CIMA CIMAC

Industry-wide Type III EPD

Conventional Loose-Fill Cellulose Insulation

Cellulose insulation is a natural thermal/acoustical insulation material produced from recovered paper fibers in highly efficient electrically driven mills. Recycled newsprint and cardboard are the principal ingredients, but other paper fibers can be, and often are, used.

Due to its inherent recovered content and high thermal efficiency cellulose insulation is often called 'The Greenest of the Green.'

NAHB New American Home, Las Vegas. Exterior and interior walls insulated with cellulose for thermal efficiency, sound transmission control and fire safety.

Participating manufacturers:

- Advanced Fiber Technology
- Applegate Insulation
- Can-Cell Industries
- Cell-Pak
- Cleanfiber
- Climatizer
- Fiberlite
- Igloo Cellulose
- International Cellulose Corporation
- Mason City Recycling Center
- Nu-Wool
- Soprema
- Thermo-Kool

Performance dashboard

Features & functionality

An insulation upgrade in the walls, ceilings, and attics of new homes.

A preferred material for installation in walls and attics of existing homes.

Totally fills building assembly cavities, creating a tight, energy-efficient building envelope.

Creates more fire-resistant walls and attics.

A time-proven product with nearly a century of demonstrated durability and thermal performance.

Sequesters carbon for the life of the building – and beyond.

Visit CIMA for more product specifications

Environment & materials

Improved by:

85%, or more, recovered content – most of it post-consumer.

Much material used in cellulose insulation is locally-sourced recovered paper and cardboard

Low or zero VOC emissions

Certifications, rating systems & disclosures:

ASTM Standard C739

Consumer Products Safety Commission Interim Safety Standard 16 CFR Part 1209

Canada Consumer Product Safety Act 16-2-B Part 1404

CAN/ULC S703

CSI MasterFormat® 07 21 23
Cellulose Insulation General Specifications
For spec help, contact us or call 888-881-2462

See LCA, interpretation & rating systems

SM Transparency Report™

VERIFICATION	LCA
3rd party reviewed	✔ NSF
	Transparency Report (EPD)
3rd party verified	✔ NSF

Validity: 2019/12/23– 2024/12/23
CIM – 20191223 – 001

This environmental product declaration (EPD) was independently verified by NSF to the UL PCR.

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Ann Arbor, MI 48105, USA
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734 769 8010

SUMMARY

Reference PCR
UL Building Envelope Thermal Insulation, 04/18 – 02/23

Regions; system boundaries
North America; Cradle to grave

Functional unit / reference service life:
1 m^2 of installed insulation w/packaging; thickness that gives an avg thermal resistance of RSI = 1 $m^2 \cdot K/W$ over 75 years.

LCIA methodology: TRACI 2.1

LCA software; LCI database
SimaPro Analyst 8.5.2.0
EcoInvent 3.1, 2.2

LCA conducted by: Sustainable Minds

Public LCA:
CIMA Loose-Fill Cellulose Insulation Products

Cellulose Insulation Manufacturers Association
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Contact us

LCA results & interpretation

Conventional Loose-Fill Cellulose Insulation

Life cycle assessment

Scope and summary

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

Application

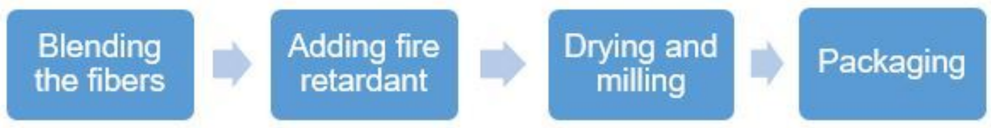
Conventional loose-fill cellulose insulation is made from any cellular plant source although it typically comes from waste paper products. It is installed by using an insulation blowing machine. Conventional loose-fill cellulose insulation is typically applied to enclosed areas, unfinished attic floors, and other hard to reach places.

Functional unit

Reference service life: 75 years. One square meter of installed insulation material, packaging included, with a thickness that gives an average thermal resistance of RSI=1m2·K/W over a period of 75 years. ASTM C518 was used to determine R-value.
Reference flow range: 0.6697-6.2748 kg
Thickness range: .038-.043 m
Density range: 20.27-28.35 kg/m3

Manufacturing data

Reporting period: January--December, 2018
Representing 13 locations across the United States and Canada (Ohio, Arizona, Colorado, Kentucky, Georgia, Louisiana, Wisconsin, Pennsylvania, Alabama, New York, Alaska, Missouri, Texas, Iowa, Michigan, Alberta, Quebec, Ontario) Conventional loose-fill cellulose insulation is produced in several manufacturing steps that involve the blending of fibers, adding the fire retardant in liquid form to the fibers, and then drying and milling the fibers before placing them into bags.



All submitted data were checked for quality multiple times on the plausibility of inputs and outputs. All questions regarding data were resolved with CIMA manufacturers.

Default installation, packaging, and disposal scenarios

At the installation site, insulation products are unpackaged and installed with a blowing machine. The potential impact of the blower is included in this study. Plastic packaging waste is disposed (100% to landfill), and no maintenance or replacement is required to achieve the product's life span. After removal, the insulation is assumed to be landfilled.

Uncertainty analysis of industry-wide results

An uncertainty analysis is done to measure how the LCA results of each product differ due to the differences in the data inputs and determine if each product falls within the industry average mean. A Monte Carlo uncertainty analysis was done in SimaPro for each participant. The results were converted from yearly outputs to the functional unit and averaged for all the companies, which provides the uncertainty range for the impact categories used for comparison. The average is representative of data from all 13 manufacturers. This range is the confidence interval. A 95% confidence level demonstrates the confidence that the results are representative of all cellulose insulation manufacturers, based on this sample.

This industry-wide EPD serves as a product group benchmark to which product-specific results can be compared. Three impact categories are used for comparison. The PCR requires global warming and the other two were selected because they had the lowest variability (see table to the left). When a manufacturer compares its product-specific results, if the environmental impact is **within the range**, it is determined to be **equivalent** to the industry impact; **below** the range, **lower** impact; **above** the range, **higher** impact.

The Embodied Carbon in Construction Calculator (EC3) from the Carbon Leadership Forum and industry partners is designed to enable the building industry to transparently measure, compare, and reduce embodied carbon emissions from construction materials. The EC3 methodology uses the median, the average lower limit (2.50%) and average upper limit (97.5%) values of the interval to establish the 20 – 80th percentiles.

What's causing the greatest impacts

All life cycle stages

For the loose-fill cellulose insulation product, the raw materials acquisition, transportation to the manufacturing site, and manufacturing stages (A1-A3) dominate the results for all impact categories. This study assessed a multitude of inventory and environmental indicators. The overall results are consistent with expectations for insulation products' life cycles, as these products are not associated with energy consumption during their use stage. LCIA results are relative expressions and do not predict impacts on category endpoints, the exceeding of thresholds, safety margins or risks. These six 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. For an average EPD for a declared unit of R-value of a specific type of insulation material, the representativeness of the average EPD could be described by relevant technical properties such as the range of density, thermal conductivity and thickness for which the average EPD is representative.

The primary finding, across the environmental indicators, was that raw material acquisition, transportation to manufacturing facility, and the manufacturing stages (A1-A3) dominate the impacts due mainly to the raw materials. Chemicals such as boric acid and ammonium, used as fire retardants, have a lower ecotoxicity. Transportation (A1) of raw materials to manufacturing contribute mainly to fossil fuel depletion and global warming due to emissions of trucks and trailers. Transportation of the final products to distribution facilities (A4) is the second highest contributor for these impact categories.

Installation accounts for a small fraction of overall life cycle impact. The only installation impacts are associated with packaging disposal and the gas and electricity used for an installation blower machine. There is no impact associated with the use stage. While insulation can influence building energy performance, this aspect is assumed to be outside the scope of this study. Additionally, it is assumed that insulation does not require any maintenance to achieve its reference service life, which is modeled as being equal to that of the building. No replacements are necessary; therefore, results represent the production of one square meter of insulation at a thickness defined by the functional unit.

At the end of life, insulation is removed from the building and land-filled. For all products, waste was dominated by the final disposal of the product. Non-hazardous waste also accounts for waste generated during manufacturing and installation. Non-hazardous waste is associated with product end-of-life when it is disposed to a landfill so no reporting of this done for A3. No substances required to be reported as hazardous are associated with the production of this product.

The results show that the largest area for reduction of each product's environmental impact is in the raw material acquisition and manufacturing phase. This can be done by turning of certain machines when they are not in use and recycling dust emissions back into their product to reduce manufacturing impacts.

Raw materials acquisition stage

The impact of the raw material acquisition stage is mostly due to chemicals such as boric acid and ammonium sulfate. This is because of the high material weights used in manufacturing.

Multi-product weighted average

For an average EPD for a declared unit of R-value of a specific type of insulation material, the representativeness of the average EPD could be described by relevant technical properties such as the range of density, thermal conductivity and thickness for which the average EPD is representative.Results represent the weighted average using production volumes for the products covered. Variations of specific products in grid mix, manufacturing techniques, raw material composition, and different supply chains account for differences of 10–20% against the average are indicated in purple; differences greater than 20% are indicated in red. A difference greater than 10% is considered significant.

percentiles.

Global warming potential (kg CO2 eq)
6.39E-01 avg 2.50 | **7.04E-01** avg median | **7.85E-01** avg 97.5%

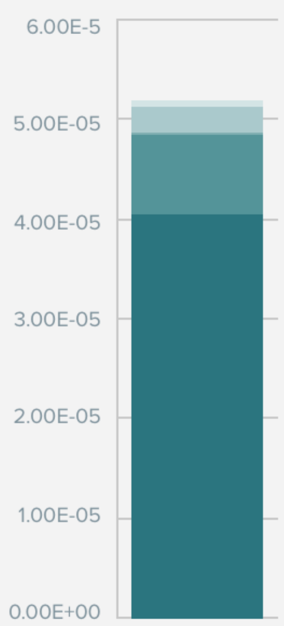
Uncertainty analysis results for three impact categories

IMPACT CATEGORIES	AVERAGE MEAN	95% CONFIDENCE INTERVAL
Global warming, kg CO_2 eq	7.04E-01	6.39E-01 – 7.85E-01
Acidification, kg SO2 eq	4.43E-03	3.71E-03 – 5.40E-03
Smog, kg O3 eq	5.24E-02	4.32E-02 – 6.58E-02

Material composition greater than 1% by weight

FLOW	MASS PERCENTAGE
Boric acid	5%
Amonium Sulfate	4%
Wastepaper/ paper fiber/ newspaper/ newsprint/cellulose fibers (loose and baled)/ mixed recycled papers	81%
Cardboard	2%
Fiber residuals	3%
Water	2%

Total impacts by life cycle stages [mPts/func unit]



LIFE CYCLE STAGE	MPTS/FUNC UNIT
Raw Material Acquisition and Manufacturing	4.03E-05
Transportation	8.49E-06
Installation and Maintenance	1.83E-07
Transportation	2.48E-06
Disposal	7.39E-07

How we're making it greener

Cellulose insulation has very low embodied carbon due to the use of recycled raw material content, low embodied energy during manufacturing, and sequesters carbon.

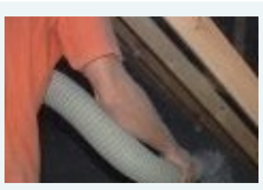
It is an inherently recycled product with 85%, or more, recovered content, most of which is post-consumer. A medium size cellulose insulation plant will convert three to five truckloads, or more, of recovered paper to energy-saving insulation each production shift.

The energy used to make cellulose insulation is referred to as embodied energy. It includes the energy required to transport raw materials, manufacture and distribute the product. Using mostly locally sourced materials manufactured in electrically-driven mills, which can be shut down between production runs and do not need to run 24x7, cellulose insulation is an extremely energy efficient product to produce.

Since the primary feedstock -- recovered paper fibers -- is derived from trees, cellulose insulation sequesters carbon in the walls and ceilings of homes for the life of the building.

See how we make it greener

LCA results

LIFE CYCLE STAGE	RAW MATERIAL ACQUISITION AND MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	TRANSPORTATION	DISPOSAL/REUSE/ RECYCLING
Information modules: Included | Stages C1, C3, and D are excluded.	**A1 Raw Materials**	**A4 Transporation/ Delivery**	**A5 Construction/ Installation**	**C2 Transportation**	**C4 Disposal**
In the installation and maintenance phase, packaging waste and electricity or gas used by the insulation blowing machines in module A5 are the only contributors to the potential impacts.	**A2 Transportation**		**B1 Use**		
	A3 Manufacturing		**B2 Maintenance**		
			B3 Repair		
			B4 Replacement		
			B5 Refurbishment		
			B6 Operational energy use		
			B7 Operational water use		
					

SM 2013

Learn about SM Single Score results

Impacts per 75 years of service	4.03E-05 mPts	8.49E-06 mPts	1.83E-07 mPts	2.48E-06 mPts	7.39E-07 mPts
Materials or processes contributing >20% to total impacts in each life cycle stage	Boric acid and ammonium sulfate used in the production of the insulation.	Truck and trailor, rail, and ship transportation used to transport product to manufacturing site.	Transportation to disposal, energy required for installation with a blowing machine, and disposing of packaging materials.	Transportation to landfill.	Landfilling of product.

TRACI v2.1 results per functional unit

A variation of 10 to 20% | A variation greater than 20%

Ecological damage

Impact category	Unit	RAW MATERIAL ACQUISITION AND MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	TRANSPORTATION	DISPOSAL/REUSE/ RECYCLING
Acidification	kg SO_2 eq	3.26E-03	3.36E-04	1.89E-05	9.80E-05	6.72E-05
Eutrophication	kg N eq	4.22E-04	4.79E-05	1.21E-06	1.40E-05	7.75E-06
Global warming (Embodied carbon)	kg CO_2 eq	4.87E-01	8.99E-02	1.70E-03	2.62E-02	8.47E-03
Ozone depletion	kg CFC-11 eq	7.20E-08	2.17E-08	7.97E-11	6.34E-09	3.06E-09

Human health damage

Impact category	Unit	RAW MATERIAL ACQUISITION AND MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	TRANSPORTATION	DISPOSAL/REUSE/ RECYCLING
Carcinogenics	CTU_h	6.46E-09	6.56E-10	2.49E-11	1.94E10	8.06E-11
Non-carcinogenics	CTU_h	8.25E-08	1.93E-08	2.56E-10	5.64E-09	8.13E-10
Smog	kg O_3 eq	3.37E-02	6.83E-03	5.67E-04	1.99E-03	1.61E-03

Additional environmental information

Impact category	Unit	RAW MATERIAL ACQUISITION AND MANUFACTURING	TRANSPORTATION	INSTALLATION AND MAINTENANCE	TRANSPORTATION	DISPOSAL/REUSE/ RECYCLING
Respiratory effects	kg $PM_{2.5}$ eq	3.91E-04	6.09E-05	4.89E-07	1.78E-05	8.23E-06
Ecotoxicity	CTU_e	8.95E-01	4.50E-01	8.77E-03	1.61E-01	1.73E-02
Fossil fuel depletion	MJ, LHV	7.99E-01	1.83E-01	3.88E-03	5.33E-02	2.65E-02

References

LCA Background Report
CIMA and CIMAC Loose-Fill Cellulose Insulation Products LCA Background Report (public version), CIMA and CIMAC 2019. SimaPro Analyst 8.5.2.0, ecoinvent 3.1, 2.2 database.

PCRs

ISO 21930:2017 serves as the core PCR along with EN 15804 and UL Part A.

ULE PCR Part A: Life Cycle Assessment Calculation Rules and Report Requirements v3.1
May 2, 2018. Technical Advisory Panel members reviewed and provided feedback on content written by UL Environment and USGBC. Past and present members of the Technical Advisory Panel are listed in the PCR.

ULE PCR Part B: Building Envelope Thermal Insulation
Version 2.0, April 2018. PCR review conducted by Thomas Gloria, PhD (chair, t.gloria@industrial-ecology.com); Andre Desjarlais; and Christoph Koffler, PhD.

ISO 14025, "Sustainability in buildings and civil engineering works -- Core rules for environmental product declarations of construction products and services", ISO21930:2017

SM Transparency Reports (TR) are ISO 14025 Type III environmental declarations (EPD) that enable purchasers and users to compare the potential environmental performance of products on a life cycle basis. They are designed to present information transparently to make the limitations of comparability more understandable. A limitation to this study is that not all manufacturers in North America participated. TRs/EPDs of products that conform to the same PCR and include the same life cycle stages, but are made by different manufacturers, may not sufficiently align to support direct comparisons. They therefore, cannot be used as comparative assertions unless the conditions defined in ISO 14025 Section 6.7.2. 'Requirements for Comparability' are satisfied. Comparison of the environmental performance of building envelope thermal insulation using EPD information shall be based on the product's use and impacts at the building level, and therefore EPDs may not be used for comparability purposes when not considering the building energy use phase as instructed under the PCR. Full conformance with the PCR for building envelope thermal insulation allows EPD comparability only when all stages of a life cycle have been considered, when they comply with all referenced standards, use the same sub-category 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 data sets may lead to different results upstream or downstream of the life cycle stages declared.

Rating systems

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

LEED BD+C: New Construction | v4 - LEED v4
Building product disclosure and optimization
Environmental product declarations
Note: Compliance with model building codes does not always ensure compliance with state or local building codes, which may be amended versions of these model codes. Always check with local building code officials to confirm compliance

- ✔ Industry-wide (generic) EPD — ½ product
- ○ Product-specific Type III EPD — 1 product

LEED BD+C: New Construction | v4.1 - LEED v4.1
Building product disclosure and optimization
Environmental product declarations

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Green Globes for New Construction and Sustainable Interiors
Materials and resources

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

Collaborative for High Performance Schools National Criteria
MW 7.1 – Environmental Product Declarations

- ✔ Third-party certified type III EPD — 2 points

BREEAM New Construction 2018
Mat 02 - Environmental impacts from construction products
Environmental Product Declarations (EPD)

- ✔ Industry average EPD — .5 points
- ○ Multi-product specific EPD — .75 points
- ○ Product specific EPD — 1 point

SM Transparency Report™

VERIFICATION LCA
3rd party reviewed ✔ NSF
Transparency Report (EPD)
3rd party verified ✔ NSF

Validity: 2020/12/01 – 2024/12/23
CIM – 20191223 – 001

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How we make it greener

Conventional Loose-Fill Cellulose Insulation

Collapse all

See LCA results by life cycle stage

RAW MATERIAL ACQUISITION

Utilize recycled content

Cellulose insulation is an inherently recycled product with 85%, or more, recovered content, most of which is postconsumer. A medium size cellulose insulation plant will convert three to five truckloads, or more, of recovered paper to energy-saving insulation each production shift. Since the primary feedstock -- recovered paper fibers -- is derived from trees cellulose insulation sequesters carbon in the walls and ceilings of homes for the life of the building.

Many cellulose insulation manufacturers have their own recycling programs and "paper drives" to collect paper and cardboard and use local community recycling programs as material sources. Here are hundreds of tons of waste paper that will not be landfilled , incinerated, or deinked using toxic chemicals. Instead, it, and its embodied carbon, will be sequestered in the walls and ceilings of homes, making them more energy-efficient.

TRANSPORATION

Compression packaging and regional production

Recovered paper goes from potentially problematic trash to energy-saving insulation ready for shipment in just a few minutes in cellulose insulation plants.

Cellulose insulation is compressively packaged to 10x, or more, nominal settled density for maximum transportation efficiency. The compressive packaging allows for fewer deliveries and more cellulose insulation on the transportation vehicle compared to other types of insulation.

MANUFACTURING

Low-energy manufacturing

Cellulose insulation manufacturing is a low-energy process, resulting in material with the least embodied energy of any of the commonly-used insulation products. The production process generates no waste, other than dust, which is confined within the production system and filtered out of air discharged to the environment. Fire retardants used in cellulose insulation are considered to be of low or no toxicity. Improvements in fire retardant processing and infusion technology have resulted in historically low fire retardant content with no loss of fire safety.

Several manufacturers recycle their dust back into the product. These companies produce no on-site air or solid waste pollution in the manufacturing process.

INSTALLATION AND USE

Be confident in cellulose insulation safety

Cellulose insulation is often installed in interior walls to make homes quieter and more fire safe.

Non-irritating cellulose insulation requires no special protective clothing during installation. Many cellulose insulation products have been tested for VOC emission and have been found to be low VOC sources.

Low carbon footprint homes

Cellulose insulation has been a preferred material for reinsulating walls in older homes. In many cases cellulose can be added to walls with existing, but inadequate, insulation.

CIMA encourages a revolutionary new concept for creating energy efficient homes that offer the best solution to minimize energy consumption, reduce the amount of paper going to landfills and limit carbon emissions associated with construction and housing— Building lower carbon footprint homes.

New research on the use of wood-intensive construction and cellulose insulation products in homes shows it is actually possible to lower the carbon footprint of houses, so they become "carbon sinks" capable of sequestering carbon for the life of the dwelling. The carbon rich wood and cellulose wood fiber stays in the home for years effectively trapping the carbon from escaping into the environment.

Utilizing wood products and cellulose insulation with naturally high amounts of carbon in home building is a simple and highly effective method of lowering the carbon footprint of homes to sequester carbon. The role wood can play in mitigating climate change was specifically recognized as early as 2003 in the European Commission's 6th Environment Action Programme.

Additional EPD content required by: ULE PCR Parts A and B for Building Envelope Thermal Insulation

Conventional Loose-Fill Cellulose Insulation

Data

Background This industry average declaration was created by collecting product data over the course of a year for each product at each location the product was manufactured. For products with multiple manufacturing locations, data are a weighted average by production volume at each location. The reference service life applies for the reference in-use conditions only.

Allocation the allocation methods used were re-examined according to the updated allocation rules in ISO 21930:2017 and we were determined to be in conformance; no updates to allocation methods were made.

Cut-off criteria For the inclusion of mass and energy flows are 1% of renewable primary resource (energy), 1% nonrenewable primary resource (energy) usage, 1% of the total mass input of that unit process, and 1% of environmental impacts. The total of neglected input flows per module does not exceed 5% of energy usage, mass, and environmental impacts. The only exception to these criteria is substances with hazardous and toxic properties, which must be listed even when the given process unit is under the cut-off criterion of 1% of the total mass. No known flows are deliberately excluded from this declaration. Any biogenic carbon is assumed to be sequestered in landfill.

Scenarios and additional technical information

PARAMETER	VALUE	UNIT
Transport to the building site [A4]		
Vehicle type	20T Truck	
Range of distance from manufacturer to installation site	126-966	km
Fuel Type	Diesel (250)	Liters
Weight	19,215,345	kg
Installation into the building [A5]		
Distance from installation site to disposal	161	km
Mass of paper packaging waste to disposal	9.93E-05-1.85E+00	kg
GWP based in biogenic carbon content of plastic packaging	0	kg CO_2e
Electricity Consumption	406.1	kWh
Other energy carriers	111972.61	kg
Disposal/reuse/recycling [C1-C4]		
Distance from installation site to disposal	161	km
Mass of product waste to disposal	0.67-6.27	kg

LCIA results, resource use, output and waste flows, and carbon emissions and removals for Conventional Loose-fill Cellulose Insulation per functional unit

Parameter	Unit	A1-A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	Total
LCIA results																
Acidification	kg SO2eq	3.26E-03	3.36E-04	1.89E-05	0	0	0	0	0	0	0	0	9.80E-05	0	6.72E-05	**3.78E-03**
Eutrophication	Kg N eq	4.22E-04	4.79E-05	1.21E-06	0	0	0	0	0	0	0	0	1.40E-05	0	7.75E-06	**4.93E-04**
Global warming	kg CO_2 eq	4.87E-01	8.99E-02	1.70E-03	0	0	0	0	0	0	0	0	2.62E-02	0	8.47E-03	**6.13E-01**
Ozone depletion	kg CFC-11	7.20E-08	2.17E-08	7.97E-11	0	0	0	0	0	0	0	0	6.34E-09	0	3.06E-09	**1.03E-07**
Smog	kg O_3 eq	3.37E-02	6.83E-03	5.67E-04	0	0	0	0	0	0	0	0	1.99E-03	0	1.61E-03	**4.47E-02**
Fossil fuel depletion	MJ, LHV	7.99E-01	1.83E-01	3.88E-03	0	0	0	0	0	0	0	0	5.33E-02	0	2.65E-02	**1.07E00**
Carcinogenics	CTUh	6.46E-09	6.56E-10	2.49E-11	0	0	0	0	0	0	0	0	1.91E-10	0	8.06E-11	**7.41E-09**
Resource use indicators																
Renewable primary energy used as energy carrier (fuel)	MJ, LHV	5.36E-01	8.92E-03	5.75E-05	0	0	0	0	0	0	0	0	2.60E-03	0	1.43E-03	**5.49E-01**
Renewable primary resources with energy content used as material	MJ, LHV	7.98E-01	0	8.53E-05	0	0	0	0	0	0	0	0	0	0	0	**7.98E-01**
Total use of renewable primary resources with energy content	MJ, LHV	1.33E00	8.92E-03	1.43E-04	0	0	0	0	0	0	0	0	2.60E-03	0	1.43E-03	**1.35E00**
Non-renewable primary resources used as an energy carrier (fuel)	MJ, LHV	2.19E01	1.44E00	2.97E-02	0	0	0	0	0	0	0	0	4.20E-01	0	2.05E-01	**2.40E-01**
Non-renewable primary resources with energy content used as material	MJ, LHV	1.88E-03	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.88E-03**
Total use of non-renewable primary resources with energy content	MJ, LHV	2.19E01	1.44E00	2.98E-02	0	0	0	0	0	0	0	0	4.20E-01	0	2.05E-01	**2.40E+01**
Secondary materials	kg	1.65E00	0	0	0	0	0	0	0	0	0	0	0	0	0	**1.65E+00**
Renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-renewable secondary fuels	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Recovered energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Use of net fresh water resources	m3	6.36E00	9.86E-02	6.60E-04	0	0	0	0	0	0	0	0	2.88E-02	0	1.55E-02	**6.51E00**

Output flows and waste category indicators

Hazardous waste disposed	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Non-hazardous waste disposed	kg	0	0	2.51E-02	0	0	0	0	0	0	0	0	0	0	9.55E-01	**9.80E-01**
High-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Intermediate- and low-level radioactive waste, conditioned, to final repository	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Components for re-use	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for recycling	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Materials for energy recovery	kg	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Exported energy	MJ, LHV	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Carbon emissions and removals

Biogenic Carbon Removal from Product	kg CO_2	2.35E-02	0	0	0	0	0	0	0	0	0	0	0	0	0	**2.35E-02**
Biogenic Carbon Emission from Product	kg CO_2	4.44E-02	0	0	0	0	0	0	0	0	0	0	0	0	1.27E-04	**4.45E-02**
Biogenic Carbon Removal from Packaging	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Biogenic Carbon Emission from Packaging	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Biogenic Carbon Emission from Combustion of Waste from Renewable Sources Used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Calcination Carbon Emissions	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbonation Carbon Removals	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
Carbon Emissions from Combustion of Waste from Non-Renewable Sources used in Production Processes	kg CO_2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**

Numbers shown in purple have a variation of 10 to 20%
Numbers shown in red have a variation greater than 20%