Environmental Product Declaration

BREG EN EPD No.: 000058 Issue: 01

ECO EPD Ref. No.: 000190

This is to certify that this verified Environmental Product Declaration provided by:

Synthos S.A.

Is in accordance with the requirements of:

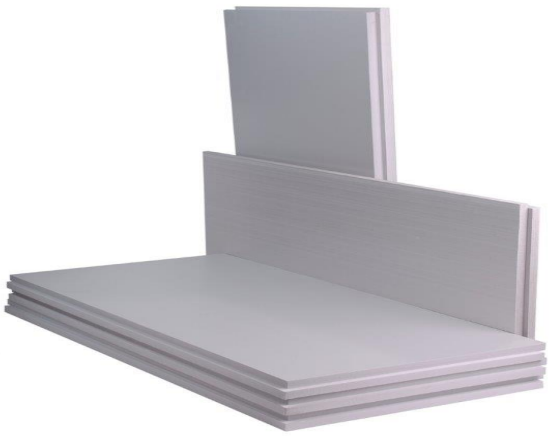
EN 15804:2012+A1:2013

This declaration is for:

Synthos XPS Insulation Board

Company Address

Synthos S.A.
ul. Chemików 1
Oswiecim
32-600



Signed for BRE Global Ltd	Derek Hughes Operator	15 June 2015 Date of this Issue
15 June 2015 Date of First Issue		14 June 2020 Expiry Date

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EPD verification and LCA details

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
Third party verifier[b]: **Victoria Blake**
a: Product category rules b: Optional for business-to-business communication; mandatory for business-to-consumer communication (see EN ISO 14025:2010, 9.4)

LCA Consultant	Verifier
Julia Barnard BRE Ltd. Bucknalls Lane Watford WD25 9XX www.bre.co.uk	Victoria Blake BRE Global Bucknalls Lane Watford WD25 9XX www.bre.co.uk

General Information

Summary

This environmental product declaration is for 1 square metre of Synthos XPS Insulation Board produced by Synthos S.A. at the following manufacturing facilities:

Synthos Kralupy a.s.
Otto Wichterleho Str. 810

Kralupy nad Vltavou
278 01
Czech Republic

Synthos Dwory 7 spolka z ograniczona
odpowiedzialnoscia Spolka Jawna
ul. Chemików 1

Oswiecim
32-600
Poland

This is a Cradle to gate with options EPD. The life cycle stages included are as shown below (X = included, MND = module not declared):

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	Transport	Waste processing	Disposal		Reuse, Recovery and/or Recycling potential
X	X	X	X	X	MND	MND	MND	MND	MND	MND	MND	MND	MND	X	X		X

Programme Operator

BRE Global, Watford, Herts, WD25 9XX, United Kingdom.
This declaration is based on the BRE Environmental Profiles 2013 Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013.

Comparability

Environmental declarations from different programmes may not be comparable if not compliant with EN 15804:2012+A1:2013. Comparability is further dependent on the product category rules used and the source of the data, e.g. the database. See EN 15804:2012+A1:2013 for further guidance.

Construction Product

Product Description

The product group evaluated in this study is Synthos XPS (Extruded Polystyrene) insulation boards produced at 2 facilities; Dwory, Poland and Kralupy, Czech Republic.

The group comprises the following products: Synthos XPS, Synthos XPS S, Synthos XPS Prime, Synthos XPS Prime G, Synthos XPS Prime S (both Dwory and Kralupy), and Synthos XPS G (Dwory only).

Technical Information

Property	Value	Unit
Colour	White/Silver	n/a
Fire Euroclass	E/F	n/a
Density Range	22-36	kg/m³
Thickness Range	20-160	mm
Thermal Conductivity	0.033	W/MmK
Water absorption	<0.7	%
Tensile Strength	100-400	kPa
Shear Strength	170-270	kPa
Compressive Stress	250-700	kPa
Bending Strength	300-600	kPa
Compressive Creep	100-250	kPa

Product Contents

Material/Chemical Input	%
Polystyrene	86
Carbon dioxide	5
Dimethyl ether	3
Fire Retardant	3
Additives & Pigments	3

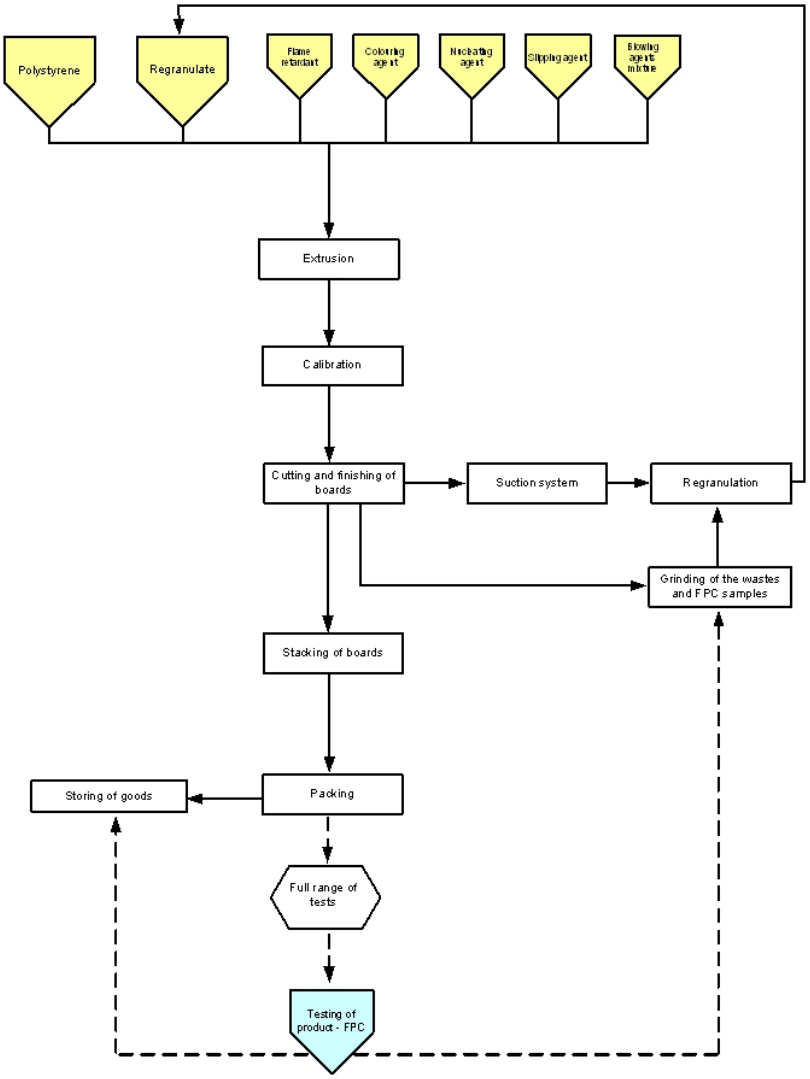
Manufacturing Process

The XPS insulation products are manufactured in a process of extrusion and foaming of polystyrene and finishing of panels into boards. Polystyrene resin is combined with additives including flame retardants, heated up, creating melted mixture. Blowing agents are added into the mixture including carbon dioxide. The mixture is then cooled, and finally foamed creating the foam mass, which is then extruded into shape. Edges of panels are finished into various finishings including half-lapped joints.

Waste material is regranulated and put back into the compound to be re-extruded in a continuous loop.

The finished product is then packaged and made ready for transport.

The process flow diagram is shown below:



Construction Installation

The construction stage assumes an average transport distance from the factory to the construction site, and an average installation wastage rate of 1% to reflect supply to order. The scenario also includes quantities for energy in the installation process, as well as ancillary materials required.

Use Information

Synthos XPS insulation board is suitable for a variety of uses, including use as perimeter insulation of walls and floors (also with very heavy load), insulation of strip footings, insulation of layer walls, insulation of places where cold bridges may appear, construction of partition walls, thermal insulation of inverted roofs, insulation of transportation routes and parking lots, exterior basement wall insulation, plaster base, and XPS sandwich panels. More information at: www.synthosxps.com

End of Life

The scenario assumes 50% of the material is recovered for recycling and 50% is sent to landfill disposal.

Within the recycling route there would be some impact for the manual sorting of XPS waste and removal of contaminants; there is also the potential for up to 1% of the waste to be incinerated for energy recovery; however the impacts associated with these activities have not been modelled in the calculated scenario.

Life Cycle Assessment Calculation Rules

Declared / Functional unit

1m² of 100mm thick Synthos XPS insulation board, i.e. 0.1m³ with an average density up to 36 kg/m³.

System boundary

The system boundary of the EPD is according to the modular approach as defined in EN 15804. This cradle to gate with options EPD includes the modules A1-A3, A4, A5, C3, C4 & D.

Data sources, quality and allocation

Data collection was by means of questionnaire. Manufacturing process data was for the 12 month period 01/04/2012 to 31/03/2013, across two manufacturing locations.

Specific foreground data derived from the XPS production processes is used in the production LCA for modules A1-A1. Generic data is used for all other upstream and downstream processes that are beyond the control of the manufacturer.

Modelling of the life cycle of Synthos XPS insulation board is performed using SimaPro 8 LCA software from PRé. All relevant background LCI datasets are taken from the Ecoinvent database v2.2. Where the creation of alternative datasets was required, these have been created using Ecoinvent datasets.

As far as we are aware all data sets are complete and conform to the system boundary and the criteria for the exclusion of inputs and outputs according to the requirements specified in EN 15804.

Data quality is in line with the requirements of EN 15804 and ISO 14025.

100% of production from both sites, Dwory and Kralupy were included in the LCA study; therefore no further allocation of resources was necessary. On site generation of electricity was taken into account and converted into an appropriate MWh value based on the means of generation.

A final representative model was created for Synthos XPS insulation board as a weighted average, based on the relative output of each specific product manufactured at either site, by mass.

Cut-off criteria

The inventory process in this LCA includes all data related to raw material, packaging and consumable items, and the associated transport to the manufacturing site. Process energy and water use, direct production waste and emissions to air and water are included. Scenarios have been developed to account for downstream processes such as demolition and waste treatment in accordance with the requirements of EN 15804.

LCA Results

(INA = Indicator not assessed, AGG = Aggregated, NA = Not Applicable)

Indicator	Unit	A1	A2	A3	A1-A3	A4	A5	B1	B2	B3
		Raw materials supply	Transport to factory	Manufacturing	Aggregateted	Transport to site	Construction - installation	Use	Maintenance	Repair
Environmental impacts per declared/functional unit										
GWP	kg CO_2 eq.	AGG	AGG	AGG	22.4	0.0553	0.992	INA	INA	INA
ODP	kg CFC 11 eq.	AGG	AGG	AGG	3.19E-05	5.23E-08	8.33E-05	INA	INA	INA
AP	kg SO_2 eq.	AGG	AGG	AGG	0.0812	0.000268	0.00537	INA	INA	INA
EP	kg $(PO_4)^{3-}$ eq.	AGG	AGG	AGG	0.00624	6.01E-05	0.000532	INA	INA	INA
POCP	kg C_2H_4 eq.	AGG	AGG	AGG	0.022	2.14E-05	0.0286	INA	INA	INA
ADPE	kg Sb eq.	AGG	AGG	AGG	1.68E-07	1.68E-11	9.42E-09	INA	INA	INA
ADPF	MJ eq.	AGG	AGG	AGG	479	0.722	42.4	INA	INA	INA
GWP = Global Warming Potential (Climate Change); ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels										
Resource use										
PERE	MJ	AGG	AGG	AGG	2.98	0.00112	0.439	INA	INA	INA
PERM	MJ	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
PERT	MJ	AGG	AGG	AGG	2.98	0.00112	0.439	INA	INA	INA
PENRE	MJ	AGG	AGG	AGG	476	0.709	42.6	INA	INA	INA
PENRM	MJ	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
PENRT	MJ	AGG	AGG	AGG	476	0.709	42.6	INA	INA	INA
SM	kg	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
RSF	MJ	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
NRSF	MJ	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
FW	m^3	AGG	AGG	AGG	0.283	6.68E-05	0.011	INA	INA	INA
PERE = Use of renewable primary energy excluding renewable primary energy resources 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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water										
Waste to disposal										
HWD	kg	AGG	AGG	AGG	0.589	9.77E-06	0.119	INA	INA	INA
NHWD	kg	AGG	AGG	AGG	0.000323	9.74E-08	0.0162	INA	INA	INA
TRWD	kg	AGG	AGG	AGG	0.000202	1.40E-05	0.000652	INA	INA	INA
RWDHL	kg	AGG	AGG	AGG	2.32E-05	1.83E-06	8.38E-05	INA	INA	INA
HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; RWDHL = Radioactive waste disposed (high-level nuclear waste)										
Other output flows										
CRU	kg	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
MFR	kg	AGG	AGG	AGG	0.0063	INA	6.30E-05	INA	INA	INA
MER	kg	AGG	AGG	AGG	INA	INA	INA	INA	INA	INA
EE	MJ	AGG	AGG	AGG	1.27	0.00013	0.355	INA	INA	INA
CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Export energy										

LCA Results (continued)

(INA = Indicator not assessed, AGG = Aggregated, NA = Not Applicable)

Indicator	Unit	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse/ Recovery/ Recycling potential
Environmental impacts per declared/functional unit										
GWP	kg CO_2 eq.	INA	INA	INA	INA	INA	INA	INA	0.199	-4.7
ODP	kg CFC 11 eq.	INA	INA	INA	INA	INA	INA	INA	1.88E-08	-1.16E-05
AP	kg SO_2 eq.	INA	INA	INA	INA	INA	INA	INA	6.22E-05	-0.0175
EP	kg $(PO_4)^{3-}$ eq.	INA	INA	INA	INA	INA	INA	INA	4.92E-05	-0.00139
POCP	kg C_2H_4 eq.	INA	INA	INA	INA	INA	INA	INA	4.36E-05	-0.005
ADPE	kg Sb eq.	INA	INA	INA	INA	INA	INA	INA	6.05E-11	-9.88E-08
ADPF	MJ eq.	INA	INA	INA	INA	INA	INA	INA	0.108	-121
GWP = Global Warming Potential (Climate Change); ODP = Ozone Depletion Potential; AP = Acidification Potential for Soil and Water; EP = Eutrophication Potential; POCP = Photochemical Ozone Creation; ADPE = Abiotic Depletion Potential – Elements; ADPF = Abiotic Depletion Potential – Fossil Fuels										
Resource use										
PERE	MJ	INA	INA	INA	INA	INA	INA	INA	0.00465	0.13
PERM	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
PERT	MJ	INA	INA	INA	INA	INA	INA	INA	0.00465	0.13
PENRE	MJ	INA	INA	INA	INA	INA	INA	INA	0.129	-119
PENRM	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
PENRT	MJ	INA	INA	INA	INA	INA	INA	INA	0.129	-119
SM	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
RSF	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
NRSF	MJ	INA	INA	INA	INA	INA	INA	INA	INA	INA
FW	m^3	INA	INA	INA	INA	INA	INA	INA	2.79E-05	-0.0625
PERE = Use of renewable primary energy excluding renewable primary energy resources 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 resources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Net use of fresh water										
Waste to disposal										
HWD	kg	INA	INA	INA	INA	INA	INA	INA	1.80	0.0286
NHWD	kg	INA	INA	INA	INA	INA	INA	INA	1.13E-07	-1.38E-04
TRWD	kg	INA	INA	INA	INA	INA	INA	INA	2.79E-06	0.000109
RWDHL	kg	INA	INA	INA	INA	INA	INA	INA	3.33E-07	8.14E-06
HWD = Hazardous waste disposed; NHWD = Non-hazardous waste disposed; TRWD = Total Radioactive waste disposed; RWDHL = Radioactive waste disposed (high-level nuclear waste)										
Other output flows										
CRU	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
MFR	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
MER	kg	INA	INA	INA	INA	INA	INA	INA	INA	INA
EE	MJ	INA	INA	INA	INA	INA	INA	INA	0.00226	-0.556
CRU = Components for reuse; MFR = Materials for recycling; MER = Materials for energy recovery; EE = Export energy										

Scenarios and Additional Technical Information

Module A4 – Transport to the building site				
Vehicle Type	**Fuel Consumption (L/km)**	**Distance (km)**	**Capacity Utilisation (%)**	**Density Of Product (kg/m³)**
Lorry 16-32t	0.302	100	29	36

Module A5 - Installation in the building			
Parameter	**Description**	**Unit**	**Value**
Ancillary materials for installation	Bituminous adhesive	kg/m²	1.5
Ancillary materials for installation	Cap nails, 4pcs at approx. 5g each	g/m²	20
Energy Use	Electricity	kWh/m²	0.03
Waste materials from installation wastage	Total amount of material wasted during installation	%	1
Waste materials sorted on site for recycling, energy recovery, disposal (specified by route)	Installation waste sorted for recycling	kg	0.018
Waste materials sorted on site for recycling, energy recovery, disposal (specified by route)	Installation waste sorted for disposal to landfill	kg	0.018

End-of-life modules – C1, C3, and C4			
Parameter	**Description**	**Unit**	**Value**
Waste for recycling	Waste XPS Recovered	%	50
Waste for final disposal	Waste XPS sent to Landfill	%	50

Module D – Reuse/Recovery/Recycling Potential

The benefits and loads for module D have been calculated based on the following scenario. Where 50% of a wasted XPS insulation board (3.6 kg x 0.5 = 1.8 kg) is sent to a recycling facility with a 95% recycling efficiency, the output of the recycling process produces 1.71 kg (i.e. 0.95 x 1.8 kg) recycled polystyrene which is available for use in a new process, and the remaining 0.09 kg sent to landfill disposal.

The recycling process incorporates the energy required for cutting, melting, degassing and pelletizing the waste polystyrene (based on the specifications of ARTEC MODUL 240).

The recycled polystyrene can be substituted for virgin polystyrene as a 1:1 replacement, therefore avoiding 1.71 kg of virgin material.

Interpretation

For the weighted average Synthos XPS insulation board (Figure 1), the findings from the LCA study show that for the A1-A3 production stage the environmental impacts arise primarily from the polystyrene input material and the fuel sources chosen to represent the on-site energy generation for both sites, Dwory and Kralupy.

For all impact categories, except ODP and POCP, the majority of the impacts are associated with the production stage A1-A3 (Figure 2). For ODP and POCP, a greater proportion of the impacts arise from the A5, construction installation stage and is associated with the bituminous adhesive; the proportions are emphasised however due to the small absolute values for these categories.

There is some energy use associated with the crushing and heating of the waste XPS, preparing it for use in a new system. The output is a recycled polystyrene material, which can be substituted 1:1 for the virgin material that would be required to produce further XPS and other polystyrene products. This is modelled in module D.

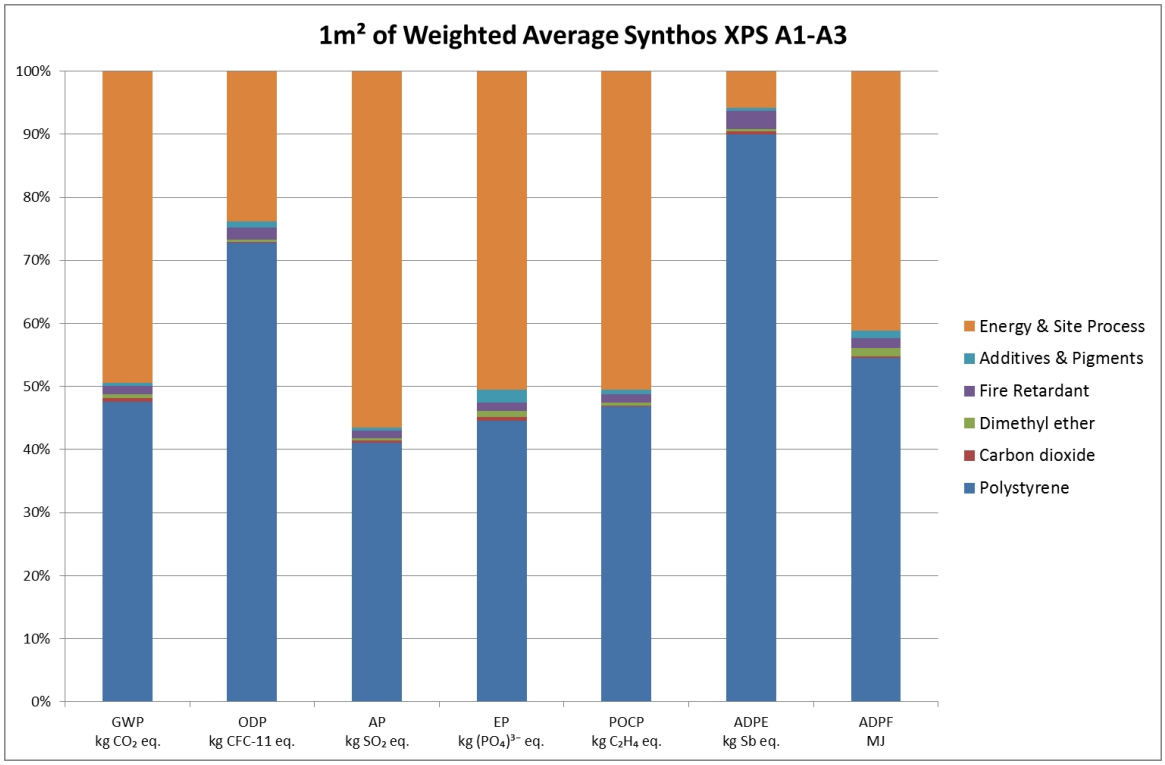
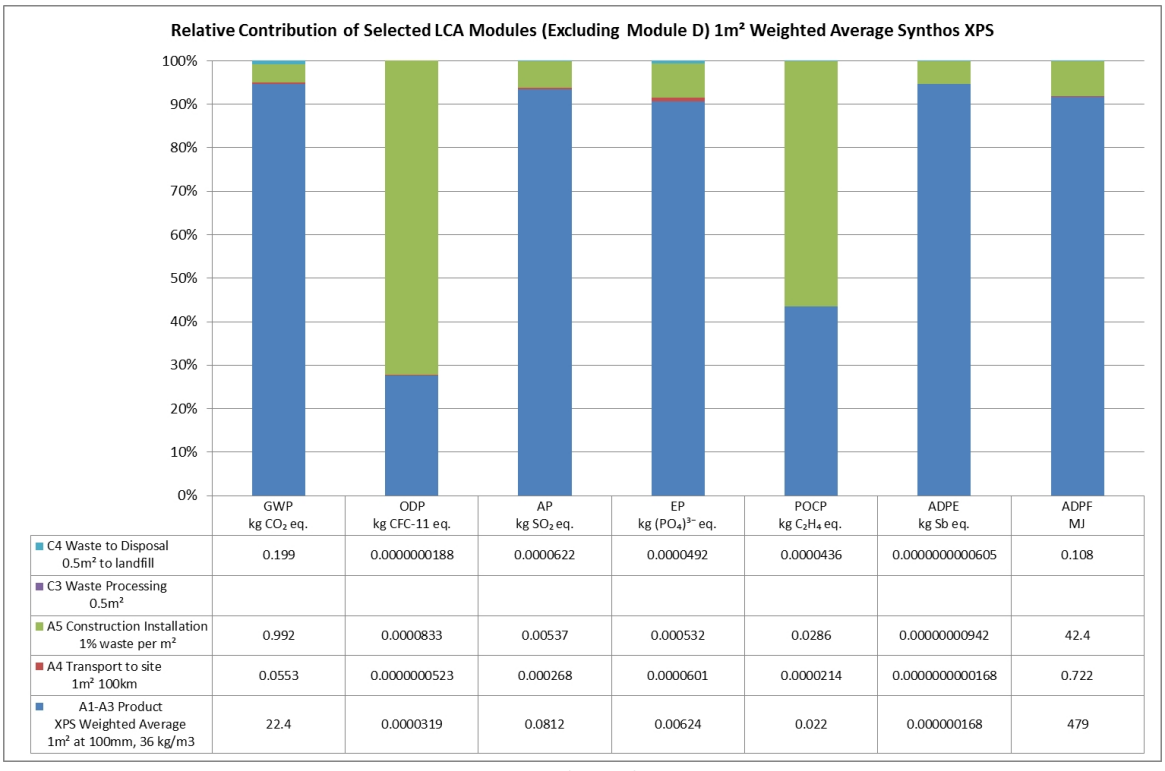


Figure 1



	GWP kg CO_2 eq.	ODP kg CFC-11 eq.	AP kg SO_2 eq.	EP kg $(PO_4)^{3-}$ eq.	POCP kg C_2H_4 eq.	ADPE kg Sb eq.	ADPF MJ
C4 Waste to Disposal 0.5m² to landfill	0.199	0.0000000188	0.0000622	0.0000492	0.0000436	0.0000000000605	0.108
C3 Waste Processing 0.5m²							
A5 Construction Installation 1% waste per m²	0.992	0.0000833	0.00537	0.000532	0.0286	0.00000000942	42.4
A4 Transport to site 1m² 100km	0.0553	0.0000000523	0.000268	0.0000601	0.0000214	0.0000000000168	0.722
A1-A3 Product XPS Weighted Average 1m² at 100mm, 36 kg/m3	22.4	0.0000319	0.0812	0.00624	0.022	0.000000168	479

Figure 2

Sources of additional information

BRE Global. BRE Environmental Profiles 2013: Product Category Rules for Type III environmental product declaration of construction products to EN 15804:2012+A1:2013. PN 514. Watford, BRE, 2014.

BSI. Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products. BS EN 15804:2012+A1:2013. London, BSI, 2013.

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.

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ecoinvent Centre. Swiss Centre for Life Cycle Inventories. http://www.ecoinvent.org

Technical Data Sheets: Synthos XPS G, Synthos XPS Prime G, Synthos XPS Prime S, Synthos XPS Prime, Synthos XPS S, & Synthos XPS. December 2013.

ARTEC machinery GmbH, Offer Number 13-A029b, Dated 10.04.2014, Plastics Recycling Plant, Type MODUL 240, technical specifications.