A135.6-2012: Engineered wood siding.
- ASTM D1037-06a: Standard Test Methods for Evaluating Properties of Wood-Based Fiber and Particle Panel Materials.
- CAN/CGSB-11.3-M87 Hardboard Type 5: Hardboard.
- CAN/CGSB-11.5-M87 Hardboard, Precoated, Factory Finished, for Exterior Cladding.
- EN 622-2 Standard (EN 310, EN 371, EN 323, EN 1087-1: Fibreboards — Specifications.

2.5. MATERIAL COMPOSITION

The weighted average profile of each m^3 of CanExel siding is calculated based on 2021 annual production data. These represent the material inputs to manufacture 1 m^3 of CanExel siding. Table 1 presents the composition rate of 1 m^3 of the CanExel product as delivered with a moisture content of 9%.

Table 1: Material composition per 1 m^3 of CanExel siding.

Materials	CanExel
	Ratio (%)
Wood	92.29%
Adhesive	2.45%
Additive	0.98%
Wax	2.84%
Paint	0.74%
Pre-Press Sealer	0.70%

2.6. MANUFACTURING

The manufacture of CanExel siding is a multi-step process including chipping, shaking, washing chips, defibrating, mixing the material with chemicals, mat forming and pressing, humidification, sawing and shaping, finishing and packaging.

Figure 2 shows the flow diagram for CanExel siding, according to the process scope of the study and in accordance with ISO 21930 [5].

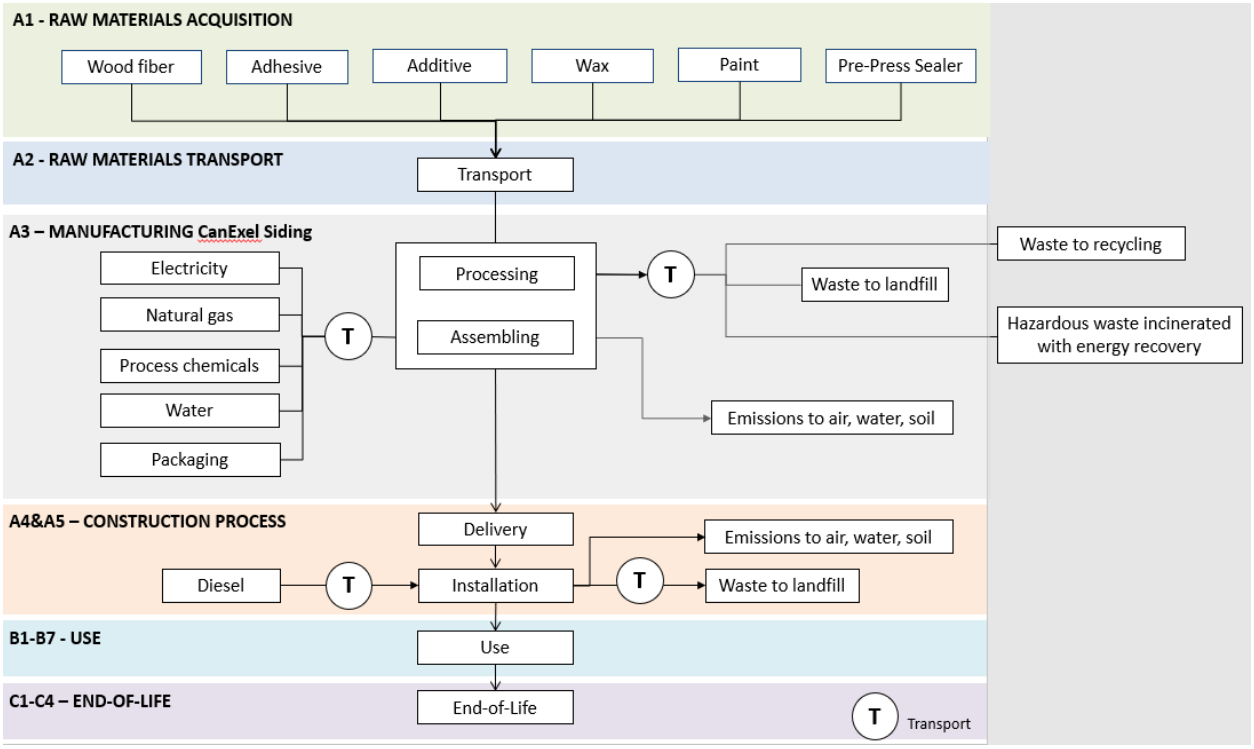


Figure 2: Flow diagram of production processes for CanExel.

2.7. PACKAGING

CanExel siding is packaged using the materials presented in Table 2.

Table 2: Amount of packaging materials used per FU of CanExel siding.

Items	Materials	Units	CanExel
Pallets	Wood	pallet	7.20E-01
Foam	Polyurethane	kg	8.44E-01
Shrink wrap	Polyester	kg	2.10E+00
Shrouds	Polyester	kg	8.23E-01
Strapping	Polyester	kg	3.58E-01
Corner protectors	Corrugated cardboard	kg	7.89E+00

2.8. TRANSPORTATION

CanExel siding is transported by truck, train and boat from the manufacturing site in Nova Scotia (Canada) to installation sites. The major market of CanExel is in North America. Less than 5% of the CanExel manufactured is installed in Europe, mainly in France. Information data for transportation is presented in Table 3.

Table 3: Distribution data

Transport Mode	Units	CanExel
Truck transport	km	1.16E+03
Boat transport	km	7.08E+03
Train transport	km	4.49E+03

2.9. PRODUCT INSTALLATION

According to the CanExel installation documents, fasteners, touch-up paints and aluminium moulding joints are used for installation. It is strongly recommended that installers refer to the Maibec CanExel installation guidelines, and that they keep comprehensive records of the website conditions and preparation information prior to installation.

The installation product loss rate is 5%. Module A5 includes:

- Installation product waste (additional production and transport processes to compensate for the loss of product waste),
- Disposal of product packaging waste and product waste generated during installation,
- Product installation, including the manufacturing and transport of ancillary materials to the installation site and direct energy use.

The electricity used during installation (module A5) is considered negligible. Drawing from table 2 of the PCR part A, waste resulting from installation of Maibec CanExel siding and packaging waste (including wood, cardboard polyurethane foam and plastic) were assumed to be 100% landfilled. Transport distance was 30 km (located at Windsor Road, in NS) and 1,265 km (located in Chambly, QC). Transportation (tkm) was calculated and included in this analysis.

2.10. USE CONDITIONS

According to the manufacturer, the product is easy to maintain (module B2—Maintenance) and corresponds to the woodboard siding industry standard. The manufacturer recommends repainting CanExel siding every 15 years. No energy is needed as paint is applied manually. In this module, the estimated service life (ESL) of the building (75 years according to UL Environment's PCR, Part B [3]) was taken into account.

For replacements of CanExel siding (module B4), the warranty provided for the structural component (HDF unpainted) is 25 years. Given this, customers must remove and reinstall new CanExel siding every 25 years. During the building's estimated service life (ESL) (75 years according to UL Environment's PCR Part B [3]) CanExel siding must be replaced two times (at 25 years and 50 years). Module B4 includes the modules A1 to A5 and the end of the life stages (modules C1 to C4) two times, as a result.

2.11. PRODUCT REFERENCE SERVICE LIFE AND BUILDING ESTIMATED SERVICE LIFE

According to UL Environment's PCR, Part A, the estimated service life (ESL) of the building is assumed to be 75 years. There is no reference service life (RSL) for CanExel siding in UL Environment's PCR [3] as CanExel siding has a 25-year warranty for structural components. During the estimated service life (ESL) of the building (75 years according to UL

Environment's PCR Part B [3]), CanExel siding must be repainted three times and replaced two times (at 25 years and 50 years).

2.12. RE-USE PHASE

No materials are re-used in the manufacturing of CanExel siding.

2.13. DISPOSAL

This LCA study assumes that CanExel siding disposal at the end of its service life follows construction, renovation and demolition (CRD) waste disposal practices commonly followed in North America. Inspired by UL Environment PCR, part A, Tables 2 and 3, it was assumed that CanExel siding and packaging materials are 100% landfilled.[2] In landfills, over a 100-year timeline to be conservative given the lack of data, it was considered that 1.5% of wood was decomposed. For packaging material (wood pallets), it was considered the same decomposition ratio based on the ecoinvent dataset for the ''treatment of waste wood, untreated, sanitary landfill | waste wood, untreated | Cutoff, U - RoW''. Other packaging materials (polyester, polyurethane and corrugated cardboard) are also 100% landfilled without decomposition over the 100-year period. Emissions of landfill gases into the atmosphere are mainly comprised of methane and carbon dioxide, assuming a ratio of 50:50. This ratio is applied in the LCA, along with the assumption that landfill gas consists of equal parts carbon dioxide and methane. Based on the same ecoinvent dataset, 62% of methane goes directly to the atmosphere and 38% is captured for energy production. It was assumed that methane combustion was complete combustion.

3. LCA CALCULATION RULES

3.1. FUNCTIONAL UNIT

The selected functional unit (FU) for this study according to UL Environment's PCR [3] is 1 m^3 of CanExel siding installed in a building over a period of 75 years (packaging included) as the estimated service life. Table 4 presents all products targeted by this report and their respective FUs.

Table 4: Functional unit of studied product.

Items	Units	CanExel Siding
Functional Unit (FU)	1 m^3 of Maibec's CanExel siding installed in a building with 75 years (packaging included) as estimated service life	
Uses	-	Exterior siding
Mass/surface (9% MC)	kg/m^3	960
Thickness to achieve the FU	mm	9.5 - 11.1
Average thickness	mm	10.3
Average overlap	%	11
Conversion factor	m^2	86.77

3.2. SYSTEM BOUNDARIES

According to UL Environment's PCR [3], the LCA modelling covers cradle-to-grave stages. Four (4) life cycle stages are therefore considered. They include Production (A1 to A3), Construction (A4 and A5), Use (B1 to B7) and End-of-Life (C1 to C4) stages. Table 5 presents the system boundaries of this study.

Table 5: Description of the system boundary life cycle stages and related information modules

PRODUCTION STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END-OF-LIFE STAGE			
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4
Extraction and Upstream Production	Transport	Manufacturing	Transport from Gate to Site	Assembly/ Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational Energy Use	Operational Water Use	Deconstruction	Transport	Waste Processing	Disposal
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Key: X = included; MND = module not declared (excluded)

Life Cycle Stages

Extraction and upstream production (module A1): This stage includes the extraction and transformation of raw materials needed to produce the products under study. Wood materials and chemicals included in the product have been taken into account in the inventory.

Raw materials transportation to the manufacturing plant (module A2): This stage includes the transportation of raw materials from suppliers to the CanExel manufacturing plant in Nova Scotia, Canada.

Manufacturing (module A3): This stage includes water and energy (electricity, natural gas, propane) consumption for manufacturing processes. Chemicals for water treatment are also included. Hazardous and non-hazardous waste treatment has been taken into account, as well. Manufacturing of packaging materials, including their transportation to the factory gate, is considered in this module.

Transport to installation site (module A4): Products are transported by truck, boat and train from the manufacturing site to installation sites in North America and Europe.

Product installation (module A5): To install CanExel siding, fasteners, aluminium joint mouldings, paint and electricity are used. Electricity consumption during installation is negligeable. In this module, the waste generated includes wood product and packaging. Hazardous and non-hazardous waste treatment has been included, as well.

Use stage (module B1 to B7): The product needs to be maintained (module B2). As recommended by the manufacturer, the siding product must be recoated every 15 years. During the estimated service life of the building, CanExel must be replaced (module B4) two times.

Transport to waste processing and/or disposal (module C2): Transport distance from the demolition site to a landfill site is considered in this module and done by truck.

Disposal of waste (module C4): In the North American context, it was assumed that CanExel siding waste is 100% landfilled.

3.3. ESTIMATION AND ASSUMPTIONS

During the service life of the building, the product does not require operational energy (B6) or water use (B7). There are no activities in the use (B1), repair (B3), refurbishment (B5) modules. Based on this information, the environmental impacts of modules B1, B3, B5, B6 and B7 are therefore considered as nil.

For the EoL stage, there is no energy consumption for the demolition module (C1) because it is generally a manual operation. In the case of C3, the waste goes directly from the building site to the landfill site with no energy consumed with respect to sorting. Module D is excluded from the system boundaries.

3.4. CUT-OFF RULES

According to the PCR, which follows ISO 21930:2017 directives, cut-off rules shall not be applied in order to hide data. Any application of the criteria for the exclusion of inputs and outputs shall be documented.

In this EPD, any material input less than 1% of the total mass of the final product, with no significant environmental impact, is not included in the scope of the study. However, material inputs greater than 1% of the total mass of the final product are included within the scope of the study. The cumulative material inputs and environmental impacts less than 5% of the total weight of the FU are excluded. No known flows are deliberately excluded from this EPD.

3.5. DATA SOURCES

Inventory data was collected from the CanExel plant located in Nova Scotia, Canada, using a life cycle inventory (LCI) questionnaire. All data collected were used in the analysis.

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. [6, 7]

When ecoinvent unit processes were not available specifically for North America or Nova Scotia, they were adapted by replacing their electricity grid by the ecoinvent process "Market for Electricity, medium or low voltage – CA NS," or by "Market group for Electricity, medium or low voltage – RNA."

3.6. DATA QUALITY

Data Quality Parameter	Data Quality Discussion
Source of manufacturing data: Description sources of data	Manufacturing data was collected from Maibec's manufacturing plant located in Nova Scotia, Canada, for the 2021 production year. This data included total production mass of products produced at the manufacturing plants, as well as the total annual units in m^3 and 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 and packaging material.
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 production takes places. Otherwise, ecoinvent data representative of the global market or "rest-of-the-world" were selected as proxies. Forest residues data and transport data were taken from the US LCI database [7], which is specific to a North American context.
Geographical representativeness	The manufacturing facility is located in Nova Scotia, Canada; hence electricity consumption is based on the hydropower grid mix. Geographical correlation of the material supply and the selected datasets are representative of each specific area or a larger area. For example, wood material comes mainly from Canada and a low percentage from the USA.
Temporal representativeness	Primary data was collected to be representative of the full 2021 year, while this is not always the case for ecoinvent and US LCI datasets. Nevertheless, ecoinvent and US LCI remain the reference LCI databases.
Technological representativeness	Primary data, obtained from the manufacturer, is 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.

3.7. PERIOD UNDER REVIEW

The period under review is the 2021 production year.

3.8. ALLOCATION

The ISO 14040 [8] allocation procedure states that whenever possible, allocation should be avoided by collecting data related to the process under study or by expanding the product system.

According to ISO 14040, step 2 consists of partitioning the inputs and outputs between the different products in a way that reflects the physical relationship between them.

In this study, no allocation was performed, because there are no co-products or multiple products resulting from the Maibec CanExel siding manufacturing process.

3.9. COMPARABILITY AND BENCHMARKING

Comparison of the environmental performance of CanExel siding using EPD information shall be based on the product's use and impacts in construction works, and therefore EPDs may not be used for comparability purposes when not considering the construction energy use phase as instructed under UL Environment's PCR, Part B for structural and architectural wood products.

Full conformance with this PCR allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same PCR, and use equivalent scenarios with respect to construction works. However, variations and deviations are possible. Example of variations: different LCA software and background LCI datasets may lead to differences in results upstream or downstream of the life cycle stages declared.

4. LIFE CYCLE ASSESSMENT SCENARIOS AND ADDITIONAL TECHNICAL INFORMATION

Table 6: Transport from gate to installation site (A4)

Name	CanExel Siding	Unit
Fuel type	Diesel	-
Litres of fuel	-	l/100 km
Vehicle type	Transport truck, boat, train	-
Weighted average transport by truck	1.01E+02	tkm
Weighted average transport by boat	3.78E+03	tkm
Weighted average transport by train	1.52E+03	tkm
Capacity utilization (including empty runs, mass-based)	-	%
Gross density of products transported	960	Kg/m^3
Capacity utilization volume factor (factor=1 or <1 or ≥1 for compressed or nested packaging products)	<1	-

Table 7: Installation (A5)

Name	CanExel Siding	Unit
Ancillary materials – aluminium	1.50E+00	kg
Ancillary materials – paint	3.28E-01	kg
Ancillary materials – fasteners	1.77E+00	kg
Net freshwater consumption	2.96E-01	m^3
Electricity consumption	-	kWh
Product loss per functional unit	5	%
Waste materials at the construction site before waste processing, generated by product installation	-	Kg
Output materials resulting from on-site waste processing (specified by route; e.g. for recycling, energy recovery and/or disposal)	48	kg
Packaging waste	7.20E+01	Kg/m^3
Biogenic carbon contained in packaging	2.64E+01	Kg C
Direct emissions to ambient air, soil and water	-	Kg
VOC emissions	NA	µg/m3

Table 8: Reference Service Life (RSL)

Name	Value	Unit
RSL	25	Year
Declared product properties (at the gate) and finishes, etc.	-	Units as appropriate
Design application parameters (if instructed by the manufacturer), including references to the appropriate practices and application codes	Installation as per manufacturer's recommendations	-
An assumed quality of work, when installed in accordance with the manufacturer's instructions	Accepted industry standard	-
Indoor environment, (if relevant for indoor applications), e.g temperature, moisture, chemical exposure	Normal building operating conditions	-
Use conditions, e.g. frequency of use, mechanical exposure	Normal building operating conditions	-
Maintenance, e.g. required frequency, type and quality of replacement components	Maintenance based on manufacturer's recommendations	-

Table 9: End-of-Life (C1-C4)

Name		CanExel Siding	Unit
Assumptions for scenario development (description of deconstruction, collection, recovery, disposal method and transportation)		The Maibec CanExel product is manually removed.	
Collection process (specified by type)	Collected separately	0.00E+00	Kg
	Collected with mixed construction waste	9.60E+02	kg
Recovery (specified by type)	Reuse	0.00E+00	kg
	Recycling	0.00E+00	kg
	Landfill	0.00E+00	kg

Name		CanExel Siding	Unit
	Incineration	0.00E+00	kg
	Incineration with energy recovery	0.00E+00	kg
	Energy conversion (specify efficiency rate)	0.00E+00	%
Disposal (specified by type)	Product or material for final deposition	9.60E+02	kg
Biogenic carbon removals (excluding packaging)		0.00E+00	Kg CO_2

5. LIFE CYCLE ASSESSMENT RESULTS

5.1. RESULTS TABLES

According to the PCR, life cycle assessment results must be presented per FU. It should be noted that LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds safety margins, or risks.

According to the PCR, the life cycle impact assessment shall be presented for the North American context. [3] LCIA results are presented in Table 10 for CanExel.

Table 10: Life Cycle Impact Assessment Results for CanExel siding

Impact Categories	Indicators	Units	Production stage			Construction stage		Use					End of life			
			A1	A2	A3	A4	A5	B1	B2	B3	B4	B5-B7	C1	C2	C3	C4
Global Warming Potential	IPCC GWP 100a(2)	kg CO2 eq.	8.02E+02	4.89E+02	7.65E+02	4.49E+02	2.15E+02	0.00E+00	5.79E+01	0.00E+00	5.93E+03	0.00E+00	0.00E+00	1.79E+02	0.00E+00	6.68E+01
Biogenic Carbon Removal from product system	BCR	kg CO2 eq.	-1.68E+03	0.00E+00	-9.22E+01	0.00E+00	-7.79E+01	0.00E+00	0.00E+00	0.00E+00	-3.70E+03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Biogenic Carbon Emissions from product system	BCE	kg CO2 eq.	0.00E+00	0.00E+00	2.02E+02	0.00E+00	1.47E+01	0.00E+00	0.00E+00	0.00E+00	4.64E+02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E+01
Ozone Depletion Potential	ODP (1)	kg CFC-11 eq.	1.78E-05	9.75E-06	5.44E-05	8.75E-06	5.80E-06	0.00E+00	4.32E-08	0.00E+00	2.01E-04	0.00E+00	0.00E+00	3.57E-06	0.00E+00	2.95E-07
Acidification Potential	AP (1)	kg SO2 eq.	6.34E+00	3.89E+00	4.18E+00	4.42E+00	1.54E+00	0.00E+00	3.37E-01	0.00E+00	4.37E+01	0.00E+00	0.00E+00	1.40E+00	0.00E+00	9.03E-02
Eutrophication Potential	EP (1)	kg N eq.	9.14E-01	5.23E-01	2.36E+00	4.96E-01	9.22E-01	0.00E+00	3.25E-02	0.00E+00	2.47E+01	0.00E+00	0.00E+00	1.90E-01	0.00E+00	6.94E+00
Smog Formation Potential	SFP (1)	kg O3 eq.	1.06E+02	7.90E+01	4.03E+01	9.35E+01	2.52E+01	0.00E+00	5.59E+00	0.00E+00	7.48E+02	0.00E+00	0.00E+00	2.82E+01	0.00E+00	1.91E+00
Abiotic Resource Depletion Potential of Non-renewable (fossil) energy resources (ADPfossil)	ADPfossil (1)	MJ surplus	8.44E+03	5.58E+03	5.55E+02	4.71E+03	1.46E+03	0.00E+00	1.19E+02	0.00E+00	4.57E+04	0.00E+00	0.00E+00	2.05E+03	0.00E+00	2.80E+01

(1): Calculated as per U.S EPA TRACI 2.1 with OpenLCA v 1.11 software

(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).

Note: A negative represents biogenic carbon removed from the atmosphere.

According to the PCR, the life cycle inventory (LCI) shall be presented for resources used and output flows and waste categories. [3] 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 in Table 11 for CanExel.

Table 11: Life Cycle Inventory Results for CanExel siding.

Resource use																
Parameters	Units	Production stage			Construction stage		Use						End of life			
		A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6-B7	C1	C2	C3	C4
RPR_E (3)	MJ, LHV	1.46E+03	N/A	N/A	N/A	1.20E+02	N/A	5.27E-01	0.00E+00	3.15E+03	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A
RPR_M (4)*	MJ, LHV	1.25E+04	N/A	N/A	N/A	6.69E+02	N/A	0.00E+00	0.00E+00	2.64E+04	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A
$NRPR_E$ (5)	MJ, LHV	5.88E+04	N/A	N/A	N/A	1.08E+04	N/A	3.88E+02	0.00E+00	1.39E+05	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A
$NRPR_M$ (6)*	MJ, LHV	1.98E+03	N/A	N/A	N/A	1.04E+02	N/A	5.26E+02	0.00E+00	4.16E+03	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A
SM (7)	kg	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
RSF (8)	MJ, LHV	N/A	N/A	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
NRSF (9)	MJ, LHV	N/A	N/A	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
RE (10)	MJ, LHV	N/A	N/A	5.09E-01	N/A	0.00E+00	N/A	0.00E+00	0.00E+00	1.02E+00	0.00E+00	N/A	N/A	N/A	N/A	N/A
FW (11)	m^3	0.00E+00	N/A	5.93E+00	N/A	2.96E-01	N/A	0.00E+00	0.00E+00	1.25E+01	0.00E+00	N/A	N/A	N/A	N/A	N/A
Output Flows and Waste																
HWD (12)	kg	N/A	N/A	2.99E-02	N/A	1.50E-03	N/A	0.00E+00	0.00E+00	6.29E-02	0.00E+00	N/A	N/A	N/A	N/A	0.00E+00
NHWD (13)	kg	N/A	N/A	4.68E+02	N/A	2.34E+01	N/A	0.00E+00	0.00E+00	9.83E+02	0.00E+00	N/A	N/A	N/A	N/A	0.00E+00
HLRW (14)	m^3	9.26E-07	2.07E-06	7.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.50E-07	0.00E+00	0.00E+00	0.00E+00	2.50E-09	0.00E+00	4.32E-09
ILLRW (15)	m^3	1.10E-06	2.95E-06	1.85E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.17E-07	0.00E+00	0.00E+00	0.00E+00	1.46E-08	0.00E+00	2.36E-08
CRU (16)	kg	N/A	N/A	N/A	N/A	N/A	N/A	0.00E+00	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	N/A
MR (16)	kg	N/A	N/A	4.61E+02	N/A	2.31E+01	N/A	0.00E+00	0.00E+00	9.69E+02	0.00E+00	N/A	0.00E+00	N/A	0.00E+00	0.00E+00
MER (16)	kg	N/A	N/A	2.99E-02	N/A	1.50E-03	N/A	0.00E+00	0.00E+00	3.14E-02	0.00E+00	N/A	N/A	N/A	0.00E+00	N/A
EE (16)	MJ, LHV	N/A	N/A	0.00E+00	0.00E+00	0.00E+00	N/A	0.00E+00	0.00E+00	0.00E+00	0.00E+00	N/A	N/A	N/A	0.00E+00	0.00E+00

*In the calculation of RPRM and NRPRM, packaging materials were included.

(3): RPRE = RPRT – RPRM, where RPRT is equal to the value for renewable energy obtained using the CED LHV.

(4): RPRM is calculated by multiplying the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of the input as per ACLCA ISO 21930 Guidance [9]. In the calculation of RPRM, packaging materials were excluded.

(5): NRPRE = NRPRT – NRPRM, where NRPRT is equal to the value for non-renewable energy obtained using the CED LHV methodology (both non-renewable energy fossil fuel and nuclear energy).

(6): NRPRM is calculated by multiplying the mass (kg) of the material input (or its components) by the net calorific value (lower heating value) (MJ/kg) of the input as per ACLCA ISO 21930 Guidance [9]. In the calculation of NRPRM, packaging materials were excluded.

(7): Calculated as per ACLCA ISO 21930 Guidance [9], 6.5 Secondary material, SM: There is no SM involved in Maibec's CanExel siding.

(8): Calculated as per ACLCA ISO 21930 Guidance [9], 6.6 Renewable secondary fuels, RSF: There is no RSF involved in the Maibec's CanExel siding manufacturing process.

(9): Calculated as per ACLCA ISO 21930 Guidance [9], 6.7 Non-renewable secondary fuels, NRSF: There is no NRSF involved in the Maibec's CanExel siding manufacturing process.

(10): Calculated as per ACLCA ISO 21930 Guidance [9], 6.8.1 Recovery Energy, RE was reported.
(11): Represents the net use of fresh water at the manufacturing site.
(12): Calculated from life cycle inventory results, based on datasets marked as “hazardous.”
(13): Calculated from life cycle inventory results, based on “non-hazardous” waste.
(14): Calculated as per ACLCA ISO 21930 Guidance [9], 10.3 High-level radioactive waste, conditioned, to final repository. It should be noted that Maibec’s CanExel siding 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)
(15): Calculated as per ACLCA ISO 21930 Guidance [9], 10.4 Intermediate- and low-level radioactive waste, conditioned, to final repository. It should be noted that Maibec’s CanExel siding 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)
(16): Reused components (CRU) and exported energy (EE) are not applicable for this project. Materials for recycling (MR), materials for energy recovery (MER) are reported.

Table 12: Biogenic carbon accounting result for a FU

Parameters	Units	CanExel
BCRP	kg CO2 eq	-5.26E+03
BCEP	kg CO2 eq	6.84E+02
BCRK	kg CO2 eq	-2.90E+02
BCEK	kg CO2 eq	1.16E+01

BCRP - Biogenic carbon removal from product; BCEP - Biogenic carbon emission from product; BCRK - Biogenic carbon removal from packaging; BCEK - Biogenic carbon emission from packaging.

6. LCA: INTERPRETATION

6.1. CONTRIBUTION ANALYSIS

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 the product studied.

The contribution analysis of the CanExel per life cycle stage (Figure **3**) indicates that the major contributing stage is the use stage (modules B1 to B7) due to the impacts of module B4 (replacement). The impacts of the replacement modules are two (2) times the impacts of the production stage, construction stage and the end-of-life stages because CanExel siding is replaced two (2) times during the estimated service life of the building. Its impact represents 67% of the total impact of the CanExel for all life cycle stages. The second contributor is the production stage with impacts between 10% and 27%. The construction and end-of-life stages represent between 4% and 11% and 1% and 19%, respectively, of the total impacts. Figure **4** presents the impacts per module. Regarding the production stage, the extraction and upstream production module (A1) is a major contributor for all impact categories except for Eutrophication Potential and Ozone Depletion Potential where the major contributors are modules C4 and A3, respectively. In module A3, the electricity mix for Nova Scotia and plastic used for packaging are the major contributors.

Breaking down the extraction and upstream production module (A1), Figure 5 indicates that the production of adhesive is the major contributor with impacts between 75% and 92% of the total impacts of this module and for all indicators.

When including biogenic carbon in the calculation, the environmental impacts of CanExel for the Global Warming Potential impact category decreases.

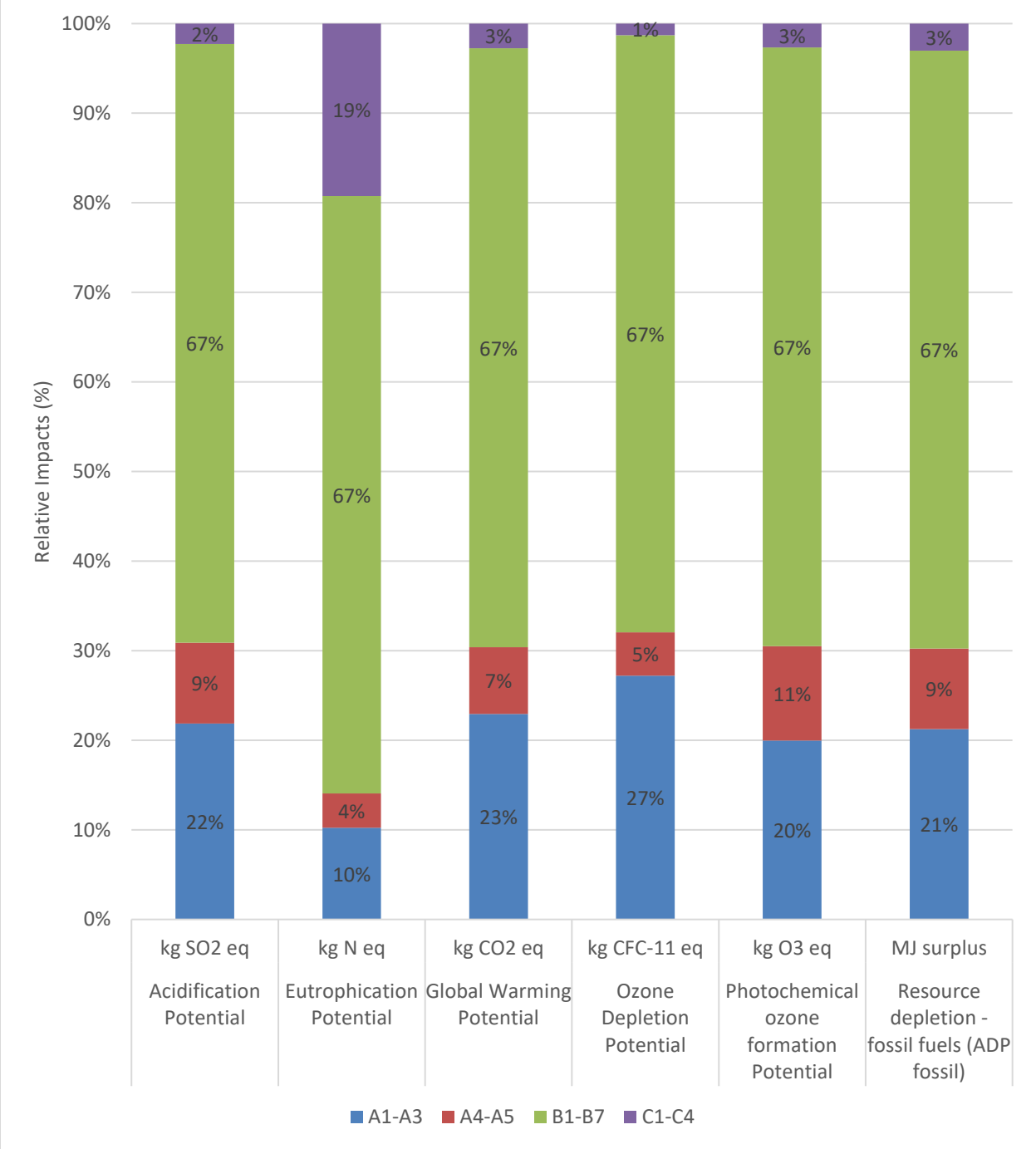


Figure 3: Contribution of each life cycle stage for CanExel.



Figure 4: Contribution of each life cycle module for CanExel.

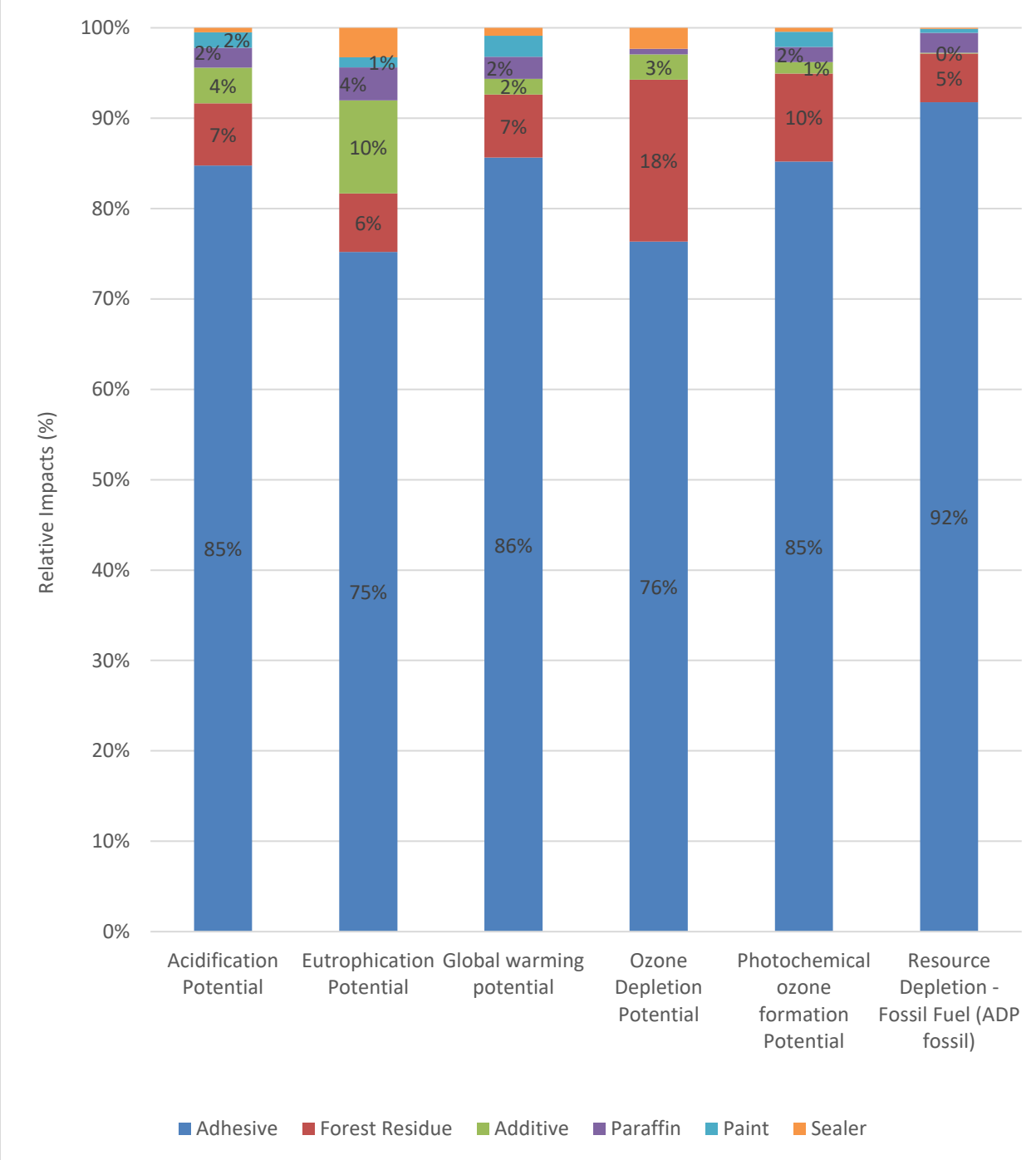


Figure 5: Contribution analysis of materials in module A1 for CanExel.

7. ADDITIONAL ENVIRONMENTAL INFORMATION

7.1. ENVIRONMENTAL ACTIVITIES AND CERTIFICATION

In addition, Maibec has a Health Product Declaration (HPD) for CanExel siding.

7.2. ENVIRONMENT AND HEALTH DURING INSTALLATION

The manufacturer's installation instructions should be followed. During installation, wearing personal protective equipment is recommended.

7.3. EXTRAORDINARY EFFECTS

No extraordinary effects are to be reported.

8. REFERENCES

[1] ISO 14025, "Environmental labels and declarations - Type III environmental declarations - Principles and procedures.," 2006.

[2] UL Environment, "Product Category Rules for Building-Related Products and Services in: Part A: Life Cycle Assessment Calculation Rules and Report Requirements.," version 4.0, 2022.

[3] UL Environment, "Product Category Rules for Building-Related Products and Services. Part B: Structural and Architectural Wood Products EPD Requirements. UL 10010-09.," versioin 1.0, 2019.

[4] GreenDelta, "About openLCA. http://www.openlca.org/the-idea/," 2000. [Online] [Accessed 2021-02-15].

[5] ISO 21930:2017 (E), "Sustainability in buildings and civil engineering works — Core rules for environmental product declarations of construction products and services," 2017.

[6] Frischknecht R, "Overview and Methodology. ecoinvent report No. 1.," Swiss Centre for Life Cycle Inventories, Dübendorf, (2007)."

[7] U.S. Life Cycle Inventory Database, " "https://www.lcacommons.gov/nrel/search," National Renewable Energy Laboratory (2012) [Online] [Accessed 10 10 2021].

[8] ISO 14040, "Environmental management - Life cycle assessment - Principles and framework," 20 pp (2006).

[9] American Center for Life Cycle Assessment (ACLCA), "ACLCA Guidance to Calculating Non-LCIA Inventory metrics in Accordance with ISO 21930;2017," American Center for Life Cycle Assessment, 2019.



EPD

This LCA and EPD were prepared by Vertima Inc.

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