EPD - ENVIRONMENTAL PRODUCT DECLARATION

according to ISO 14025 and EN 15804

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Blown insulation made of cellulose fibre

ISOCELL GmbH

General information

Product name ISOCELL Cellulose fibre insulation material	**Declared Product / Declared Unit** The LCA study concerns the product ISOCELL Cellulose from ISOCELL GmbH used for thermal and acoustic insulation in construction industry. ISOCELL is thermal insulation made of cellulose fibre, manufactured by reusing newspaper in an optimized recycling process. The pre-sorted newspaper is supplied to the plant and cut into rough fibres. Mixed with mineral salts it is finally ground in a mill. The mineral salts improve the reaction to fire of ISOCELL resistant to fire. The EPD represents the average of all ISOCELL products produced by ISOCELL GmbH in the production sites Hartberg (Austria) and Amel (Belgium) from July 2012 to July 2013. The average variance of the results of the two sites is 5.8 %. The minimum nominal density is 28 kg/m³, the maximum density is 65 kg/m³. The thermal conductivity λ_D is 0.039 W/mK in case of machine processing. One cubic metre of insulation material (m³) was defined as declared unit. **Validity** The average data published in this EPD are representative for all ISOCELL products produced on the sites Hartberg (Austria) and Amel (Belgium). The owner of the declaration is liable for the underlying information and evidence; the Bau EPD GmbH is not liable with respect to manufacturer information, life cycle assessment data and evidences.
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Declaration data ☐ Specific data ☒ Average data	
Declaration based on: PCR In-situ cellulose fibre insulation material PCR-Code: 2.22.4 Version 1.0 – 30.06.2014 (PCR tested and approved by the independent expert committee = PCR-Gremium)	
Type of Declaration as per the Austrian standard ÖNORM EN 15804 From cradle to gate with options	**Data base, software, version** GaBi Professional Database 2013, Umberto NXT Universal (Version 7.1)
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Note:
EPDs from similar product groups from different programmes must not necessarily be comparable.

Index

1 Product / System description

1.1 General product description

ISOCELL cellulose insulation materials are thermal insulation elements manufactured by recycling newspaper for thermal and sound insulation in building construction applications. The products are made from secondary-material waste paper. ISOCELL cellulose fibre is impregnated with mineral salts to protect it from fire.

The EPD represents the average of all cellulose fibre insulation materials produced by ISOCELL GmbH at the production sites Hartberg (Austria) and Amel (Belgium) from July 2012 to July 2013. The minimum density is 28 kg/m³, the maximum density is 65 kg/m³. The thermal conductivity λ_D is 0.039 W/mK in case of machine processing.

1.2 Placing and making available on the market

Placing and making available of the ISOCELL cellulose fibre insulation materials on the market are based on the following regulations:

- European Technical Assessment ETA-06/0076 of the Austrian Institute of Construction Engineering (OIB Österreichisches Institut für Bautechnik)
- EC certificate of conformity 1159-CPD-0138/06 and EC certificate of conformity 0432-BPR-42-2045
- Declarations of performance

1.3 Range of application

ISOCELL cellulose fibre insulation material is used in thermal and sound insulation applications, including solid wood walls, timber frame walls, roof slopes and mezzanine floors, and for many other purposes.
Cellulose fibre insulation is used for applications where vertical or horizontal cavities are completely filled by blowing in non-loadable insulating material, or where it is used to cover horizontal, arched or moderately pitched (≤ 10°) areas.

1.4 Technical data

Table 1: Technical data of the declared construction product according to ETA-06/0076 of the OIB

Designation	Value	Unit
Settlement according to ISO/CD 18393, Method A – Settling by impact excitation	8	%
Settlement according to ISO/CD 18393, Method C – Settling of wall cavity insulation by vibration	0	%
Settlement according to ISO/CD 18393, Method D – Settling by specified climatization	10	%
Water absorption as per EN 1609	No Performance Declared	-
Water vapour diffusion resistance factor (µ-value)	1	-
Airflow resistance as per EN 29053 at a density of 30 kg/m³ at a density of 50 kg/m³	minimum 5.3 25.1	(kPa s) / m²
Declared value of thermal conductivity λ_D -category 1 (by conversion of $\lambda_{(10, dry, 90/90)}$)	0.039	W/(mK)
Declared value of thermal conductivity λ_D -category 2 (by conversion of $\lambda_{(10, dry limit)}$)	0.038	W/(mK)
Classification of fire behaviour according to ÖNORM EN 13501-1 40 mm - 100 mm ≥ 100 mm	 Euroclass E Euroclass B-s2, d0	-

Specific product data sheets can be downloaded from the website of ISOCELL GmbH (www.isocell.at).

Table 2: Additional technical data of the declared construction product according to ETA-06/0076 of OIB

Designation	Value	Unit
Moisture conversion factor F_m of thermal conductivity (23 °C/50 % RH – 23 °C/80 % RH)	1.025	-
Density range depending on the area of application:		
Vertical: blown insulation in exterior partition wall cavities	38 - 65	kg/m³
Pitched: blown insulation in suitable cavities underneath roof waterproofing membranes (pitch >10°)	38 - 65	kg/m³
Horizontal: blown insulation in flat roof and ceiling cavities	38 - 65	kg/m³
Horizontal: exposed, non-accessible blown insulation for ceiling constructions (pitch ≤10°)	28 - 40	kg/m³

Reaction to fire, exposure to moisture and mechanical destruction

Reaction to fire See table 1, fire classification according to ÖNORM EN 13501-1.

Moisture protection: No adverse effects to water quality are known to ISOCELL GmbH, no testing was carried out. Exceptional exposure to moisture can lead to degradation of insulating properties. Small amounts of water dry easily due to the permeability of the material. In case of long term exposure to water (flooding) settlement is possible and the insulation material must be renewed.

Mechanical destruction: As the material consists of loose flakes, it cannot be destroyed by mechanical forces.

1.5 Conditions of delivery

ISOCELL cellulose fibre insulating material is packed into bags of ca. 12.5 kg and put on Euro pallets of 21 bags per pallet. The pallets are delivered to the clients by truck. The products must be stored in a dry location. According to the manufacturer there are no particular specifications.

2 Description of life cycle

2.1 Raw materials (main components and additives)

Table 3: Raw materials

Components	Function	Mass fraction in percent
Waste paper	Insulating material	> 90
Fire protection agent on mineral basis	Fire protection agent	< 7
Boric acid	Fire protection agent	< 3

2.2 Production

ISOCELL is manufactured from the raw materials waste paper, a mineral-based fire protection agent and boric acid. The biggest share is the waste paper with about 90 mass percent. The use of waste paper leads to a reduction of the demand on primary raw materials (preservation of resources). The production of the ISOCELL products at the Hartberg and Amel plants is technologically identical.

2.3 Packaging

The products are packed in polyethylene bags of approx. 12.5 kg and delivered on reusable pallets of 21 bags per pallet.

2.4 Transport

There was no data available for the transport of the ISOCELL products (A4), so this module is not declared.

2.5 Construction-, installation process

There was no data available for the installation of the ISOCELL products (A5) so this module is not declared.

2.6 Use stage

During the use stage, no material or energy flows relevant for the LCA occur. The stages B1 use and B2 maintenance as well as B3 repair are not relevant for the product group. The stage B4 replacement is equivalent to an end-of-life scenario. No material or energy flows occur during removal of the product. The stages B5 conversion/refurbishment, B6 operational energy use and B7 operational water use are not applicable on insulation products.

2.7 End-of-life stage

2.7.1 Re-use and recycling

The manufacturer states that the material can be returned if not contaminated by foreign matter. Reuse is possible.

2.7.2 Thermal utilisation

Combustion of the product is permissible in a waste incineration plant in monocharge processing or together with other municipal waste. Cellulose fibre insulating material is usually submitted to a waste incineration plant.

2.7.3 Disposal

Disposal of cellulose fibre insulating material on landfills is not allowed in Austria and Germany. Waste disposal code (EAK): 17 06 04, 17 09 04, 20 03 01.

2.8 Benefits and loads

2.8.1 Reuse-, recovery-, and recycling potential (D)

No by-products are produced in phases A1 - A3; the complete treatment of the production waste takes place within the system boundaries.
The scenario “Thermal waste treatment” was chosen for the end-of-life stage C4. The status “End of waste properties” is not reached before incineration. The plant has an R1 factor of < 0.6. The environmental impact of incineration processes is declared as a disposal process in module C4. According to the German Federal Institute for Research on Buildings, Urban Affairs and Spatial Development (Bundesinstitut für Bau-, Stadt- und Raumforschung) *(*BBSR, 2014) the energy produced during waste treatment is declared as exported energy in C4 and the produced benefits from this energy are declared in module D.

3 Life cycle assessment

3.1 Methodical assumptions

3.1.1 Type of EPD, system boundary

From cradle to gate with options.
Manufacturing phase (A1 – A3), end-of-life stage (C1 – C4) and benefits and loads (D).

3.1.2 Declared unit

The declared unit is 1 cubic metre of insulation material.

Table 4: Declared unit

Designation	Value	Unit
Declared unit	1	m^3
Density for conversion into kg Loose layers Filling cavities	 28 (min.) 65 (max.)	 kg/ m^3

3.1.3 Calculation of averages

The EPD represents the average of all cellulose fibre insulating materials produced by ISOCELL GmbH at the Hartberg (Austria) and Amel (Belgium) production plants in the period from July 2012 to July 2013. All input and output quantities originating from Hartberg and Amel from July 2012 - June 2013 were divided by the production volume from the same period. The input and output data for both plants provided by the manufacturer were entered into the calculation software and extrapolated. The average was formed on the basis of the resulting impact assessment of both plants.

3.1.4 Estimations and assumptions

A full declaration of all contents of the product was provided. All energy consumptions, amounts of waste and packaging materials were collected. For infrastructure data like the machinery, no specific data was collected. No other data was known to be missing. Emission measurements are not mandatory for the manufacturer. A measurement of dust emission at the workplace was carried out in 2007. The concentration of dust of 5 mg/m³ could not be converted to the amount of production and therefore was unattended.

3.1.5 Cut-off criteria

The application of cut-off criteria was considered in the production stage according to PCR Part A “General Rules for LCA assessment and requirements on the background report”. All raw materials used were considered. Waste paper is a secondary material. According to the LCA rules the collection and sorting is attributed to the previous product. For waste paper, only the transport from the disposal company to the manufacturer, the feedstock (lower calorific value of waste paper) and the CO_2 stored in the renewable raw material were considered. In the used ecoinvent data set one kg of wastepaper contains 1.72 kg CO_2 (Ecoinvent data set was used because no GaBi dataset was available). The characterisation of the used chemicals was carried out on the basis of the enclosed safety data sheets and information provided by the manufacturer. Regarding the mineral-based fire protection agents, the water was not considered. Auxiliary materials such as lubricating oils were neglected.

3.1.6 Data

The data fulfil the following quality requirements:

- The data sets refer to the production year July 2012 to July 2013
- The criteria of Bau EPD GmbH for data collection, generic data and cut-off of material and energy flows were complied with.
- A data validation as per EN ISO 14044:2006 was carried out.
- The used data correspond with the yearly average of the basic year.

- All essential data like energy and raw material demand, emissions, transports, packages, waste and by-products within the system boundary was provided by the manufacturer.
- The data are plausible, meaning that deviations from comparable results (other manufacturers, literature, similar products) are comprehensible.
- For the use of green energy, verifications were provided for both plants.

For background data the data base ecoinvent Version v.2.2 (2010) was chosen in accordance with the PCR guidance document Part A.

3.1.7 Allocation

No by-products are manufactured in the production of ISOCELL cellulose fibre insulating material. For the generic data, the rules of allocation in compliance with the database GaBi (2013) are applied. Packaging waste that occurs during production and has to be disposed of was treated as waste, even if it was transferred to an external recycling plant or energy recovery process (no allocation of material or energy profits).

3.1.8 Justification for the omission of non-declared modules

The production phase (A1 - A3) as well as the end-of-life stage (C1 - C4) were considered. For transport and delivery of ISOCELL products (A4) as well as for installation of ISOCELL products (A5) no data was available, therefore the modules are not declared. During the usage phase no material or energy flows relevant for the LCA occur. The stages B1 use, B2 maintenance and B3 repair are not relevant for this product group. The stage B4 replacement is equivalent to an end-of-life scenario. No material and energy flows occur when during removal of the product. The stages B5 conversion/refurbishment, B6 operational energy use and B7 operational water use are not applicable on insulation products.

3.2 Information on the life cycle for the assessment

Table 5: Declared life cycle stages, description of the system boundaries

PRODUCT STAGE			CON-STRUCTION PROCESS STAGE		USE STAGE							END-OF-LIFE STAGE				BENEFITS AND LOADS
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Construction, installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction, demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
x	x	x	MND	MND	MND	MND	MND	MND	MND	MND	MND	x	x	x	x	x

X = included in LCA; MND = Module not declared

Reference Service life (RSL)

Table 6: Reference service life for insulation products made from cellulose in the LCA

Designation	Value	Unit
Insulation layer made from cellulose fibre flakes	50	years

3.2.1 A1-A3 Production stage

3.2.1.1 A1 Raw material supply

Exclusively newspapers in the form of waste paper according to ÖNORM EN 643 are used as raw materials for the production of ISOCELL products. The newspaper contains a share of approximately 90 % by weight in the product and is delivered by several disposal companies. The use of waste paper leads to a reduction of the consumption of primary raw materials (preservation of resources), and also leads to energy savings, as no "new paper products" need to be manufactured for the cellulose fibre insulating material. As waste paper is a secondary material, the collection and sorting is attributed to the previous product system and not to the product of ISOCELL GmbH.

Boric acid in conjunction with a mineral-based additive is used as a stabilising fire protection agent. The proportion of mineral-based fire protection agent in the product is approximately 7-% by weight.

The amount of boric acid in ISOCELL blown cellulose insulation is about 3 % by weight. The raw material boron salt for the production of boric acid is mined in Turkey. Boric acid is formed by treating borax with hydrochloric acid or sulphuric acid. With regard to transport, it was assumed that 50 % of the upstream product for the production of boric acid are delivered by truck and the other 50 % by ship.

3.2.1.2 A2 Transport of raw materials

The transport distances of raw materials to the production plants in Hartberg and Amel were stated by the manufacturer. As the waste paper is delivered by several suppliers, a weighted average distance was calculated.

3.2.1.3 A3 Manufacturing

The first element in the production line is a shredder, into which loosened-up waste newspaper that has been inspected for foreign matter, is filled by means of a forklift truck. After shredding, the paper cuttings are separated from metal parts. In an intermediate buffer the moisture of the paper is measured and adjusted to the required moisture value with a water dosing system. This leads to better quality of the fibre and substantially improved adhesion of the fire protection agents.

The paper in the buffer container is transported by a batching belt conveyor into the mill. Mineral salts are added by several micro dosing devices in proportion to the paper quantity. The grinding fineness and texture of the fibre are regulated by mill parameters. This compensates the wearing of the grinding tools, thus ensuring consistent fibre quality.

After grinding, the final product is transported to the two packaging stations by a second intermediate buffer.

In the first packaging station, the material is filled into small packages of a pre-set weight. Afterwards the small packages are stored on pallets in a palletizer. The pallets are wrapped in weatherproof foil by an automatic wrapper and are finally ready for delivery.

Figure 1 shows the flow chart of the product life stages of the ISOCELL products:

Figure 1: Flow chart of the product life stages [see. (ISOCELL 2013)]

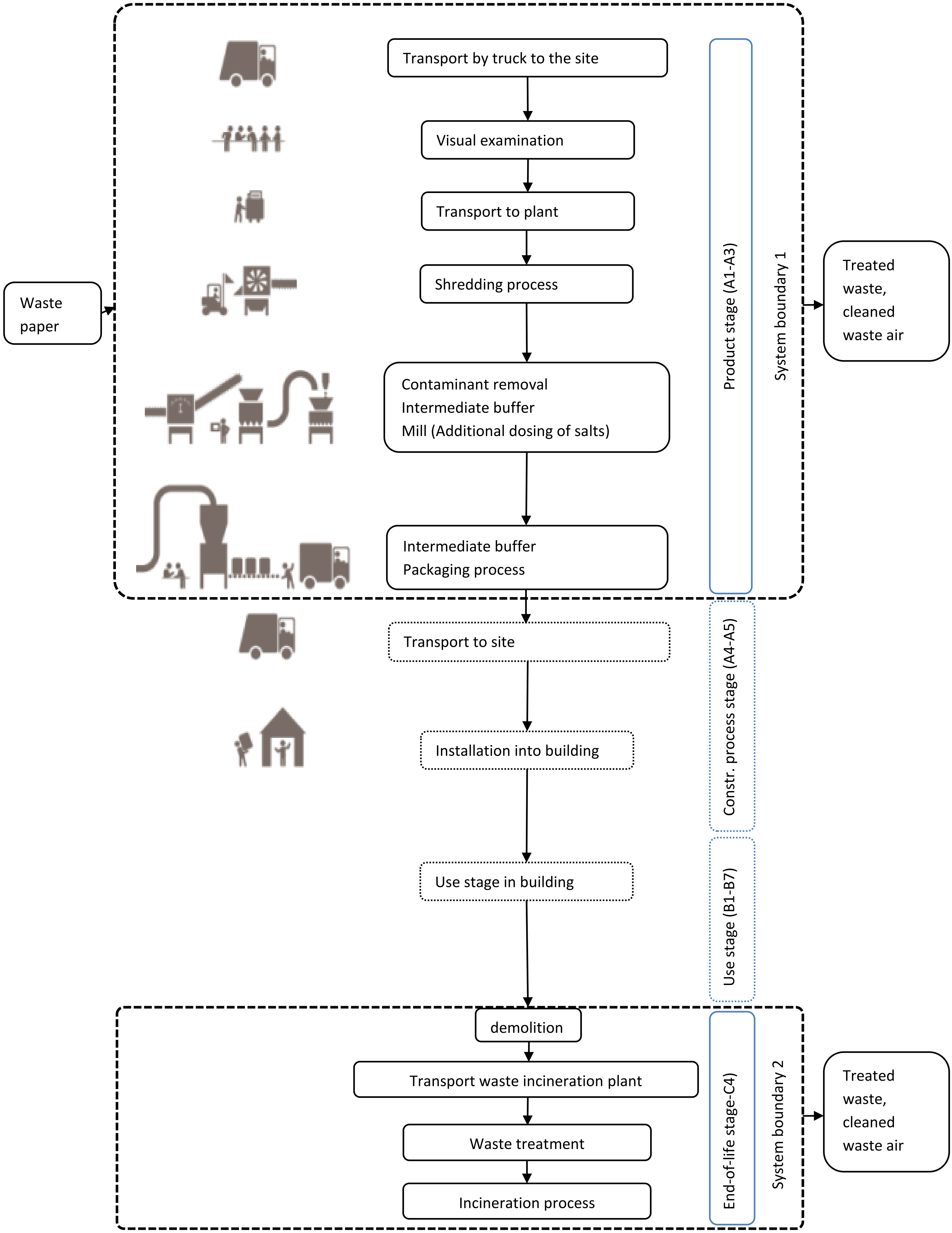


Table 7: Energy and water requirement for manufacturing per m³ product, site Hartberg

Designation	Quantity per m³ insulating material (nominal density 28 /65 kg/m³)
Green energy mix according to electricity supplier (Stadtwerke Hartberg)	9.09 / 21.10 MJ/m³
Diesel (transport within site)	0.50 / 1.17 MJ/m³
Fresh water consumption from rainwater	0 / 0 m³ /m³
Fresh water consumption from surface waters	0 / 0 m³ /m³
Fresh water consumption from well water	0 / 0 m³ /m³
Fresh water consumption from public water supply system	0 / 0 m³ /m³

Input data declared by the manufacturer originates from the year July 2012 to July 2013, the conversion to kg is based on the production quantity of July 2012 to July 2013.

Table 8: Energy and water requirement for manufacturing per m³ product, site Amel

Characterization	Quantity per m³ insulation material (nominal density 28 /65 kg/m³)
Green energy mix according to electricity supplier (Luminus)	11.92 / 27.69 MJ/m³
Propane gas (transport within site)	0.45 / 1.05 MJ/m³
Fresh water consumption from rainwater	0 / 0 m3 /m3
Fresh water consumption from surface waters	0 / 0 m3 /m3
Fresh water consumption from well water	0 / 0 m3 /m3
Fresh water consumption from public water supply system	0 / 0 m3 /m3

Input data declared by the manufacturer originates from the year July 2012 to July 2013, the conversion to kg is based on the production quantity of July 2012 to July 2013.

3.2.2 C1-C4 End-of-life stage

The blown cellulose insulating material can be removed easily. Reuse and material recycling does not take place under the current economic and technical conditions. Disposal of ISOCELL insulating material on landfills is not allowed according to the Austrian Landfill Directive (Deponieverordnung), as the products' organic content is too high (TOC > 5 M-%). The blown cellulose insulating material is usually undergoes a thermal recovery process, therefore recovery in a waste incineration plant was calculated.
In modules C1 (demolition) and C3 (waste processing) no material or energy flows relevant for the LCA arise.
Waste disposal codes: 17 06 04, 17 09 04, 20 03 01.

Table 9: Description of the scenario "Disposal of the product (C1 to C4)" (acc. to table 12 in ÖNORM EN 15804)

Parameters for end-of-life stage (C1-C4)	Value	Quantity per m³ insulating material
Collection process specified by type	-	kg collected separately
	-	kg collected with mixed construction waste
Recovery system specified by type	-	kg for re-use
	-	kg for recycling
	28 / 65	kg for energy recovery
Disposal specified by type	-	kg product or material for final deposition

3.3 Declaration of environmental indicators

Table 10: Parameters to describe the environmental impacts of ISOCELL cellulose products per m³ with a minimum nominal density of 28 kg/m³ and a maximum nominal density of 65 kg/m³

Parameter	Unit in equiv.	A1	A2	A3	Total A1 - A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Nom. density	**kg/m³**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**-**	**-**	**-**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**
GWP Process	kg CO_2	1,18 2,74	0,67 1,56	0,93 2,16	2,78 6,46	-	-	-	0 0	0,28 0,65	0 0	39,21 91,02	- 6,52 - 15,4
GWP C-content[1]	kg CO_2	- 38,6 - 89,6	0 0	0 0	- 38,6 - 89,6	-	-	-	0 0	0 0	0 0	0 0	0 0
GWP Total	kg CO_2	- 37,5 - 87,0	0,67 1,56	0,93 2,16	- 35,9 - 83,2	-	-	-	0 0	0,28 0,65	0 0	39,2 91,0	- 6,52 - 15,1
ODP	kg CFC-11	8,8E-08 2,0E-07	1,3E-09 3,0E-09	1,4E-08 3,3E-08	1,0E-07 2,4E-07	-	-	-	0 0	5,6E-10 1,3 E-09	0 0	5,3E-08 1,2E-07	- 6,4E-07 - 1,5E-06
AP	kg SO_2	0,020 0,046	0,004 0,009	0,004 0,010	0,028 0,066	-	-	-	0 0	0,001 0,003	0 0	0,008 0,018	- 0,010 - 0,023
EP	kg PO_4^{3-}	0,003 0,008	0,001 0,002	0,001 0,002	0,005 0,012	-	-	-	0 0	0,0003 0,001	0 0	0,014 0,034	- 0,002 - 0,004
POCP	kg C_2H_4	0,001 0,002	0,0004 0,001	0,001 0,002	0,002 0,005	-	-	-	0 0	0,0001 0,0003	0 0	0,001 0,003	- 0,002 - 0,004
ADPE	kg Sb	1,4E-03 3,3E-03	1,4E-08 3,4E-08	1,1E-06 2,6E-06	1,4E-03 3,3E-03	-	-	-	0 0	5,9E-09 1,4E-08	0 0	1,5E-06 3,4E-06	- 6,7E-07 - 1,5E-06
ADPF	MJ H_u	14,5 33,6	9,4 21,8	22,8 53,0	46,7 108	-	-	-	0 0	3,92 9,1	0 0	5,97 13,9	- 90,2 - 209
Legend		GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources											

[1] For the Global Warming Potential (GWP) the results are divided into "GWP-Process", "GWP C-content" and "GWP Total". GWP-Process contains all CO_2-equivalent emissions arising in the considered life cycle stages of the product. "GWP C-content" describes the share of carbon (biogenic CO_2) stored in renewable products. The corresponding values for specific materials are taken from the database "ecoinvent" and are displayed as negative numbers. The "GWP Total" results from the sum of "GWP-Process" und "GWP C-content".

Table 11: Parameters to describe the resource use of ISOCELL products per m³ with a minimum nominal density of 28 kg/m³ and a maximum nominal density of 65 kg/m³

Parameter	Unit	A1	A2	A3	Total A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Nom. density	**kg/m³**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**-**	**-**	**-**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**
PERE	MJ Hu	1,20 2,78	0,013 0,029	42,4 98,5	43,6 101	-	-	-	0 0	0,005 0,012	0 0	0,18 0,42	- 11,2 - 26,04
PERM	MJ Hu	356 826	0 0	0 0	356 826	-	-	-	0 0	0 0	0 0	0 0	0 0
PERT	MJ Hu	357 829	0,013 0,029	42,4 98,5	399 927	-	-	-	0 0	0,005 0,012	0 0	0,18 0,42	- 11,2 - 26
PENRE	MJ Hu	21,0 48,7	9,48 22,0	26,0 60,3	56,4 131	-	-	-	0 0	3,95 9,17	0 0	6,81 15,8	- 106 - 247
PENRM	MJ Hu	0 0	0 0	0 0	0 0	-	-	-	0 0	0 0	0 0	0 0	0 0
PENRT	MJ Hu	21,0 48,7	9,48 22,0	26,0 60,3	56,4 131	-	-	-	0 0	3,95 9,17	0 0	6,81 15,8	- 106 - 247
SM	kg	0 0	0 0	25,2 58,5	25,2 58,5	-	-	-	0 0	0 0	0 0	0 0	0 0
RSF	MJ Hu	0 0	0 0	0 0	0 0	-	-	-	0 0	0 0	0 0	0 0	0 0
NRSF	MJ Hu	0 0	0 0	0 0	0 0	-	-	-	0 0	0 0	0 0	0 0	0 0
FW	m³	0,007 0,016	0,001 0,003	79,9 186	79,9 186	-	-	-	0 0	0,00005 0,0001	0 0	0,027 0,062	- 38,7 - 89,9
Legend		PERE = Renewable primary energy as energy carrier; PERM = Renewable primary energy resources as material utilization; PERT = Total use of renewable primary energy resources; PENRE = Non-renewable primary energy as energy carrier; PENRM = Non-renewable primary energy as material utilization; PENRT = Total use of non-renewable primary energy resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of fresh water											

Table 12: Parameters to describe the waste categories of ISOCELL products per m³ with a minimum nominal density of 28 kg/m³ and a maximum nominal density of 65 kg/m³

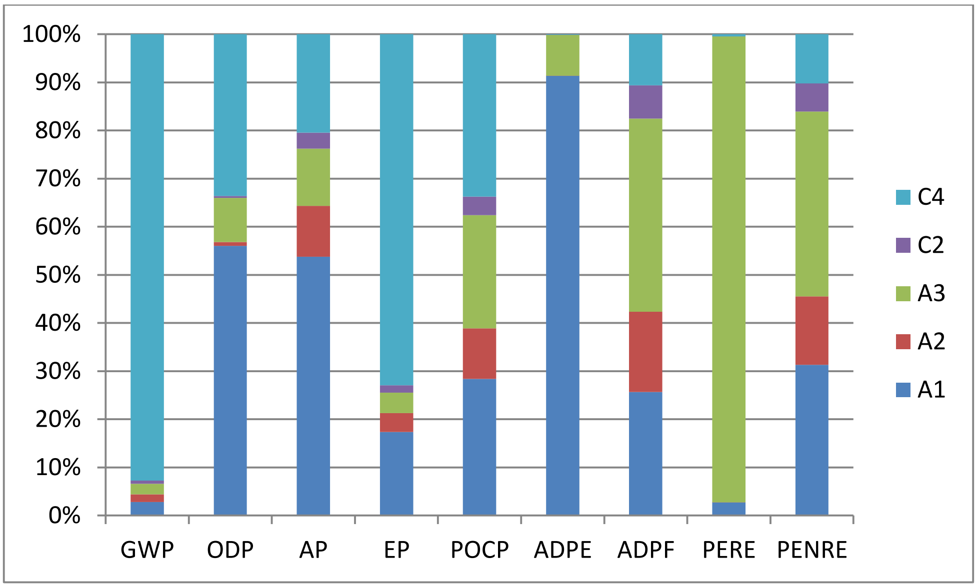
Parameter	Unit	A1	A2	A3	Total A1-A3	A4	A5	B1-B7	C1	C2	C3	C4	D
Nom. density	**kg/m³**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**-**	**-**	**-**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**	**28 / 65**
HWD	[kg]	3,4E-05 7,8E-06	4,8E-07 1,1E-06	0,0006 0,0013	0,0006 0,0013	-	-	-	0 0	0 0	0 0	0 0	- 0,0078 - 0,18
NHWD	[kg]	0,12 0,29	0,025 0,059	0,58 1,34	0,60 1,40	-	-	-	0 0	8,0E-06 1,9E-05	0 0	0 0	- 0,017 - 0,040
RWD	[kg]	1,7E-04 3,9E-04	1,6E-05 3,8E-05	5,0E-05 0,0001	2,4E-04 5,3E-04	-	-	-	0 0	7,0E-06 1,6E-05	0 0	0 0	- 0,0063 - 0,015
Legend		HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; RWD = Radioactive waste disposed											

Table 13: Parameters describing the potential of waste treatment and recovery in end-of-life stage of ISOCELL cellulose products per m³ with a minimum nominal density of 28 kg/m³ and a maximum nominal density of 65 kg/m³

Parameter	Unit	A1-A3	A4	A5	B1-B7	C1-C4	D
Nom. density	**kg/m³**	**28 / 65**	**-**	**-**	**-**	**28 / 65**	**28 / 65**
CRU	kg	0 0	-	-	-	0 0	0 0
MFR	kg	0 0	-	-	-	0 0	0 0
MER	kg	0 0	-	-	-	25,2 58,5	0 0
EEE	MJ	0 0	-	-	-	20,1 46,8	0 0
EET	MJ	0 0	-	-	-	178 413	0 0
Legend		CRU = Components for re-use; MFR = Materials for recycling; MER = Materials for energy recovery; EEE = Exported electric energy; EET = Exported thermal energy					

3.4 Interpretation of the LCA results

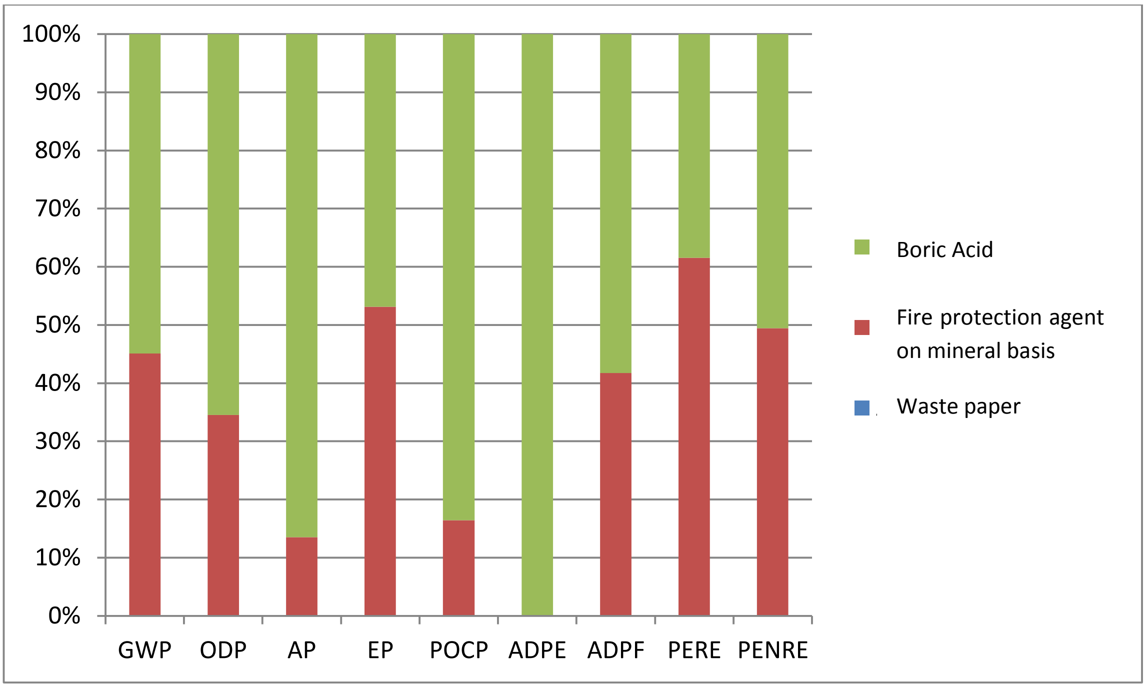
Figure 2: Average share of raw material supply A1, transport of raw materials A2, manufacturing A3, transport of waste C2 and incineration C4 of the Hartberg and Amel plants.



Legend	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources PERE = Renewable primary energy as energy carrier; PENRE = Non-renewable primary energy as energy carrier

Figure 2 shows the allocation of loads of ISOCELL blown cellulose insulating material in the considered product life cycle stages. Due to the fact that green energy is used at both plants, manufacturing (A3) with approx. 95 % has the highest impact regarding the consumption of renewable primary energy carriers (PERE). The raw material supply (A1) causes the highest loads regarding the impact categories Formation potential of tropospheric ozone photochemical oxidants (POCP) and acidification potential of land and water (AP). The incineration of the products (C4) is responsible for the highest loads in the categories Eutrophication potential (PE) and global warming potential (GWP) and lead to the high depletion potential of the stratospheric ozone layer (ODP).

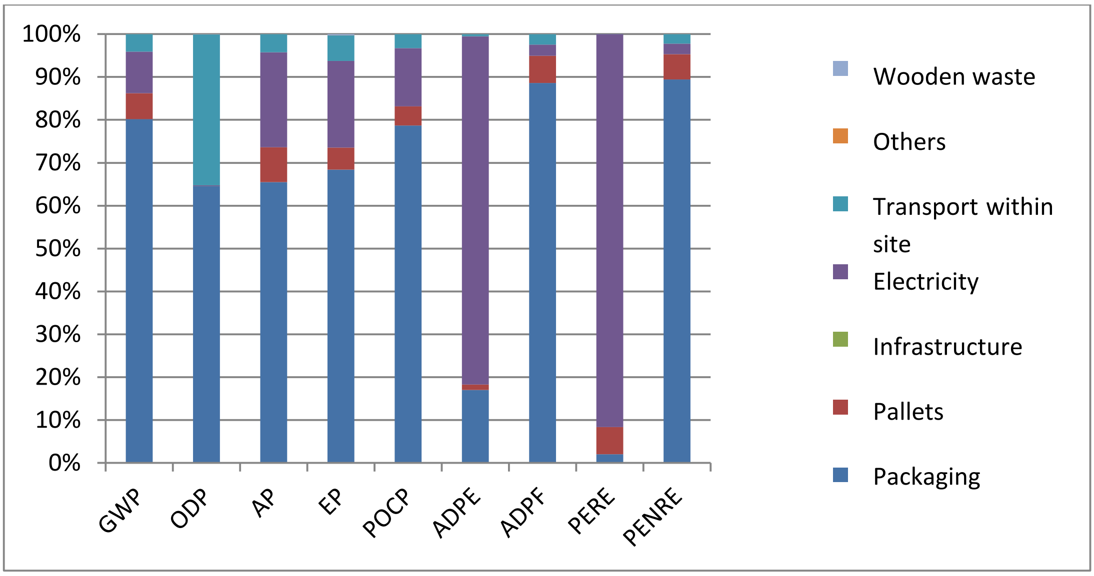
Figure 3: **Shares of different raw materials in the whole raw material supply (A1) for ISOCELL products from the Hartberg and Amel plants**



Legend	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources PERE = Renewable primary energy as energy carrier; PENRE = Non-renewable primary energy as energy carrier

Waste paper is a secondary raw material. According to the general rules for LCA-PCR part A of Bau EPD GmbH (version V 1.5 of 7th April 2014) the collection and sorting is attributed to the previous product. No loads are allocated to the raw material supply of waste paper. The boric acid shows the highest loads in raw material supply in all impact categories except in eutrophication potential (EP) and renewable primary energy as energy carriers (PERE). This is caused by the transport of the boron salts for the production of boric acid.

Figure 4: Causers of loads in manufacturing (A3)



Legend	GWP = Global warming potential; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential of land and water; EP = Eutrophication potential; POCP = Formation potential of tropospheric ozone photochemical oxidants; ADPE = Abiotic depletion potential for non-fossil resources; ADPF = Abiotic depletion potential for fossil resources PERE = Renewable primary energy as energy carrier; PENRE = Non-renewable primary energy as energy carrier

The foil packages are responsible for the highest loads in most of the impact categories, as the production costs of ISOCELL blown cellulose insulating material can principally be classified as very low. The use of green energy is visible in the high share of electricity in the category renewable primary energy as energy carrier (PERE).

4 Dangerous substances and emissions in indoor air and environment

4.1 Declaration of substances of very high concern

The product ISOCELL blown cellulose insulating material contains no substances with properties as listed in the table 21 and is not classified.

Table 14: Declaration of substances of very high concern

Properties of hazardous materials as per EG-regulation 1272/2008 (CLP regulation)	**Chemical designation(CAS-Number)**
Carcinogenic Cat. 1A or 1B (H350, H350i):	Not relevant
Mutagenic Cat. 1A or 1B (H340):	Not relevant
Toxic for reproduction Cat. 1A rder1B (H360F, H360D, H360FD, H360Fd, H360Df):	Not relevant[2]
PBT (persistent, bio-accumulative and toxic) (REACH, annex XIII):	Not relevant
vPvB (very persistent and very bio-accumulative) (REACH, annex XIII):	Not relevant
Substances of very high concern (SVHV):	Not relevant

[2] The share of boric acid undercuts the limit values for registration of the European Chemicals Agency.

5 References

CML 2001	CML 2001 is an LCA methodology developed by the Center of Environmental Science (CML) of Leiden University in the Netherlands. More information on: http://cml.leiden.edu/software/data-cmlia.html.
GaBi 2013	GaBi Professional Database 2013.
IBO 2010	Richtwerte für Baumaterialien – Wesentliche methodische Annahmen. Boogman Philipp, Mötzl Hildegund. Version 2.2, Stand Juli 2007, mit redaktionellen Überarbeitungen am 9.10.2009 und 24.02.2010, URL: http://www.ibo.at/documents/LCA_Methode_Referenzdaten_kurz.pdf.
ISOCELL 2013	All collected data of the manufacturer ISOCELL GmbH, Neumarkt am Wallersee, 2013.
ISOCELL 2013	Website of ISOCELL GmbH: http://www.ISOCELL.at
OiB 2013	European Technical Assessment ETA-06/0076 of the Austrian Institute of Construction Engineering (OIB Österreichisches Institut für Bautechnik) and the European Organization for Technical Assessment, validity period 08.05.2013 to 07.05.2018, Vienna, 2013.
BBSR 2014	In personal communication with the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR): "Additional Requirements for the modelling of Ökobau.dat", 2014.
Environment Agency Austria 2007	Publisher: Environment Agency Austria; Waste incineration in Austria, Status report 2006, Vienna 2007.

Rules and standards:

ÖNORM EN ISO 14040:2009-10 Environmental management - Life cycle assessment -- Principles and framework (ISO 14040:2006)

ÖNORM EN ISO 14044:2006-10 Environmental management - Life cycle assessment -- Requirements and guidelines

ÖNORM EN ISO 14025:2010-07 Environmental labels and declarations -- Type III environmental declarations -- Principles and procedures (ISO 14025: 2010)

ÖNORM EN 15804 Sustainability of construction works - environmental product declarations. Core rules for the product category of construction products, version: 2012-04-01

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