Environmental Product Declaration: GREENGirt

In accordance with EN 15804 and ISO 14025

Report for Advanced Architectural Products

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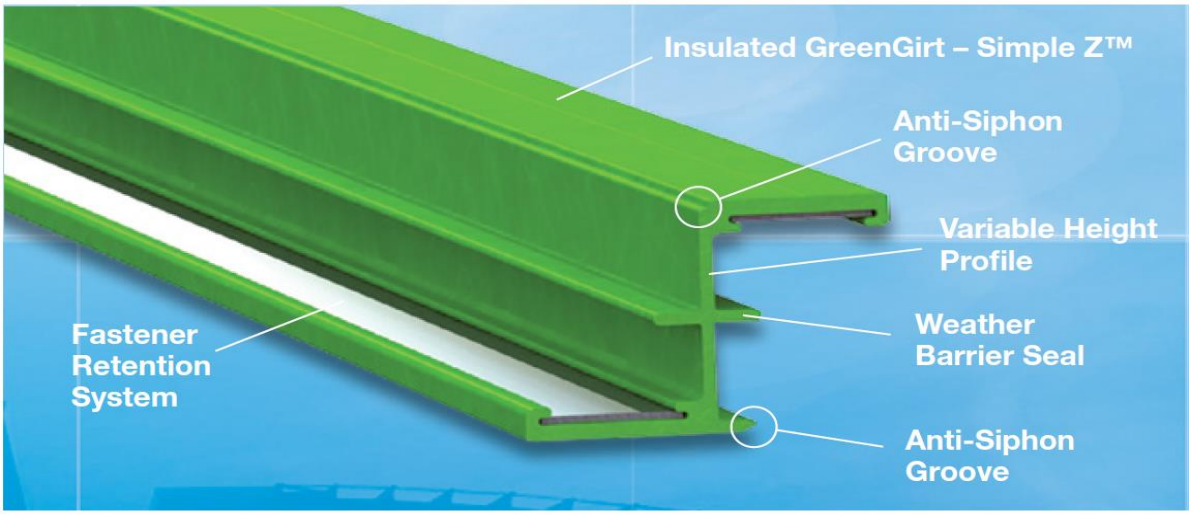
Registration number: S-P-01552

ED 12241 | Issue Number 1 | 11/11/2019

1 General information

This EPD concerns the GREENGirt, a composite z-shaped girt (CPC: 3712[1]) that joins the building cladding and insulation to a building structure. It predominantly consists of fibreglass, with metal inserts and some use of resins. Its intended use is between the building structure and the building cladding.

Figure 1: GREENGirt profile



1.1 Manufacturer

The producer is Advanced Architectural Products (AAP). The GREENGirt production facility is located at 3393 South M-40, Building #10, Hamilton, Michigan, 49419. Further information about AAP and the GREENGirt is available via AAP's website: www.smartcisystems.com

Table 1: Manufacturer details

Manufacturer	Site Function	Site address
Advanced Architectural Products	Manufacturing via pultrusion	3393 South M-40, Building #10, Hamilton, Michigan, 49419

1.2 Specification of declaration

This section outlines the key specification of the declaration. It was prepared by Ricardo on behalf of AAP. The declaration is issued by AAP. Zach Kukkonen (Design Engineer) is the responsible person. Contact information is included in Table 3.

Table 2: PCR details

Programme:	International EPD® System3
PCR	Construction products and construction services (2012) v2.3
Date of issue:	2019-11-13
Validity date:	2024-11-11
EPD owner:	Advanced Architectural Products
Registration number:	S-P-01552

[1] Central Product Classification code from: https://unstats.un.org/unsd/classifications/unsdclassifications/cpcv21.pdf

Table 3: Table of key contacts

Person	Role	Company	Email address
Zach Kukkonen	Design Engineer	Advanced Architectural Products	zach.k@GREENGirt.com
Sam Hinton & Simon Gandy	EPD Author	Ricardo Energy & Environment	sam.hinton@ricardo.com & simon.gandy@ricardo.com
Robbie Epsom	EPD Verifier	WSP	Robbie.Epsom@wsp.com
	Programme operator	EPD International[2]	www.environdec.com

Further information can be found through the following contact details for AAP;
Address: 959 Industrial Drive, Allegan, Michigan, USA, 49010
Telephone: 269-355-1818
Fax: 866-858-5568
Email: info@smartcisystems.com / corporate@smartcisystems.com
Website: www.smartcisystems.com

1.2.1 Demonstration of verification

This EPD has been prepared in accordance with the requirements of ISO 14025 and EN 15804. It concerns the production, installation and disposal of the GREENGirt, a composite z-shaped girt that joins the building cladding and insulation to a building structure. The declaration corresponds to 1 Lft of GREENGirt and is based on an average length of 8Lft.

This EPD may not be comparable with EPDs of other construction products if they do not comply with EN 15804. Environmental product declarations within the same category from different programs may not be comparable.

Table 4: Demonstration of verification

CEN standard EN 15804 serves as the core PCR[a]	
Independent verification of the declaration, according to ISO14025	
☐ Internal	✓ External
Third party verifier: [b]	Robbie Epsom, an approved EPD verifier working for WSP
[a] Product Category Rules	
[b] Optional for business-to-business communication; mandatory for business-to-consumer communication	

[2] *EPD International AB, Valhallavägen 81, 114 27 Stockholm, Sweden*

1.3 Scope of declaration

Table 5 outlines the key specifications for this EPD.

Table 5: Key specifications of the EPD.

Specification	Description
Scope	Cradle-to-gate with options
System boundary	Covering product stages A1 – C4, covering raw material extraction, transportation, manufacturing, transportation, installation, use, maintenance, repair, replacement, refurbishment, operational-energy-use, operational water use, de-construction / demolition, transport, waste processing and disposal.
Reference service life	50 years.[3]
Allocations	Calculations cover a minimum of 95% of total inflows to the system boundary.
Time period	All product and manufacturing data were collected from AAP covering the period January 2018- December 2018.
System boundary (geospatial)	There is no geospatial boundary; all impacts are considered regardless of physical location. Standard US grid emissions and impact factors are used for all consumption of electricity at the manufacturing location.
Declared unit	One linear foot (*1Lft*) of GREENGirt
Data	Ecoinvent 3.5 processes (as contained in SimaPro 9)

[3] Based on assumed building lifetime of 50 years. The GREENGirt is anticipated to last longer than building RSL, however no explicit data available.

2 Product specification

2.1 Product components and typical use

The GREENGirt is a composite z-shaped girt that joins the building cladding and insulation to a building structure. The manufacturer is AAP as stated in Table 1. It predominantly consists of fibreglass, with metal inserts and some use of resins. The upstream material breakdown is shown in Table 6 below.

Table 6: Material content per 1Lft of product

Material	Quantity g / 1Lft
Fiberglass	226
Galvanized steel	117
Polyester	82.4
Alumina trihydrate	65.4
Styrene	15.8
Stainless steel	8.45
Colorant	2.66
Lubricant	1.91
Catalyst	1.14

3 Scope of inventory

3.1 Lifecycle stages considered

Figure 2 shows the key process flows involved in the manufacture, use and disposal of the GREENGirt.

Figure 2: System boundary diagram

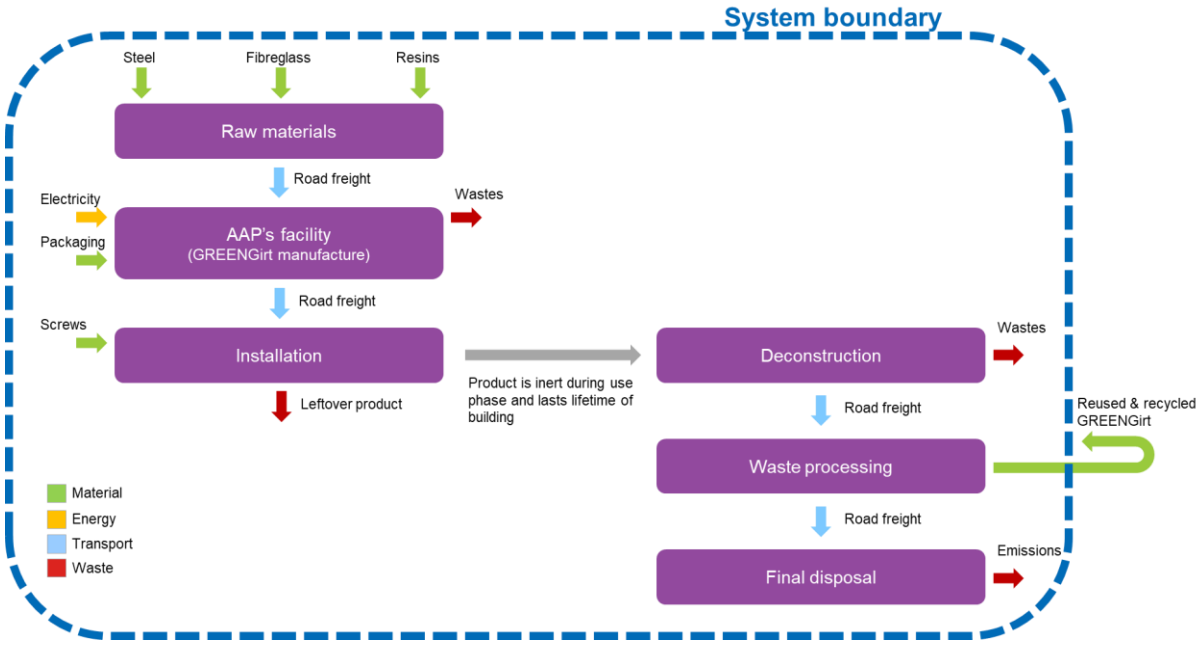


Table 7 below states the modules assessed within this declaration.

Table 7: Description of system boundary. MNA indicates 'module not assessed'.

Product Stage				Construction Stage		Use Stage							End-of-life stage			BLB*
Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction / demolition	Transport	Waste processing	Disposal	Reuse-recovery
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	MNA

3.2 A1 - Raw materials

The GREENGirt primarily consists of fibreglass, this is formed into the GREENGirt via pultrusion. Rolls of fibreglass are pulled through a resin bath, heated to harden and then cut to shape where they are combined with metal inserts. Table 8 details the bill of raw materials used in the GREENGirt manufacturing process. Note this is inclusive of raw materials lost during cutting that do not make it into the final product.

Table 8: GREENGirt bill of materials

Material	Value / 1Lft
Fiberglass	235
Galvanized steel	122
Polyester	86
Alumina trihydrate	68
Styrene	16
Stainless steel	9
Colorant	3
Lubricant	2
Catalyst	1
Mould release	1

3.3 A2 - Transport

Raw materials are transported to AAP via road. This was modelled using suppliers' distance to AAP's facility and the ecoinvent process for '*Transport, freight, lorry, unspecified {RoW}| market for transport, freight, lorry, unspecified | Cut-off, U'.*

3.4 A3 - Manufacturing

As described in section 3.2 above, AAP produces the GREENGirt through a process of pultrusion, where fibreglass is continually pulled into the process and bathed in resin. Once produced, the GREENGirt is packaged ready for transport. Table 9 below details the electricity, packaging and waste flows per declared unit.

Table 9: Life cycle inventory for Module A3

Material	Value / 1Lft	Units
Grid electricity	0.214	kWh
Cardboard (waste packaging)	7.47	g
Plastic (waste packaging)	1.87	g
GREENGirt waste	20.6	g
Plastic shrink wrap	0.0973	g
Plastic band	0.0265	g

3.5 A4 - Transport

The GREENGirt is transported to installation via a variety of transport modes, but predominantly road freight. A small number of products are transported via ferry. Table 10 below details typical transport modes.

Table 10: Mode of transport from AAP to installation site

Transport process	Value / 1Lft
Intermodal (train)	10.00%
Ferry	0.20%
Conestoga	29.93%
Flatbed	29.93%
Van truck	29.93%

3.6 A5 - Installation

The GREENGirt is fixed to a building's structure with screws and a screwdriver. Table 11 below details the electricity requirements for screwdrivers, screws and packaging waste disposed of at site. It is assumed that this waste is landfilled.

Table 11: Life cycle inventory for Module A5

Description	Value / Lft	Units
Electricity (screwdriver)	9.08	Wh
Screws	8.98	g
Plastic shrink wrap (waste)	0.0973	g
Plastic bands (waste)	0.0265	g
Waste GREENGirt	5.22	g

3.7 B1-B7 – Operational lifecycle stages

The GREENGirt does not consume any energy or water while it is in use. It has no moving parts and requires no maintenance or repair. Since it is connected to the building's structure, it is only removed during demolition. Consequently, the GREENGirt is considered inert through modules B1 to B7 and, therefore, these modules were not modelled.

3.8 C1 - Deconstruction

It is assumed that the same amount of electricity required to install the GREENGirt is required to remove it during deconstruction.

3.9 C2 – Transport

Once removed, it is assumed screws will be transported to a metal recycling facility and the GREENGirt will either be used on a new construction project or sent back to AAP for recycling. A generic ecoinvent process for steel recycling was used to derive transport distances for the screws, while the A4 transport distances were used to model the GREENGirt's transport.

3.10 C3 – Waste processing

It is assumed that the metal screws are recycled and the GREENGirt is either re-used or recycled. Table 12 shows the amount sent to each fate per declared unit.

Table 12: Life cycle inventory for Module C3

Process	Value / 1Lft
Screws	9.18 g
GREENGirt for recycling	264 g
GREENGirt for reuse	264 g

4 LCA results

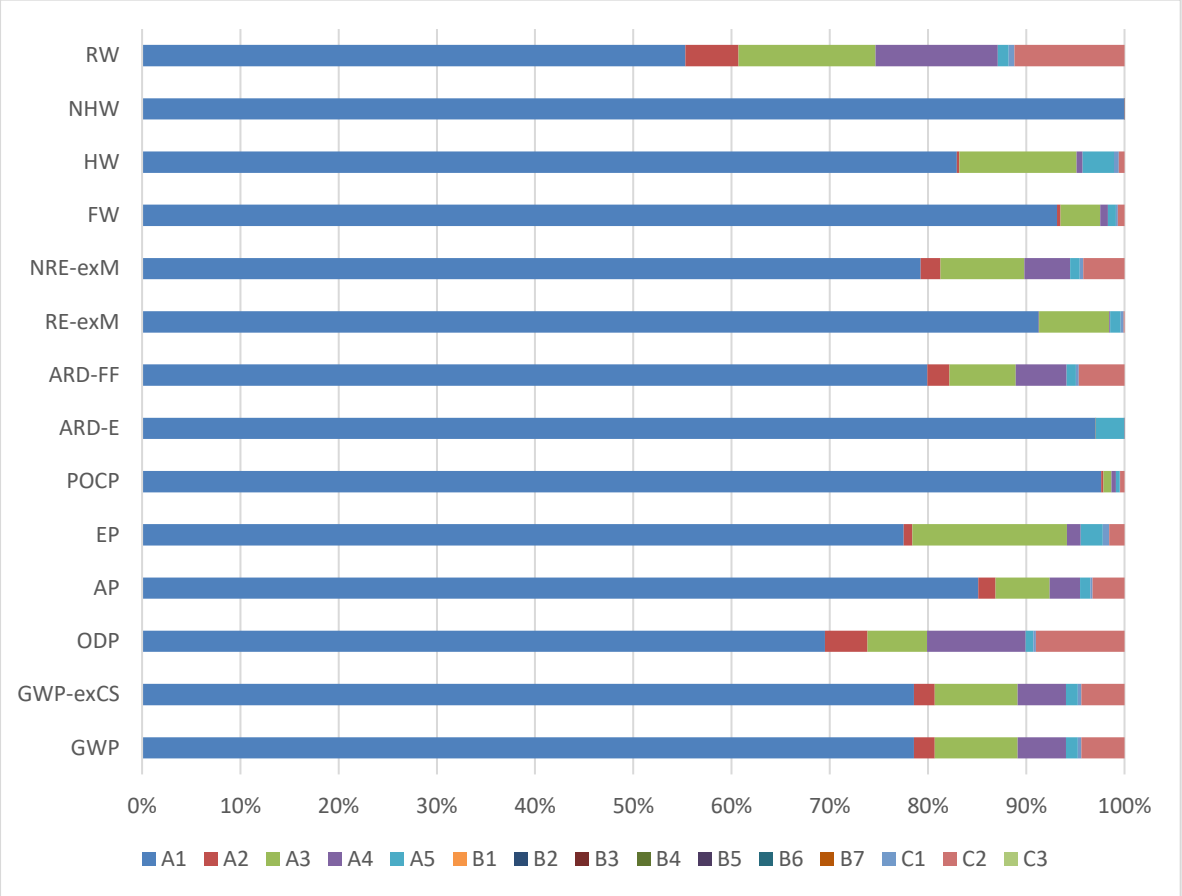
Table 13 below lists the impacts associated with the manufacture, transport and disposal of 1 Lft of GREENGirt for each impact category.

Table 13: Environmental, energy use and resource use impacts per 1Lft of GREENGirt

Indicator	Units	Value / 1Lft
GWP	kg CO_2 equivalents, GWP_{100} method	1.73
GWP-exCS	kg CO_2 equivalents, GWP_{100} method	1.73
ODP	kg CFC 11 equivalents	0.000000154
AP	SO_2 equivalents	0.00806
EP	kg PO_4--- eq	0.00336
POCP	kg C_2H_4 eq	0.00234
ARD-E	kg Sb equivalents	0.00000696
ARD-FF	MJ net calorific value	23.2
RE-exM	MJ, net calorific value	1.78
RE-M	MJ, net calorific value	0
T-RE	MJ, net calorific value	1.78
NRE-exM	MJ, net calorific value	27.5
NRE-M	MJ, net calorific value	0
T-NRE	MJ, net calorific value	27.5
SM	kg	0.039
RSF	MJ, net calorific value	0
NRSF	MJ, net calorific value	0
FW	m^3	0.0156
HW	kg	0.0000363
NHW	kg	0.0118
RW	kg	0.0000692
CR	kg	0.264
MR	kg	0.263
MER	kg	0
EE	MJ per energy carrier	0

Figure 3 illustrates the impact per life cycle module.

Figure 3 - Environmental, energy, water and waste impacts per 1Lft including C4 (landfill)



The results have shown that the greatest impact occurs within the upstream raw material stage, which is many times greater than the next highest contribution from manufacturing. It is notable that AAP's product is made from fibreglass to prevent thermal bridging.

Sensitivity analysis was performed to model a range of end-of-life scenarios. Within the LCA study, it was discovered that the re-use of the product produced significant benefits as the greatest impacts that occur within module A1 are largely offset. While this is believed to be a realistic assumption these benefits have not been included in this EPD since a GREENGirt is yet to reach the end of its reference service life.

5 Data assumptions

Table 14: Data assumptions

Aspect	Detail of assumption
A2 – transport	AAP provided the location of each of its tier 1 suppliers. Ricardo used desktop research to obtain transport distances, these are stated in
Electricity use	All electricity use within the system is assumed to use US grid electricity. This is modelled using ecoinvent's process 'electricity, medium voltage US'. This dataset has been extrapolated from year 2015 to the year of the calculation (2018).
A4 transport	AAP provided the average trip distance from its facility to customers. AAP estimated that 10% of these journeys were undertake by rail freight with the remainder via a mix of road freight options. A small amount included a ferry trip. Ricardo has assumed that 1% of journeys include a ferry leg lasting approximately 2500km (Oregon/Washington coast to Anchorage, Alaska).
A5 installation	The GREENGirt is fixed to buildings using screws. Ricardo has assumed this is undertaken with a 5.5 kW electric screwdriver and 10 screws are fixed per minute.
C1 removal	It is assumed that the GREENGirt is removed from buildings at end of life using an electric screwdriver under the same assumptions stated above.
C2 transport	The precise fate of the GREENGirt at end of life is uncertain. It is likely it will be re-used on a new project locally, however Ricardo has modelled all fates' transport burden as if it is shipped back to AAP, since this represents the longest transport journey.
C3 waste processing	It is assumed that the GREENGirt is re-used and recycled at end of life. However, a landfill scenario is performed in sensitivity analysis.
Cut-off criteria	Primary data are based on precise amounts recorded by James Jones. Upstream material processes are based on the average values for such processes given in the ecoinvent database. Contributions cut-off from ecoinvent 3 processes used within this model have been excluded. Production and maintenance of equipment is not included in the LCA except for frequently consumed items included in the inventory if they meet the data 1% cut-off rule (for example lubricant). All energy use within AAP's facility is included.
Data sources/references	Ecoinvent 3.5 and primary data supplied by AAP.
Averages	This LCA reports impacts per declared unit of one linear foot *(1Lft)* of GREENGirt, of an average size. The average length and weight of each GREENGirt product is 8ft and 9.6lbs.
Unit length	Feet (ft) has been used as the declared unit since the GREENGirt is sold primarily in the US using imperial measurements. The conversion factor is provided below.
Conversion of feet to metres (imperial to metric)	1ft = 0.305m

6 References

AAP has provided primary data covering modules A1, A2 and A3, covering January 2018 to December 2018 data. The bill of materials data for A1 did not balance with the amount of product sold by AAP in 2018. This is due to stock considerations concerning products manufactured in 2018 consuming materials purchased in previous periods. Consequently, the primary A1 data has been scaled up to balance 2018 sales. AAP provided a weighted average for A4 data. A5 data was estimated based on each product's requirements, for instance the number of screws needed per product. The GREENGirt is inert during the use phase, and is only removed from the building during demolition. Consequently there are no relevant flows for modules B1-B7. Primary data was not available for modules C1-C4; these values have been reverse-calculated from the installation flows and assumed fates for the GREENGirt's core materials.

The flows described in sections 3.2 to 3.10 were modelled in SimaPro 9 using ecoinvent 3.5 processes using the cut-off methodology. For the full list of processes and resources used, please to refer to sections 4 and 5 of the more detailed LCA report, which can be obtained by contacting AAP.

Glossary

AP	Acidification of land and water
ARD-E	Depletion of abiotic resources (elements)
ARD-FF	Depletion of abiotic resources (fossil)
CR	Components for re-use
EE	Exported energy
EP	Eutrophication potential
FW	Use of net fresh water
GWP	Global warming potential
GWP-exCS	Global warming potential (excluding carbon storage)
HW	Hazardous waste
MER	Materials for energy recovery
MR	Materials for recycling
NHW	Non-hazardous waste
NRE-exM	Use of non- renewable primary energy excluding non- renewable primary energy resources used as raw materials
NRE-M	Use of non- renewable primary energy resources used as raw materials
NRSF	Use of non-renewable secondary fuels
ODP	Ozone depletion
POCP	Photochemical ozone creation potential
RE-exM	Use of renewable primary energy excluding renewable primary energy resources used as raw materials
RE-M	Use of renewable primary energy resources used as raw materials
RSF	Use of renewable secondary fuels
RW	Radioactive waste
SM	Use of secondary material
T-NRE	Total use of non- renewable primary energy resources (primary energy and primary energy resources used as raw materials)
T-RE	Total use of renewable primary energy resources (primary energy and primary energy resources used as raw materials)

The Gemini Building
Fermi Avenue
Harwell
Didcot
Oxfordshire
OX11 0QR
United Kingdom
t: +44 (0)1235 753000
e: enquiry@ricardo.com

ee.ricardo.com