

## Statement of Verification

BREG EN EPD No.: 000596

Issue 01

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



is in accordance with the requirements of:  
**EN 15804:2012+A2:2019**  
and  
**BRE Global Scheme Document SD207**

This declaration is for:  
**1 kg of ThermaBead's expanded polystyrene (EPS) bead**

### Company Address

ThermaBead Limited,  
Units 1 and 2 Shipston Close,  
Worcester,  
WR4 9XN



Signed for BRE Global Ltd

Emma Baker  
Operator

02 July 2024  
Date of this Issue

02 July 2024  
Date of First Issue

01 July 2029  
Expiry Date



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BRE Global Ltd., Garston, Watford WD25 9XX.  
T: +44 (0)333 321 8811 F: +44 (0)1923 664603 E: [Enquiries@breglobal.com](mailto:Enquiries@breglobal.com)





## Environmental Product Declaration

EPD Number: 000596

### General Information

EPD Programme Operator	Applicable Product Category Rules
BRE Global Watford, Herts WD25 9XX United Kingdom	BRE 2023 Product Category Rules (PN 514 Rev 3.1) for Type III environmental product declaration of construction products to EN 15804:2012+A2:2019
Commissioner of LCA study	LCA consultant/Tool
ThermaBead Limited, Units 1 and 2 Shipston Close, Worcester, WR4 9XN	Bala Subramanian/ LINA A2
Declared/Functional Unit	Applicability/Coverage
1 kg of Thermabead expanded polystyrene (EPS) bead	Product Average.
EPD Type	Background database
Cradle to Gate with Module C and D	Ecoinvent 3.8
Demonstration of Verification	
CEN standard EN 15804 serves as the core PCR <sup>a</sup>	
Independent verification of the declaration and data according to EN ISO 14025:2010 <input checked="" type="checkbox"/> Internal <input checked="" type="checkbox"/> External	
(Where appropriate <sup>b</sup> )Third party verifier: Jiacheng (Francis) Yu	
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
<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>				

Note: Ticks indicate the Information Modules declared.

## Manufacturing site(s)

ThermaBead Limited,  
Units 1 and 2 Shipston Close,  
Worcester,  
WR4 9XN

## Construction Product:

### Product Description

Thermabead Carbon Saver and Thermabead Diamond Cavity Wall Insulation are grey expanded polystyrene (EPS) bead materials, for use with or without a bonding agent (water based PVA adhesive). The bonding agent is used to adhere the beads together and provide long-term stability to the insulation.

Thermabead Carbon Saver and Thermabead Diamond are suitable options for injected cavity wall insulation. They effectively reduce thermal transmittance (U value) in external cavity walls with masonry inner and outer leaves, including clay and calcium silicate bricks, concrete blocks, and natural or reconstituted stone blocks.

The Carbon Saver and Diamond Bead are made from the raw materials Neopor P5200 and F2200, respectively. Both raw materials consist of 99% EPS with a slight variation in graphite content, resulting in different thermal properties. However, the manufacturing process for Carbon Saver and Diamond Beads is the same. Therefore, in this LCA analysis, both products are grouped together, and the analysis has been conducted for 1 kg. This allows the end-user to calculate the environmental impacts of Carbon Saver and Diamond Cavity Wall Insulation at the specific densities used in the building sector.

### Technical Information

The thermal transmittance (U value) of specific external wall constructions should be carried out in accordance with BS EN ISO 6946: 2017 and BRE Report BR 443: 2006, using the insulation's declared thermal conductivity.

Property	Thermabead Carbon Saver	Thermabead Diamond
Thermal conductivity ( $W \cdot m^{-1} \cdot K^{-1}$ )	0.033	0.032
Density ( $kg/m^3$ )	12	13

Note: Individual areas within the wall must not have an absolute density variation of more than  $\pm 2 kg/m^3$  from the target mean density when measured over an area of  $0.5 m^2$ .

Note: For more information please see <https://www.thermabead.co.uk/>



Figure 1 Diamond Bead



Figure 2 Carbon saver

## Main Product Contents

Material/Chemical Input	%
EPS	100

## Manufacturing Process

Manufacturing our EPS products from raw material is a four-step process:

### Step 1-Start up.

1. Turn on the boiler.
2. Turn on the compressor for the air.
3. Bring the boiler up to pressure.
4. Once all the pipes are heated, the machines can be warmed up.
5. Once the machines reach a temperature of 80 degrees, the process begins.

### Step 2-1<sup>st</sup> Stage Expansion Process

1. Load octabins of material onto the table & press button, to begin turning/feeding the material through the expansion machinery.
2. Once leave sensor activates at hopper, the machine stops, and the silo trap to be opened, to allow pellet through to steam expansion chamber.
3. As the chamber fills, bead begins to fill the drying bed.
4. As material is moving along the bed, take a weight of the material every 15 minutes.
5. Once at the end of the drying bed, bead extracts to a holding silo, where it stands for 3 hours.

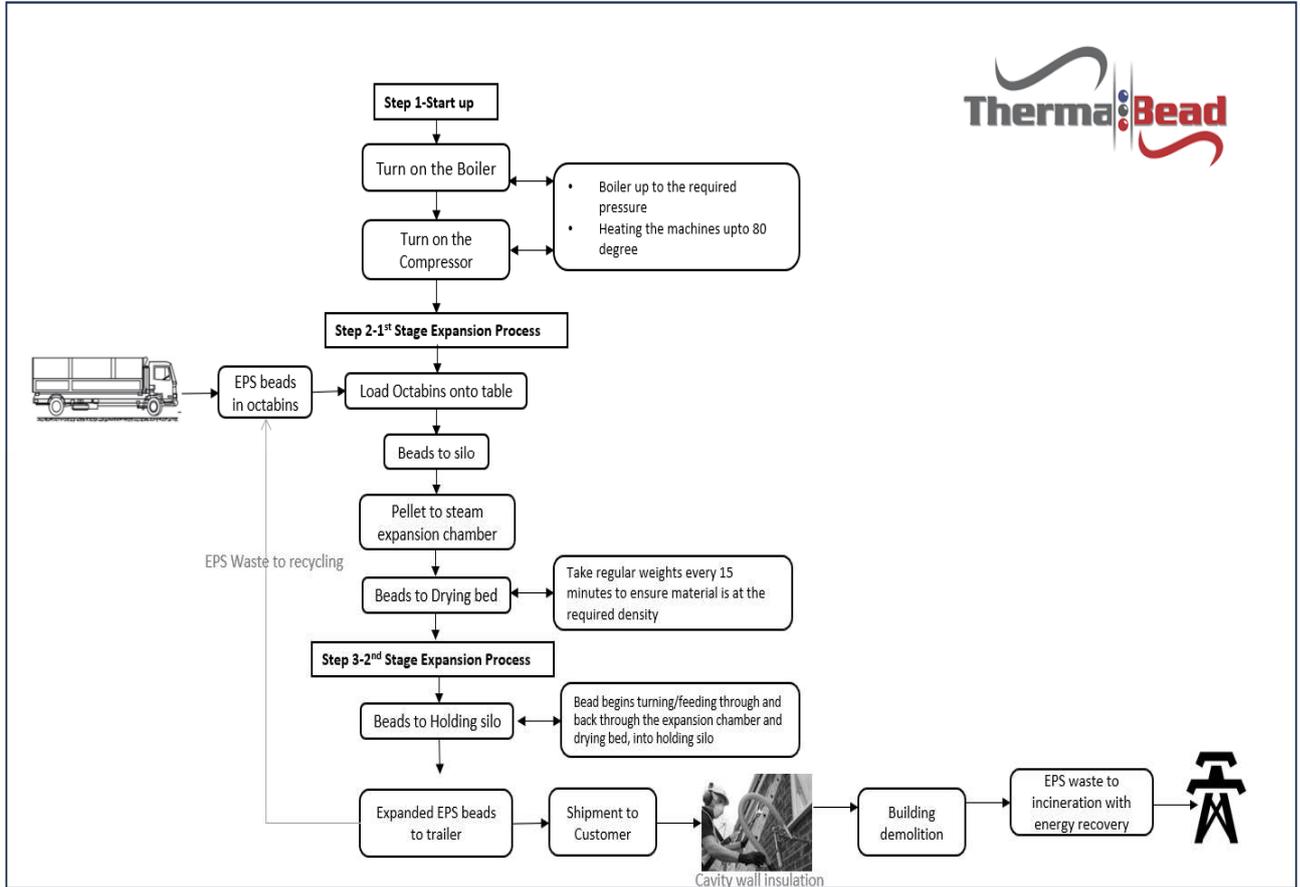
### Step 3-2<sup>nd</sup> Stage Expansion Process.

1. Fill the machine silo from the holding silo. (location 5 above)
2. Bead begins turning/feeding through and back through the expansion chamber and drying bed, into holding silo.
3. As material is moving along the bed, take regular weights every 15 minutes to ensure material is at the required density.
4. Bead is ready to dispatch.

### Step 4-Trailer Loading

1. From the holding silo, blow bead out of the factory onto customer's trailer.
2. Put the batch number for the material on the bulkhead of the trailer.

Process flow diagram



End of Life

At the end of its life, the EPS beads will be manually removed from the deconstruction unit without the use of any power tools. The recovered EPS beads will then undergo recycling or incineration. Facilities for recycling EPS are becoming more widely available, offering various methods from mechanical recovery to solvent treatments, which return the polymer back to raw materials. In areas where recycling infrastructure is lacking, EPS can be submitted to energy-from-waste schemes.

Given the high calorific value of polystyrene (46,000 kj/kg), EPS products can be incinerated at the end of their life cycle. Municipal waste incinerators equipped with energy recovery units can harness the energy embedded in EPS boards for steam and electricity generation, as well as district heating purposes. ([British Plastic Federation,2024](#)).

Life Cycle Assessment Calculation Rules

Declared / Functional unit description.

1 kg of ThermaBead expanded polystyrene (EPS) bead.

System boundary

This is a cradle to gate with module C and D LCA of EPS manufactured by Engineering foam products manufactured in the United Kingdom, reporting all production life cycle stages of modules A1 to A3 and end-of-life stages C1-C4, and D. It follows the modular design defined in EN15804:2012+A2:2019 and BRE 2023 Product Category Rules (PN 514 Rev 3.1).

### Data sources, quality and allocation

This is an average EPD, as the data covers both ThermaBead Carbon Saver and ThermaBead Diamond production. The raw materials of the two products have few differences, and they have very similar physical performances and formulations. Therefore, the same raw material data is used in the LCA for both products. The quantity used in the data collection for this EPD represents the total quantity of EPS manufactured during the data collection period (01/01/23 - 31/12/23). The original data collection form was used for the LCA analysis, with no uplift in the given data. Thermabead manufactures only EPS beads, and no other products manufactures in addition to the EPS, so all the electricity, water usage, and discharge is 100% allocated to the product by using the mass allocation according to the provisions of the BRE PCR EN514 and EN 15804+A2. During the manufacturing period no production waste has been produced. 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 EN15804.

ISO14044 guidance. <b>Quality Level</b>	<b>Geographical representativeness</b>	<b>Technical representativeness</b>	<b>Time representativeness</b>
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).	n/a
Very Good	n/a	n/a	There is approximately 1-2 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 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. The GWP carbon footprint for using 1 kWh of electricity, GB kwh is 0.239 in kgCO<sub>2</sub>e/kWh and the GWP value of 1 kWh of natural gas is 0.232 kgCO<sub>2</sub>eq.

### Cut-off criteria

All raw materials and energy input to the manufacturing process have been included, except for direct emissions to air, water, and soil, which are not measured. The inventory process in this LCA includes all data related to raw material, packaging material and consumable items. Process energy, water use, and discharge are included, except the production waste.

## 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 <sub>2</sub> eq	kg CFC11 eq	mol H <sup>+</sup> eq	kg (PO <sub>4</sub> ) <sup>3-</sup> eq			
Product stage	Raw material supply	A1	3.78E+00	3.74E+00	3.12E-02	7.81E-06	4.21E-08	1.28E-02	1.10E-04
	Transport	A2	1.76E-02	1.76E-02	1.50E-05	6.90E-06	4.06E-09	7.13E-05	1.13E-06
	Manufacturing	A3	2.50E-01	2.50E-01	3.17E-05	2.79E-05	2.16E-08	1.62E-04	5.56E-06
	Total	A1-3	4.04E+00	4.01E+00	3.12E-02	4.26E-05	6.78E-08	1.31E-02	1.17E-04
<b>100% - Incineration with energy recovery</b>									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	8.32E-03	8.31E-03	7.08E-06	3.26E-06	1.92E-09	3.37E-05	5.35E-07
	Waste processing	C3	3.18E+00	3.18E+00	8.54E-05	1.10E-05	2.62E-09	4.01E-04	4.13E-06
	Disposal	C4	0.00E+00	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	1.49E+00	1.49E+00	-2.47E-03	-2.03E-03	-1.01E-07	-4.65E-03	-2.38E-04

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 <sup>3</sup> world eq deprived	disease incidence
Product stage	Raw material supply	A1	1.95E-03	2.08E-02	1.12E-02	3.85E-07	8.29E+01	2.78E+00	1.39E-07
	Transport	A2	2.15E-05	2.35E-04	7.19E-05	6.11E-08	2.65E-01	1.19E-03	1.52E-09
	Manufacturing	A3	8.53E-05	6.66E-04	1.86E-04	1.65E-07	4.55E+00	1.81E-02	1.02E-09
	Total	A1-3	2.05E-03	2.17E-02	1.14E-02	6.11E-07	8.77E+01	2.80E+00	1.41E-07
<b>100% - Incineration with energy recovery</b>									
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.02E-05	1.11E-04	3.40E-05	2.89E-08	1.26E-01	5.65E-04	7.17E-10
	Waste processing	C3	2.05E-04	2.02E-03	4.87E-04	9.01E-08	2.94E-01	3.49E-02	1.90E-09
	Disposal	C4	0.00E+00	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	-1.10E-03	-1.22E-02	-2.97E-03	-4.20E-06	-3.96E+01	-2.83E-01	-2.27E-08

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 <sup>235</sup> eq	CTUe	CTUh	CTUh	dimensionless
Product stage	Raw material supply	A1	1.22E-03	3.61E+00	6.47E-10	7.20E-09	8.08E-02
	Transport	A2	1.36E-03	2.07E-01	6.71E-12	2.17E-10	1.82E-01
	Manufacturing	A3	2.50E-02	8.62E-01	3.28E-11	4.38E-10	2.76E-01
	Total	A1-3	2.76E-02	4.68E+00	6.86E-10	7.85E-09	5.40E-01
<b>100% - Incineration with energy recovery</b>							
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	6.46E-04	9.81E-02	3.18E-12	1.03E-10	8.63E-02
	Waste processing	C3	6.25E-04	1.64E+01	2.10E-10	8.04E-09	9.69E-02
	Disposal	C4	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	-1.39E+00	-1.85E+01	-3.74E-10	-1.06E-08	-1.48E+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	4.29E-01	0.00E+00	4.29E-01	4.32E+01	3.87E+01	8.19E+01
	Transport	A2	3.74E-03	0.00E+00	3.74E-03	2.61E-01	0.00E+00	2.61E-01
	Manufacturing	A3	1.41E-01	4.57E-03	1.46E-01	5.00E+00	1.09E-02	5.01E+00
	Total	A1-3	5.74E-01	4.57E-03	5.79E-01	4.85E+01	3.87E+01	8.72E+01
<b>100% - Incineration with energy recovery</b>								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.77E-03	0.00E+00	1.77E-03	1.23E-01	0.00E+00	1.23E-01
	Waste processing	C3	7.18E-03	0.00E+00	7.18E-03	-3.84E+01	3.87E+01	2.93E-01
	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	-3.96E+01	0.00E+00	-3.96E+01	-7.20E+00	0.00E+00	-7.20E+00

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 <sup>3</sup>
Product stage	Raw material supply	A1	0.00E+00	0.00E+00	0.00E+00	6.48E-02
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	2.96E-05
	Manufacturing	A3	2.49E-04	6.03E-07	0.00E+00	5.33E-04
	Total	A1-3	2.49E-04	6.03E-07	0.00E+00	6.54E-02
<b>100% - Incineration with energy recovery</b>						
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	0.00E+00	0.00E+00	0.00E+00	1.40E-05
	Waste processing	C3	0.00E+00	0.00E+00	0.00E+00	8.17E-04
	Disposal	C4	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	-7.21E-03

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	5.66E-02	8.36E-02	1.03E-06
	Transport	A2	2.93E-04	5.20E-03	1.80E-06
	Manufacturing	A3	1.29E-03	1.94E-02	1.63E-05
	Total	A1-3	5.82E-02	1.08E-01	1.91E-05
<b>100% - Incineration with energy recovery</b>					
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00
	Transport	C2	1.39E-04	2.46E-03	8.50E-07
	Waste processing	C3	2.62E-02	1.04E+00	4.99E-07
	Disposal	C4	0.00E+00	0.00E+00	0.00E+00
Potential benefits and loads beyond the system boundaries	Reuse, recovery, recycling potential	D	-8.21E-02	-1.14E+00	-3.50E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Transport	A2	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Manufacturing	A3	0.00E+00	8.25E-06	1.38E-08	6.85E-04	0.00E+00	-1.45E-04
	Total	A1-3	0.00E+00	8.25E-06	1.38E-08	6.85E-04	0.00E+00	-1.45E-04
<b>100% - Incineration with energy recovery</b>								
End of life	Deconstruction, demolition	C1	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	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	1.00E+00	0.00E+00	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
C1 - Deconstruction	At the end of its life, the EPS beads will be manually removed from the deconstruction unit without the use of any power tools. The recovered EPS beads will then undergo incineration for energy recovery. Facilities for recycling EPS are becoming more widely available, offering various methods from mechanical recovery to solvent treatments, which return the polymer back to raw materials. In areas where recycling infrastructure is lacking, EPS can be submitted to energy-from-waste schemes. (British Plastic Federation,2024)		
C2- Transportation	50km by road has been modelled for module C2 as a typical distance from the demolition site to the incineration with energy recovery plant. However, end-users of the EPD can use this information to calculate the impacts of a bespoke transport distance for module C2 if required.	Lorry	16-32 metric ton
	Transportation distance	km	50
	Fuel consumption	Litres per km	0.227
C3 – Pre-processing	According to EN 15804+A2 and BRE 2023 PCR PN514 Rev 3.1, the recovered EPS foam will be sent to an incineration with energy recovery plant without the need for any pre-processing.  As 100% of the product will be incinerated in C3 – pre-processing therefore no product left to landfill in C4. Hence no impacts from C4	kg	1
Module D	<p>The EPS foam will be incinerated for energy at end of life.</p> <p>The scenario is assumed at the end of life, the membranes will be incinerated in the UK, so the UK electricity dataset have been selected. The dataset used to calculate the avoided impacts of electricity consumption in a future system was 'Electricity, medium voltage {GB} market for   Alloc Def, U'.</p> <p>This process is energy-efficient, with 37.4% of the combustion heat recovered after incineration. The efficiency rate of 37.4% has been calculated by taking the weighted average of the number of waste incineration plants available in the UK. According to the Environmental Agency's 2013 article on "CHP Ready Guidance for Combustion and Energy from Waste Power Plants" in the UK, EFW plants have an efficiency of 33%, and CHP plants have an efficiency of 55%. Additionally, according to Azapagic, A., &amp; Jeswani, H. K. (2016), there are currently 25 MSW incinerators with energy recovery in the UK. It is assumed that 20 plants generate heat and power at 33%, while 5 plants generate electricity at 55%. Therefore, the weighted average calculation is used to determine the efficiency, which is calculated at 37.5%.</p> <p>Calorific value of EPS - 46 MJ/kg 100% Incineration with energy recovery – 1 kg</p>		

### Interpretation of results

In the ThermaBead manufacturing unit, both ThermaBead Carbon Saver and ThermaBead Diamond are produced out of 100% EPS and each of them makes up 50% of the total production. 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.

### Individual product calculations:

The LCA results listed in the tables above are for the processing of 1 kg of ThermaBead's Expanded polystyrene bead. The end-user of this EPD can therefore use these results to calculate impact of each carbon saver beads and diamond beads by using its individual weight.

In the below calculation table, the GWP impacts have been calculated for Thermabead product using their weight.

	Modules	1 kg	Thermabead Carbon Saver	Thermabead Diamond
			12 kg/m <sup>3</sup>	13 kg/m <sup>3</sup>
Raw material supply	A1	3.78E+00	4.54E+01	4.91E+01
Transport	A2	1.76E-02	2.11E-01	2.29E-01
Manufacturing	A3	2.50E-01	3.00E+00	3.25E+00
Total	A1-3	4.04E+00	4.85E+01	5.25E+01

## References

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A2:2019. London, BSI, 2019.

BSI. Environmental labels and declarations – Type III Environmental declarations – Principles and procedures. BS EN ISO 14025:2010 (exactly identical to ISO 14025:2006). London, BSI, 2010.

BSI. Environmental management – Life cycle assessment – Principles and framework. BS EN ISO 14040:2006. London, BSI, 2006.

BSI. Environmental management – Life cycle assessment – requirements and guidelines. BS EN ISO 14044:2006. London, BSI, 2006.

BS EN ISO 6946:2017 - Building components and building elements. Thermal resistance and thermal transmittance. Calculation methods

BRE Report BR 443: 2006 – Thermal performance testing

Azapagic, A., & Jeswani, H. K. (2016). Assessing the environmental sustainability of energy recovery from municipal solid waste in the UK. Waste Management, 47, 3-12.

Environmental Agency (2013). CHP Ready Guidance for Combustion and Energy from Waste Power Plants V1.0

Pre Consultants bv. SimaPro 9 LCA Software 2022. <http://www.pre-sustainability.com>

ecoinvent Centre. Swiss Centre for life Cycle Inventories. <http://www.ecoinvent.org>

Expanded Polystyrene (EPS) - British Plastic Federation (2024) - <https://www.bpf.co.uk/plastipedia/polymers/expanded-and-extruded-polystyrene-eps-xps.aspx>