Statement of Verification

BREG EN EPD No: 000777 Issue: 01

This is to verify that the Environmental Product Declaration provided by:

Hambleside Danelaw Ltd

are in accordance with the requirements of:

EN 15804:2012+A2:2019

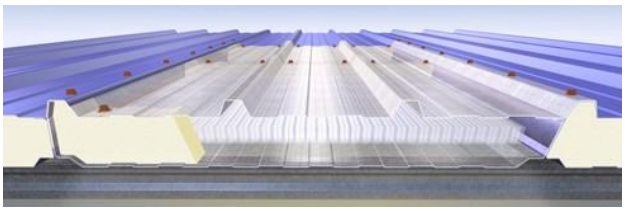
and

BRE Global Scheme Document SD207

This declaration is for:
1 linear metre of FAIR (Factory Assembled) Zenon Optimum ZF-02 panel rooflight weighing 6.43kg

Company Address

Hambleside Danelaw Ltd.
Long March
Daventry
Northamptonshire
NN11 4NR



Hambleside Danelaw
Building Products

Signed for BRE Global Limited	Hayley Thomson Operator	
13 March 2026 Date of this Issue	13 March 2026 Date of First Issue	12 March 2031 Expiry Date

BRE Global Verified EPD

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ECO PLATFORM EPD VERIFIED

Environmental Product Declaration

EPD Number: 000777

General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE 2025 Product Category Rules (PN 514 Rev 3.2) for Type III environmental product declaration of construction products to EN 15804:2012+A2:2019
Commissioner of LCA study	**LCA consultant/Tool**
Hambleside Danelaw Ltd. Long March Daventry Northamptonshire NN11 4NR	BRE LINA A2
Declared/Functional Unit	**Applicability/Coverage**
1 linear metre of FAIR (Factory Assembled) Zenon Optimum ZF-02 panel rooflight weighing 6.43kg.	Product Specific.
EPD Type	**Background database**
Cradle to Gate with options	Ecoinvent 3.8

Demonstration of Verification
CEN standard EN 15804 serves as the core PCR [a]
Independent verification of the declaration and data according to EN ISO 14025:2010 ☒Internal ☐ External
(Where appropriate [b])Third party verifier: Kim Allbury
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

Comparability
Environmental product declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A2:2019. Comparability is further dependent on the specific product category rules, system boundaries and allocations, and background data sources. See Clause 5.3 of EN 15804:2012+A2:2019 for further guidance

Information modules covered

Product			Construction		Use stage							End-of-life					Benefits and loads beyond the system boundary
					Related to the building fabric					Related to the building							
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4		D
Raw materials supply	Transport	Manufacturing	Transport to site	Construction – Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction demolition	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑		☑

Note: Ticks indicate the Information Modules declared.

Manufacturing site(s)

Hambleside Danelaw Ltd.
Long March Industrial Estate
Daventry
NN11 4NR

Construction Product:

Product Description

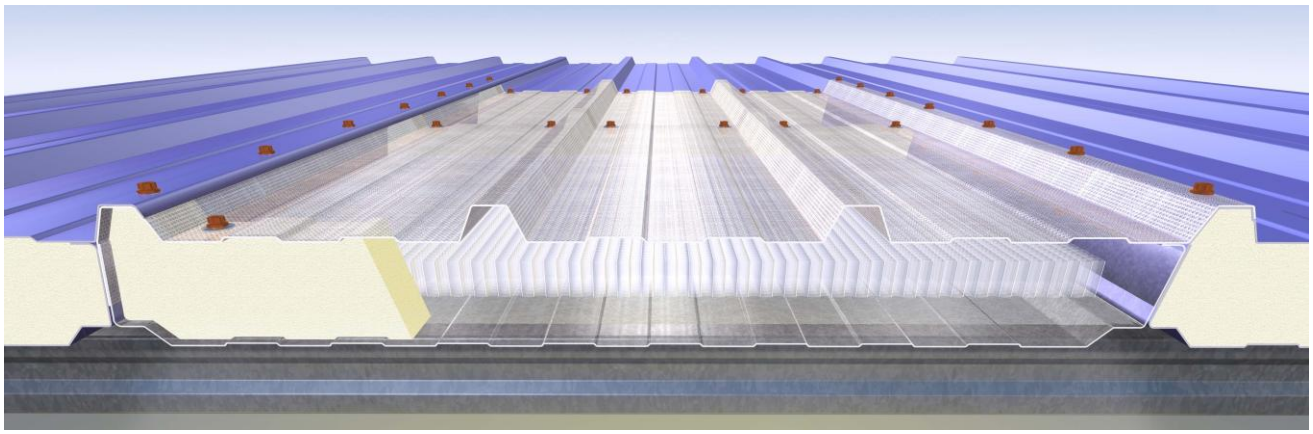
Zenon in-plane composite panel rooflights, also referred to as factory assembled insulated rooflights (FAIRs) are profiled, triple skin, translucent GRP products, comprising of a weather sheet, liner panel, and a layer of insulation. Manufactured in various fire ratings and thermal performances to suit the building's specification requirements. They are typically 1000mm cover width and are profiled to match the major UK composite (insulated) panel manufacturers. The design and width are the same across the system, and the length will be varied according to projects. Therefore, the LCA analysis was conducted for 1 linear meter, which allows the end user to scale the LCA results for different lengths.

Technical Information

Property	Value, Unit
Material	Glass Reinforced Polyester (GRP) to BS EN 1013:2012+A1:2014 (UK Annex)
Insulant	Cellulose acetate layer
Profile	To match profiled metal system
Length	To suit application
Cover Width	To match profiled metal system
Finish	Natural Translucent
Fire Properties	Outer: External Fire Exposure BROOF(t4) to BS EN 13501-5

Property	Value, Unit
	Liner: Class 1 to BS476-7, TP(a) rigid to BS 2782-0, Method 508A Liner: Surface Spread of Flame to BS 476-7; Class 1 and TP(a) rigid to BS 2782-0 Method 508A
End Lap Lengths	150mm with the fixings at the centre of the lap
L-Solar	46%
T-Solar	44%
U Value	0.94W/m^{2}K
Non-Fragility Classification	Class B
Additional Information	Manufactured using UV stabilised resins and Zenon Shield surface protection. UKCA and CE marked in accordance with BS EN 1013:2012+A1:2014 (UK Annex). Performance data obtained through physical testing programme at National Physical Laboratory

Note: The technical information is gathered from the product specification document, please contact Hambleside Danelaw for details. For full installation details including liner and insulant, please refer to manufacturer's installation recommendations.



Main Product Contents

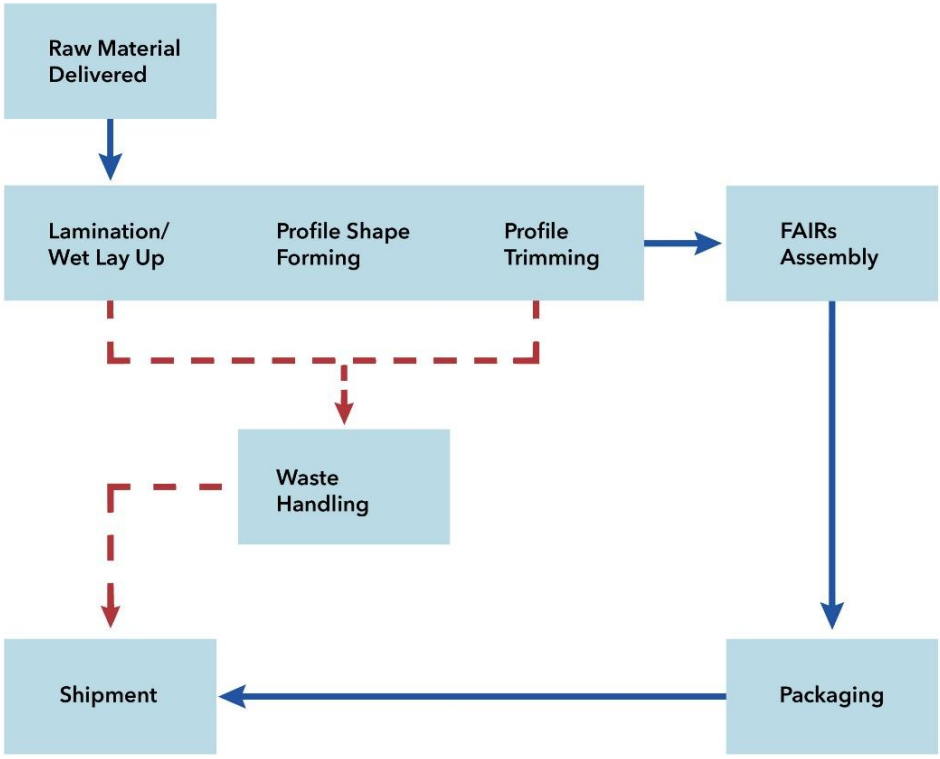
Material/Chemical Input	%
Resin	27.74
Glass	19.46
Scrim	0.09
Minor Chemicals	0.43
Fillers	4.98
Film	10.73
Hotmelt	0.3
Adhesives	4.67

Material/Chemical Input	%
Rivets	0.16
Steel Strips	1.89
Insulation Layer	29.55

Manufacturing Process

A controlled combination of raw materials, including resin and glass rovings are laid down on to a flat carrier film. This combination is then formed into the profile required and heated until it has cured. The cured profile shape is then trimmed to the length and width required against the customer's order. If the GRP is being used in a multi-skin factory assembled application (FAIR) then it undergoes an additional process to assemble the layers together. The finished product is then packaged and shipped to the customer.

Process flow diagram



Construction Installation

1. Rooflight Composite Panel
GRP (Glass Reinforced Polyester) rooflights, in a variety of profiles, different specifications and weights to meet all customer requirements.

2. Primary Fixings
There should always be a minimum of 5 fixings per purlin. These fixings should have a minimum 29mm diameter self-sealing washer with a poppy red cap. Due to differences in design profiles available, the

number and position of fixings varies. Ideally, the fixings should be positioned as evenly as possible across the profile of the sheet and central to each trough. Wider troughs may need two each.

3. Side Stitch Fastener
A sidelap stitch fastener is used when fixing the rooflight sidelaps over the metal profile. These fixings should have a poppy red cap and use a minimum of a 16mm diameter self-sealing washer and be placed at a maximum of 400mm centres. When not using a steel fixing strip incorporated into the rooflight construction, an expanding grommet type fastener should be used to fasten the side lap of the metal over the rooflight. Where non-fragile performance is required, these should be metal Fab-Lok or similar types.

4. Steel Fixing Strip
An optional galvanised steel strip is fitted into the rooflight during fabrication enabling the installer to use standard sidelap stitchers.

5. Sidelap Sealant
The sidelap sealant is essential and must be installed on the crown of the underlapping panel. The sealant should be a continuous 6x5mm butyl type strip.

6. End Lap Sealant
The sealant strips should be 6x5mm, 6mm Ø or 8mm Ø bead butyl type strip sealant. Two strips should be positioned approximately 10 to 15mm either side of the fixing, and a further strip positioned 15mm from the outer end lap. Where a better seal is required at the bottom of the lap to keep out dirt and trapped water, a bead of premium quality neutral cure silicone sealant positioned approximately 10 to 15mm from the bottom of the lap may be used as an alternative to the butyl strip.

7. Spreader Plate
A spreader plate is recommended to ensure that the composite panels and rooflights have a secure bearing. The composite rooflight must bear onto the purlin or 1.5mm min. thick spreader plate by no less than 25mm.

Use Information

Maintenance - Clean periodically with warm water and soap solution, avoid harsh detergents. Remove persistent stains by rubbing with a bristle brush. Remove tar and grease with white spirit.

Repairs - Dependent upon condition. Repairs sometimes possible; seek advice from Technical Department.

End of Life

At the end of life, the product can be disposed of via landfill or alternatively can be sent to an Energy from waste (EFW) plant where it is converted to SRF (Solid Recovery Fuel). Following this sophisticated SRF manufacturing process, the end product produced has a high calorific value and is a resource from which energy can be harnessed. It is used in cement kilns, paper mills and power stations as an alternative to fossil fuels. According to EN 15359, SRF should have an NCV between 15 and 25 MJ/kg, with chlorine content under 1% and mercury under 0.08 mg/MJ. If there is an interest in SRF pertains to its use in processes involving GRP, such as co-combustion with other materials, it's essential to consider the specific calorific value, chlorine content, and other chemical properties of the SRF to ensure compatibility and efficiency.

However, as the end-of-life options are site dependent, industrial average end-of-life data has been used for this EPD according BRE PCR for Type III EPD of Construction Products to EN 15804+A2, i.e. 95% metal waste to recycling, 5% to landfill. 100% GRP waste are incinerated.

Life Cycle Assessment Calculation Rules

Declared / Functional unit description

1 linear metre of FAIR (Factory Assembled) Zenon Optimum ZF-02 panel rooflight weighing 6.43kg.

System boundary

This is a Cradle-to-Gate with Module C & D and options LCA, reporting all production life cycle stages of modules A1 to A3, construction stages A4, A5 and end-of-life stages C1-C4, and D in accordance with EN 15804:2012+A2:2019 and BRE 2025 Product Category Rules (PN 514 Rev 3.2). The intended purpose of this LCA is for the data and results to be used in a published third-party verified EPD.

Data sources, quality and allocation

Specific primary data derived from Hambleside Danelaw's production process at Long March, Daventry, Northamptonshire NN11 4NR factory, have been modelled using the LINA LCA A2 software A2 and the ecoinvent 3.8 database. In accordance with the requirements of EN 15804:2012+A2:2019, the most current available data has been used. The manufacturer-specific data from Hambleside-Danelaw covers a period of one year (01/01/2024 – 31/12/2024). Secondary data has been obtained for all other upstream and downstream processes that are beyond the control of the manufacturer (i.e. raw material production) from the ecoinvent 3.8 database. All ecoinvent datasets are complete within the context used and conform to the system boundary and the criteria for the exclusion of inputs and outputs, according to the requirements specified in EN 15804:2012+A2:2019.

The LCA study is for Zenon ZF-02 product and the factory also produces other products. All energy, water and waste have been allocated to the product by linear metre according to the provisions of the BRE PCR PN514 Rev 3.2 and EN 15804:2012+A2:2019. Site wide values for energy, water and wastewater have been taken from bills. Figures for the raw materials, ancillary materials and packaging were from actual usages.

Quality Level	Geographical representativeness	Technical representativeness	Time representativeness
Very Good	Data from area under study.	Data from processes and products under study. Same state of technology applied as defined in goal and scope (i.e. identical technology).	There is less than 5 years between the ecoinvent LCI reference year, and the time period for which the LCA was undertaken.

Specific UK datasets have been selected from the ecoinvent LCI for this LCA. The quality level of geographical and technical representativeness is therefore very good. The quality level of time representativeness is very good as the background LCI datasets are based on ecoinvent v3.8 which was compiled in 2021. Therefore, there is less than 5 years between the ecoinvent LCI reference year and the time period for which the LCA was undertaken.

Location-based approach has been used for electricity modelling.
UK Consumption mix was used for electricity with an emissions factor of 0.239kgCO2e/kWh.
UK Natural gas data (at industrial furnace) was used with an emissions factor of 0.232 kgCO2eq/kWh.
UK renewable electricity (roof, mono solar PV) was used with an emission factor of 0.125 kgCO2e/kWh.

Cut-off criteria

All processes associated with the manufacturing process have been included. All inputs or outputs have been included and all raw materials, packaging and transport, energy, water use, emissions, and wastes, are included, except for direct emissions to water and soil, which are not measured. Upstream extraction and/or processing of inputs are included within the use of the background datasets within LINA. There is no information about the chemical composition of accelerator and catalyst input materials. Therefore, a default ecoinvent dataset - ‘unspecified organic chemical’ has been used as a proxy for the accelerator and catalyst.

LCA Results

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			GWP-total	GWP-fossil	GWP-biogenic	GWP-luluc	ODP	AP	EP-freshwater
			kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CO_2 eq	kg CFC11 eq	mol H^+ eq	kg $(PO_4)^{3-}$ eq
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	2.08E+01	2.12E+01	-4.14E-01	6.57E-02	1.93E-06	9.79E-02	5.20E-03
Construction process stage	Transport	A4	2.24E-01	2.23E-01	1.90E-04	8.77E-05	5.17E-08	9.07E-04	1.44E-05
	Construction	A5	3.48E+00	2.34E+00	9.09E-01	2.32E-01	2.96E-07	1.23E-02	2.15E-03
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario									
End of life	Deconstruction, demolition	C1	3.15E-02	3.14E-02	1.20E-05	4.37E-06	6.95E-09	2.00E-04	6.55E-07
	Transport	C2	3.21E-02	3.21E-02	2.73E-05	1.26E-05	7.42E-09	1.30E-04	2.07E-06
	Waste processing	C3	1.48E+01	1.48E+01	1.92E-03	2.90E-04	1.00E-07	3.84E-03	8.49E-05
	Disposal	C4	3.48E-05	3.48E-05	3.44E-08	3.28E-08	1.41E-11	3.27E-07	3.18E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-5.81E+00	-5.72E+00	-7.70E-02	-6.46E-03	-3.86E-07	-3.30E-02	-3.25E-03

GWP-total = Global warming potential, total;
GWP-fossil = Global warming potential, fossil;
GWP-biogenic = Global warming potential, biogenic;
GWP-luluc = Global warming potential, land use and land use change;

ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, accumulated exceedance; and
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts									
			EP-marine	EP-terrestrial	POCP	ADP-mineral& metals	ADP-fossil	WDP	PM
			kg N eq	mol N eq	kg NMVOC eq	kg Sb eq	MJ, net calorific value	m^3 world eq deprived	disease incidence
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	1.84E-02	2.00E-01	7.21E-02	2.04E-04	3.84E+02	1.27E+01	1.08E-06
Construction process stage	Transport	A4	2.73E-04	2.98E-03	9.14E-04	7.77E-07	3.38E+00	1.52E-02	1.93E-08
	Construction	A5	4.73E-03	2.61E-02	9.22E-03	3.10E-05	4.87E+01	2.87E+00	1.34E-07
Use stage	Use	B1	MND	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario									
End of life	Deconstruction, demolition	C1	7.99E-05	8.77E-04	3.07E-04	3.00E-08	4.44E-01	1.65E-03	4.44E-09
	Transport	C2	3.92E-05	4.28E-04	1.31E-04	1.11E-07	4.85E-01	2.18E-03	2.77E-09
	Waste processing	C3	1.95E-03	1.75E-02	4.46E-03	2.40E-06	2.95E+00	3.04E-01	2.77E-08
	Disposal	C4	1.14E-07	1.24E-06	3.62E-07	7.93E-11	9.71E-04	4.45E-05	6.58E-12
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.92E-03	-4.87E-02	-1.39E-02	-3.58E-06	-9.05E+01	-2.42E+00	-2.34E-07

EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, accumulated exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-mineral&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Depletion potential of the stratospheric ozone layer;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption; and
PM = Particulate matter.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing environmental impacts							
			IRP	ETP-fw	HTP-c	HTP-nc	SQP
			kBq U^{235} eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	1.78E+00	4.69E+02	1.82E-08	5.68E-07	1.15E+02
Construction process stage	Transport	A4	1.74E-02	2.64E+00	8.54E-11	2.76E-09	2.32E+00
	Construction	A5	2.88E-01	6.74E+01	3.80E-09	4.65E-08	2.23E+01
Use stage	Use	B1	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario							
End of life	Deconstruction, demolition	C1	2.20E-03	2.49E-01	4.60E-12	1.68E-10	1.21E-01
	Transport	C2	2.49E-03	3.78E-01	1.23E-11	3.97E-10	3.33E-01
	Waste processing	C3	2.38E-02	3.99E+01	2.95E-09	2.76E-08	8.59E-01
	Disposal	C4	4.31E-06	6.13E-04	1.56E-14	4.03E-13	2.04E-03
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.51E+00	-8.52E+01	-2.12E-09	-4.70E-08	-2.61E+01

IRP = Potential human exposure efficiency relative to U235;
ETP-fw = Potential comparative toxic unit for ecosystems;
HTP-c = Potential comparative toxic unit for humans;
HTP-nc = Potential comparative toxic unit for humans; and
SQP = Potential soil quality index.

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, primary energy

			PERE	PERM	PERT	PENRE	PENRM	PENRT
			MJ	MJ	MJ	MJ	MJ	MJ
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	2.22E+01	7.44E+00	2.96E+01	2.83E+02	9.73E+01	3.80E+02
Construction process stage	Transport	A4	4.76E-02	0.00E+00	4.76E-02	3.32E+00	0.00E+00	3.32E+00
	Construction	A5	7.97E-01	8.42E+00	9.21E+00	1.42E+01	2.80E+01	4.22E+01
Use stage	Use	B1	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario								
End of life	Deconstruction, demolition	C1	-1.27E+01	1.27E+01	2.28E-02	5.88E-01	9.89E-04	5.89E-01
	Transport	C2	6.83E-03	0.00E+00	6.83E-03	4.76E-01	0.00E+00	4.76E-01
	Waste processing	C3	5.55E-04	0.00E+00	5.55E-04	9.72E-02	0.00E+00	9.72E-02
	Disposal	C4	8.28E-06	0.00E+00	8.28E-06	9.53E-04	0.00E+00	9.53E-04
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-1.33E+01	0.00E+00	-1.33E+01	-9.10E+01	0.00E+00	-9.10E+01

PERE = Use of renewable primary energy excluding renewable primary energy used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;

PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resource

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Parameters describing resource use, secondary materials and fuels, use of water						
			SM	RSF	NRSF	FW
			kg	MJ net calorific value	MJ net calorific value	m^3
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	1.96E+00	2.87E-06	0.00E+00	3.03E-01
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	3.76E-04
	Construction	A5	3.51E-02	0.00E+00	0.00E+00	6.78E-02
Use stage	Use	B1	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario						
End of life	Deconstruction, demolition	C1	8.64E-07	6.38E-09	0.00E+00	4.06E-05
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	5.40E-05
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	7.23E-03
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	1.04E-06
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	-6.03E-02

SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Net use of fresh water

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing waste categories					
			HWD	NHWD	RWD
			kg	kg	kg
Product stage	Raw material supply	A1	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	1.08E+00	2.30E+01	8.66E+00
Construction process stage	Transport	A4	3.72E-03	6.61E-02	2.28E-05
	Construction	A5	2.37E-01	4.90E+00	1.32E-04
Use stage	Use	B1	MND	MND	MND
	Maintenance	B2	MND	MND	MND
	Repair	B3	MND	MND	MND
	Replacement	B4	MND	MND	MND
	Refurbishment	B5	MND	MND	MND
	Operational energy use	B6	MND	MND	MND
	Operational water use	B7	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario					
End of life	Deconstruction, demolition	C1	2.48E-03	5.07E-02	3.85E-06
	Transport	C2	5.34E-04	9.49E-03	3.28E-06
	Waste processing	C3	1.31E-04	9.14E-04	6.84E-07
	Disposal	C4	1.01E-06	1.43E-05	6.36E-09
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-4.00E-01	-1.96E+01	-4.53E-04

HWD = Hazardous waste disposed;
NHWD = Non-hazardous waste disposed;
RWD = Radioactive waste disposed

LCA Results (continued)

(MND = module not declared; MNR = module not relevant; INA = indicator not assessed; AGG = aggregated)

Other environmental information describing output flows – at end of life								
			CRU	MFR	MER	EE	Biogenic carbon (product)	Biogenic carbon (packaging)
			kg	kg	kg	MJ per energy carrier	kg C	kg C
Product stage	Raw material supply	A1	ACG	ACG	ACG	ACG	ACG	ACG
	Transport	A2	ACG	ACG	ACG	ACG	ACG	ACG
	Manufacturing	A3	ACG	ACG	ACG	ACG	ACG	ACG
	Total (Consumption grid)	A1-3	0.00E+00	3.49E-02	3.80E-03	2.34E-03	-9.10E-01	2.01E-01
Construction process stage	Transport	A4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Construction	A5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.52E-02	0.00E+00
Use stage	Use	B1	MND	MND	MND	MND	MND	MND
	Maintenance	B2	MND	MND	MND	MND	MND	MND
	Repair	B3	MND	MND	MND	MND	MND	MND
	Replacement	B4	MND	MND	MND	MND	MND	MND
	Refurbishment	B5	MND	MND	MND	MND	MND	MND
	Operational energy use	B6	MND	MND	MND	MND	MND	MND
	Operational water use	B7	MND	MND	MND	MND	MND	MND
100% GRP waste to incineration+ 95% metal waste to recycling+ 5% metal waste to landfill scenario								
End of life	Deconstruction, demolition	C1	0.00E+00	1.76E+00	3.00E-08	5.09E-06	4.04E-01	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	7.13E+01	0.00E+00	0.00E+00
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

CRU = Components for reuse;
MFR = Materials for recycling

MER = Materials for energy recovery;
EE = Exported Energy

Scenarios and additional technical information

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
A4 – Transport to the building site	Based on a typical delivery trip Daventry to Manchester		
	Fuel type / Vehicle type	Litre of fuel type per distance or vehicle type	Road Transport via 16-32 ton lorry
	Distance:	km	209
A5 – Installation in the building	Product is lifted onto the roof and fixed in place. Assumed local materials sourced from 30km delivered from 31 t lorry.		
	Sealant Tube	kg	0.1
	Sealant Tape	kg	0.9
	Screws	kg	0.15
	Electricity for Drill	kWh	0.001169
	Deisel	kg	0.000024
	Crane Exhaust Emissions	kg	0.000024
	Wooden pallet waste to recycling	kg	0.494
	Cover Sheets (GRP) waste to landfill	kg	0.2
	Cover Sheet (PC) waste to landfill	kg	0.003
	Polythene Wrap waste to landfill	kg	0.117
	Sealant Tube – to landfill	kg	0.1
C1 to C4 End of life,			
C1 – Deconstruction	It has been assumed that the product will be dismantled at the building's end of service life, where a crane will be used to bulldoze the building.		
	Transport of Diesel	km	30
	Electricity Use - Drill Battery	kWh	0.001169
	Deisel	kg	0.000024
	Tape – to landfill	kg	0.9
	Screws – to landfill	kg	0.15
C2 – Transport from site to pre-	A 30km assumption has been used in this module. The EPD users can calculate the C2 impacts for a specific distance on this basis.		

Scenarios and additional technical information			
Scenario	Parameter	Units	Results
processing facility or landfill	Road, 16-32 metric ton, euro5	km	30
C3 - Pre-processing of uninstalled product	The end-of-waste state has been assumed when the waste flow is incinerated (energy recovery form waste, assuming the plant has an R1 value > 0.6). There is currently no process in place to dispose of the product waste. Therefore, industrial average end-of-life scenarios have been used according to BRE PCR PN 514 Rev 3.2: 95% of steel and aluminium waste goes to recycling, i.e. 0.1155+0.01 = 0.1255 kg. 100% of 'Cladding panel, glass reinforced plastic (GRP) ' waste goes to incineration, i.e. 6.43-0.1321= 6.298kg.		
	Waste to Incineration (plastic)	kg	6.298
	Waste to recycling (steel)	kg	0.1155
	Waste to recycling (aluminium)	kg	0.01
C4 – Disposal	There is currently no process in place to dispose of the product waste. Therefore, industrial average end-of-life scenarios have been used according to BRE PCR PN 514 Rev 3.2: 5% of steel and aluminium waste goes to recycling, i.e. 0.0066 kg.		
	Waste to landfill (steel)	kg	0.0061
	Waste to landfill (aluminium)	kg	0.00053
Module D	The existing recycled content is less than 1% in GRP, so 6.298kg of plastic waste is declared in Module D for energy recovery benefits. As there is a lack of GRP incineration data, Incineration of plastic mixture waste dataset is used as a proxy to calculate the benefits in Module D, therefore, a specific calorific value for incineration is unable to be provided. But the electricity benefit realised from the incineration process is 3.66MJ/kg, the heat benefit realised from the incineration process is 7.66MJ/kg. For benefits due to incineration of GRP waste, the EU electricity (Electricity, high voltage (RER) market group for electricity, high voltag, 2021) with an emission factor of 0.396kgCO2eq/kWh, EU heat (Heat, district or industrial, natural gas (RER) market for heat, district or industrial, natural gas, 2021) with an emission factor of 0.187kgCO2eq/kWh, and EU heat (Heat, district or industrial, other than natural gas (RER) market for heat, district or industrial, other than natural gas, 2021) with an emission factor of 0.244kgCO2eq/kWh have been used as the background data for the energy recovered. For 0.1255 kg of metal waste, it includes 0.1155kg of steel waste and 0.01kg of aluminium waste. For steel waste, the existing recycled content makes of 37.8%. Therefore, only 62.2% of virgin steel can be claimed for benefits in module D, i.e. 0.1155* 62.2%= 0.07184 kg. For aluminium waste, the existing recycled content makes of 25.9%. Therefore, only 74.1% of virgin steel can be claimed for benefits in module D, i.e. 0.01* 74.1%= 0.00741 kg.		
	Benefits due to recycling of steel	kg	0.07184
	Benefits due to recycling of aluminium	kg	0.00741
	Benefits due to incineration of plastic mixture	kg	6.298

Interpretation

Out of the total mass of input materials, insulation layer accounts for 29.55%, resin accounts for 27.74%, glass fibres account for 19.46%, films account for 10.73% and other materials account for the remaining 12.52%. The bulk of the environmental impacts and primary energy demand are attributed to the manufacturing phase, covered by information modules A1-A3 of EN15804:2012+A2:2019.

As a result, GCP waste treatment and polyester resin contribute the most on GWP and overall environmental impacts.

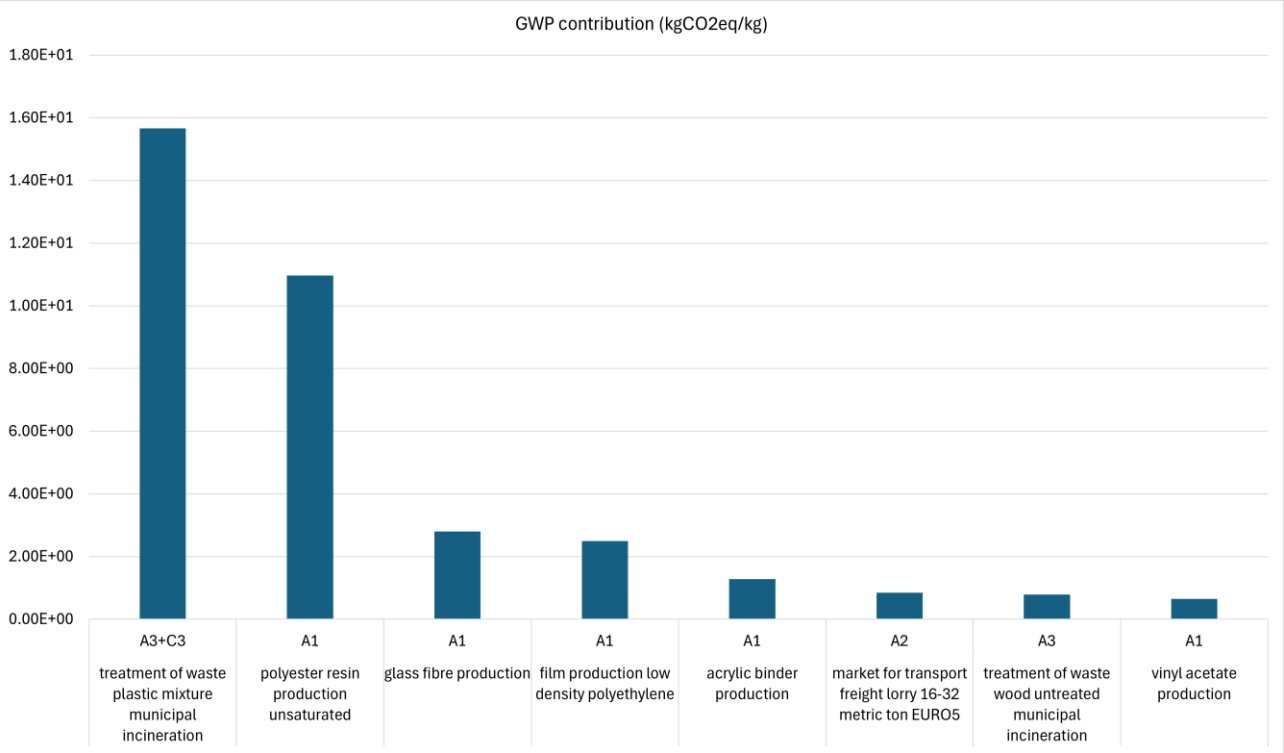


Figure 1

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