

Environmental Product Declaration



In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Oryza Building Green Technology (BGT)

from

Bronx Holdings Pte Ltd

BRONX

Programme:

EPD registered through the fully aligned regional hub:

Programme operator:

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General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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Accountabilities for PCR, LCA and independent, third-party verification
Product Category Rules (PCR)
Standards: <i>EN 15804:2012+A2:2019/AC:2021 and EN 16783:2017</i>
Product Category Rules (PCR): <i>EPD International PCR 2019:14 Construction products v1.3.2</i> <i>EPD International c-PCR-005 Thermal insulation products (EN 16783:2017)</i>
PCR review was conducted by: <i>The Technical Committee of the International EPD® System</i>
Life Cycle Assessment (LCA)
LCA accountability: <i>Jiliu WU, CIRS & Daqi Wang, CIRS Group, China</i> 
Third-party verification
Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: <input checked="" type="checkbox"/> EPD verification by individual verifier Third-party verifier: <i>Vito D'Incognito</i> Approved by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: Bronx Holdings Pte Ltd, Singapore

Contact: Choon-Ping Lim

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Description of the organisation: Bronx Holdings is a technology leader and inventor of the Oryza Aerogel range of thermal insulation solutions. Oryza Aerogel is internationally patented and used in a wide range of applications across multiple industries.

Bronx Holdings Pte Ltd, part of Bronx Group of Companies, a world leader in thermal insulation solutions offers Oryza Aerogel. We are committed to provide redefining capabilities using world class manufacturing facilities with high performance and quality assurance catered to customer needs.

The product range offers wide applications in fire technology, thermal management, acoustic and CUI management.

Product-related or management system-related certifications: ISO 9001:2015 - Quality Management System

Name and location of production site: East of Yin Hai Road and North of Qiushi Road, Economic Development Zone, Xiangshui County, Yancheng City, Jiangsu Province, China
ISO 9001 and 14001

Product information

Product name: Oryza Building Green Technology (BGT)

Product description: Oryza BGT products offer insulating solution. The non-combustion composite panel has fire resistance Class A1 according to the standard EN 13501-1:2018. Oryza Technology products are completely inorganic and so retain their strength, superior durability, and thermal properties in many working environments without the generation of low dust technology.

The product has a wide application in pitched roofs, flat roofs, balcony, terraces, facades, doors, windows, interior insulation and ceilings of basements or underground garages.

UN CPC code: 37129 Voiles, webs, mats, mattresses, boards and other articles of glass fibres, except woven fabrics

Other codes for product classification: HS code 7019699090

Geographical scope: China for modules A1-A3 (product stage), Europe for modules A4/A5/B/C/D.

LCA information

Declared unit: 1m² of Oryza BGT weighted 1.8kg for a thickness of 10mm with R value of 0.5m²*K/W is adopted as the declared unit.

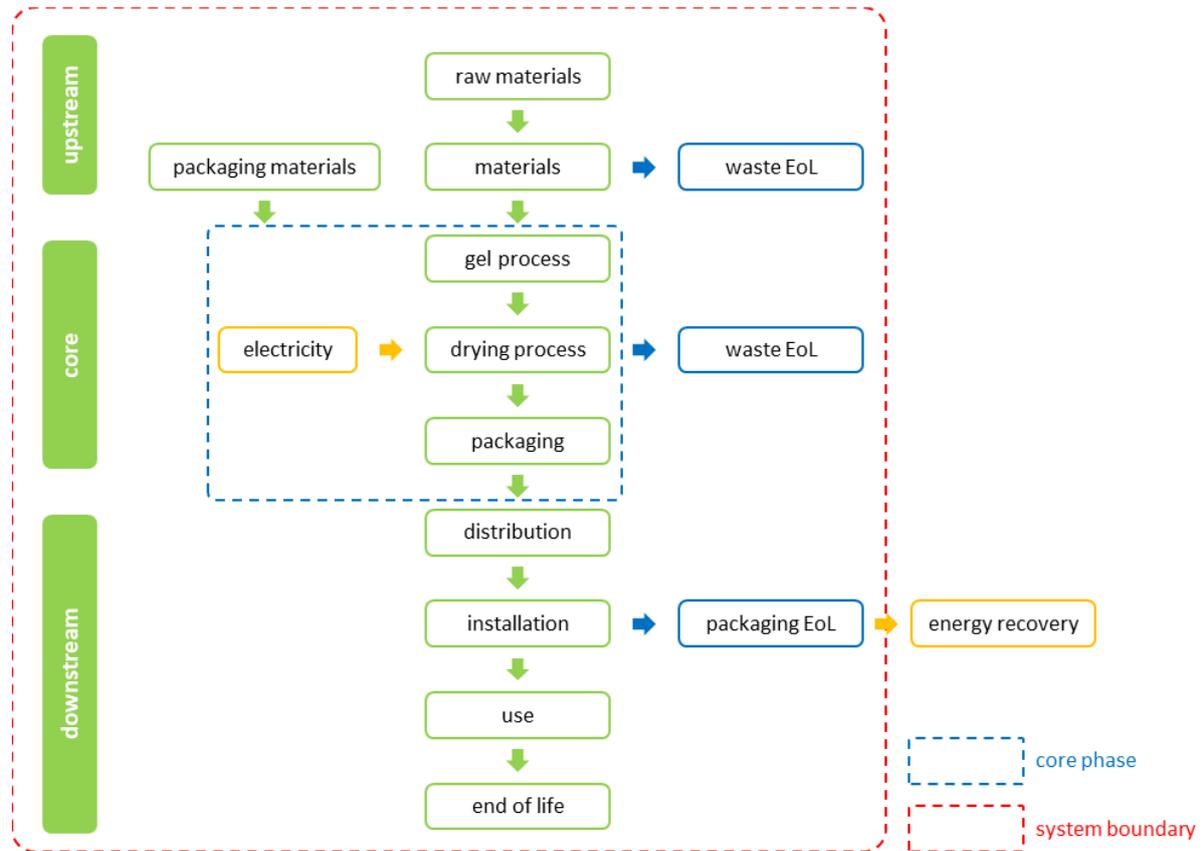
Reference service life: As long as the lifetime of the building equipment in which it is used, at least 50 years.

Time representativeness: 2022/01/01-2022/12/31

Database(s) and LCA software used: ecoinvent 3.9.1 with SimaPro 9.5.0.0

Description of system boundaries: According to section 2.2.2 in PCR 2019:14 construction products version 1.3.2, EPD type c) is chosen: cradle to grave and module D (A + B + C + D).

System diagram:



More information:

Product stage (A1-A3)

- The main raw materials for producing BGT are organosilicon A, organosilicon B and glass fibre needle punched felt. Only organosilicon A is already exists in the database while the others are not. Auxiliary materials used are catalyst, ethanol as solvent, lubricating oil, heat transfer oil and activated carbon.
- The emission factor of organosilicon A in ecoinvent database is used to describe the upstream process of organosilicon A production.
- For organosilicon B and glass fibre needle punched felt, specific production data are provided by the suppliers. Raw materials, transportation, manufacturing energy consumption and waste output are considered to better describe the upstream phase.
- The main raw materials for producing organosilicon B are trichloro(methyl)silane, sodium ethanolate, ethanol, PE winding film, IBC tank. The production of organosilicon B requires the consumption of electricity, steam, and will produce hazardous waste, waste water, exhaust gas.
- The main raw materials for producing glass fibre needle punched felt are glass fibre, paper tube, PE woven bag, plastic bag. The production of glass fibre needle punched felt requires the consumption of electricity, and will produce solid waste.
- Due to lack of waste transportation distance, a default value of 100km according to PEFCR Guidance is adopted.
- Manufacturing of BGT takes place at plant in Jiangsu, China. All the transport of raw materials (module A2) are based on the site-to-site distance from e-map. EURO4 category diesel vehicles in different lorry sizes are chosen in this study based on completed questionnaire.

- The electricity and water consumption and waste treatment are considered in manufacturing (module A3), related regional emission factors in ecoinvent v3.9.1 are chosen in this study. No other energy is involved and all waste will be incinerated.
- The finished BGTs are packaged with PE bubble film, PE winding film, and wooden pallets before sold overseas.

Construction process stage (A4-A5)

- The products are first transported to the local Qingdao Port with a distance of 290km with a EURO IV, 3.5-7.5 tons lorry. Then the scenarios in PEFCR are used to model the cross border transportation and EU domestic transportation.
- The cross border transportation is assumed as 18000km while the EU port to destination is assumed as 250km.
- In this study, installation accessories are not considered since installation of BGT is described without any fixing materials other than the wall construction itself. However, the installation situation may change according to the actual scenario. Only a 2% installation loss and end-of-life of packaging waste are considered in this phase.
- All the loss is transported to landfill and the packaging is divided into plastic and wood, the treatment rates are from Eurostat - European Union - 27 countries (from 2020). A default transportation distance of 100km in PEFCR Guidance is used since lack of specific information.
- The benefits of material and energy recovery will be calculated into module D recovery stage.

Oryza BGT installation waste treatment			
Product	Amount	Waste	Amount
Oryza BGT 10mm	1m2 (1.8kg)	Loss 2%	0.036kg
Packaging materials	Amount	Waste	Amount
PE bubble film	0.0014kg	Plastic PE	0.002kg
PE winding film	0.0008kg		
Wooden pallets	0.0952kg	Wood	0.095kg

Oryza BGT installation waste treatment scenarios Eurostat		
Treatment	PE	Wood
Recovery	71.3%	46.0%
Energy recovery	23.2%	53.4%
Incineration	0.4%	0.3%
Landfill	5.2%	0.3%

Use stage (B1-B7)

- The BGT products are assumed to be installed and also removed by hand with no connected environmental burden.
- Once installation is complete, no maintenance, repair, replacement or refurbishment is required during the use stages and no energy or water is used until the end of life. Therefore, the BGT has no impact in use stage.

End of life stage (C1-C4)

- The fate of the BGT at the Eol cannot be determined in advance since an established collection system does not yet exist. Therefore, the assumption chosen in this study, 100% landfill after the use

phase, is the most conservative approach. A default transportation distance of 100km in PEFCR Guidance is used since lack of specific information.

Resource recovery stage beyond the system boundaries (D)

- The benefits related to material recovery are calculated, where the secondary materials produced are assumed to substitute RER region materials.
- The benefits related to energy recovery are calculated with an efficiency of 60%, where the heat produced was assumed to substitute a RER region district or industrial heat.

Electricity source

LCI data for the generation of electricity used in the manufacturing process in module A3 is from ecoinvent v3.9.1.

Stage	National electricity grid	Unit	Value
A3 manufacturing	market for electricity, low voltage, State Grid East China Branch (ecoinvent v3.9.1)	kg CO2 eq / kWh	0.88

Cut-off criteria

LCI data shall according to EN 15804 include a minimum of 95% of total inflows (mass and energy) per module. In addition, if less than 100% of the inflows are accounted for, proxy data or extrapolation should be used to achieve 100% completeness. Inflows not included in the LCA shall be documented in the EPD.

All the inflows are included and there is no cut-off used in this study.

Allocation principles

The electricity consumption for 1m² Oryza BGT with 10mm thickness in production site has been estimated by allocation of the total energy consumption of the production site in one year to the production of BGT products with all the thickness.

According to the company, bulk density of all the products are similar, 180kg/m³. It was taken the assumption that energy consumption per volume is the same for any BGT products despite the thickness. Therefore, the electricity consumption in year 2022 for the entire factory was divided by the total volume of produced BGT obtaining the average electricity consumption for 1m³ BGT product. The production detail of all the BGT products in 2022 are listed below.

The water consumption, materials and waste output are allocated in the same method.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

Modules declared are noted with “X”. Modules not declared are marked as “ND”.

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage	
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential	
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	CN	CN	CN	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	EU	
Specific data used	>90%					-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	N/A					-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	N/A					-	-	-	-	-	-	-	-	-	-	-	-	-

According to section 2.2.2 in PCR 2019:14 construction products version 1.3.2, EPD type c) is chosen: cradle to grave and module D (A + B + C + D).

Content information

Product components	Weight-% per m2 BGT	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Amorphous SiO2	30-60%		0% biomass content, 0 kg C/kg
Glass fibre	40-70%		0% biomass content, 0 kg C/kg
Other	0-5%		0% biomass content, 0 kg C/kg
Auxiliary materials	Weight, kg per m2 BGT	Post-consumer material, weight-%	Biogenic material, weight-% and kg C/kg
Lubricating oil	0.0002kg		0% biomass content, 0 kg C/kg
Heat transfer oil	0.0007kg		0% biomass content, 0 kg C/kg
Activated carbon	0.0032kg		0% biomass content, 0 kg C/kg
Packaging materials	Weight, kg per m2 BGT	Weight-% (versus the product)	Weight biogenic carbon, kg C/kg
PE bubble film	0.0014kg	0.079%	0% biomass content, 0 kg C/kg
PE winding film	0.0008kg	0.042%	0% biomass content, 0 kg C/kg
Wooden pallets	0.0952kg	5.291%	50% biomass content, 0.0476 kg C/kg
TOTAL	0.0974kg	5.412%	0.0476 kg C/kg

Results of the environmental performance indicators

Mandatory impact category indicators according to EN 15804

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-fossil	kg CO ₂ eq.	2.66E+01	9.31E-01	1.05E-02	0.00E+00	0.00E+00	9.86E-02	0.00E+00	1.28E-02	-3.49E-02
GWP-biogenic	kg CO ₂ eq.	-1.40E-01	3.52E-04	1.41E-01	0.00E+00	0.00E+00	8.67E-05	0.00E+00	2.67E-05	2.51E-02
GWP-luluc	kg CO ₂ eq.	1.90E-02	6.27E-04	4.75E-06	0.00E+00	0.00E+00	5.75E-05	0.00E+00	2.06E-05	-1.72E-04
GWP-total	kg CO ₂ eq.	2.65E+01	9.32E-01	1.52E-01	0.00E+00	0.00E+00	9.88E-02	0.00E+00	1.28E-02	-9.97E-03
ODP	kg CFC 11 eq.	2.58E-04	1.59E-08	1.90E-10	0.00E+00	0.00E+00	2.16E-09	0.00E+00	2.39E-10	-8.47E-10
AP	mol H ⁺ eq.	1.48E-01	1.31E-02	5.52E-05	0.00E+00	0.00E+00	5.21E-04	0.00E+00	8.37E-05	-3.77E-04
EP-freshwater	kg P eq.	7.24E-03	6.44E-05	1.29E-06	0.00E+00	0.00E+00	8.32E-06	0.00E+00	1.83E-06	-1.86E-05
EP-marine	kg N eq.	3.07E-02	3.61E-03	2.46E-05	0.00E+00	0.00E+00	2.12E-04	0.00E+00	3.25E-05	-1.43E-04
EP-terrestrial	mol N eq.	3.19E-01	3.96E-02	2.54E-04	0.00E+00	0.00E+00	2.28E-03	0.00E+00	3.48E-04	-1.58E-03
POCP	kg NMVOC eq.	1.04E-01	1.14E-02	7.71E-05	0.00E+00	0.00E+00	7.47E-04	0.00E+00	1.12E-04	-4.64E-04
ADP-minerals&metals*	kg Sb eq.	5.19E-04	2.84E-06	3.49E-08	0.00E+00	0.00E+00	4.28E-07	0.00E+00	3.36E-08	-2.03E-07
ADP-fossil*	MJ	3.78E+02	1.24E+01	1.18E-01	0.00E+00	0.00E+00	1.39E+00	0.00E+00	2.01E-01	-7.73E-01
WDP*	m ³	9.76E+00	4.47E-02	-6.85E-04	0.00E+00	0.00E+00	5.72E-03	0.00E+00	3.30E-03	-5.15E-02
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; 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; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption									

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Additional mandatory impact category indicators

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
GWP-GHG ¹	kg CO ₂ eq.	2.67E+01	9.32E-01	1.05E-02	0.00E+00	0.00E+00	9.87E-02	0.00E+00	1.28E-02	-3.51E-02

Additional voluntary impact category indicators

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
PM	Disease incidence	1.72E-06	5.11E-08	7.66E-10	0.00E+00	0.00E+00	7.84E-09	0.00E+00	8.13E-09	-1.80E-08
IRP	kBq U235 eq.	2.13E+00	1.38E-02	2.24E-04	0.00E+00	0.00E+00	2.76E-03	0.00E+00	5.24E-04	-1.04E-02
ETP-fw	CTUe	5.89E+02	6.64E+00	6.72E-02	0.00E+00	0.00E+00	7.37E-01	0.00E+00	1.03E-01	-1.67E-01
ETP-c	CTUh	1.27E-08	4.90E-10	9.12E-12	0.00E+00	0.00E+00	6.65E-11	0.00E+00	6.98E-12	-3.18E-10
HTP-nc	CTUh	4.82E-07	7.50E-09	2.80E-10	0.00E+00	0.00E+00	1.15E-09	0.00E+00	1.08E-10	-7.85E-10
SQP	Dimension less	9.22E+01	3.70E+00	4.73E-02	0.00E+00	0.00E+00	5.74E-01	0.00E+00	1.98E-01	-9.41E+00
Acronyms	PM: Particulate matter emissions; IRP: Ionising radiation, human health; ETP-fw: Ecotoxicity (freshwater); ETP-c: Human toxicity, cancer effects; HTP-nc: Human toxicity, non-cancer effects; SQP: Land use related impacts / soil quality									

¹ This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO₂ is set to zero.

Resource use indicators

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
PERE	MJ	4.09E+00	8.74E-02	1.22E-03	0.00E+00	0.00E+00	1.42E-02	0.00E+00	3.00E-03	-1.97E+00
PERM	MJ	1.17E+01	0.00E+00							
PERT	MJ	1.58E+01	8.74E-02	1.22E-03	0.00E+00	0.00E+00	1.42E-02	0.00E+00	3.00E-03	-1.97E+00
PENRE	MJ	1.38E+02	1.24E+01	1.18E-01	0.00E+00	0.00E+00	1.39E+00	0.00E+00	2.01E-01	-7.73E-01
PENRM	MJ	2.40E+02	0.00E+00							
PENRT	MJ	3.78E+02	1.24E+01	1.18E-01	0.00E+00	0.00E+00	1.39E+00	0.00E+00	2.01E-01	-7.73E-01
SM	kg	0.00E+00								
RSF	MJ	0.00E+00								
NRSF	MJ	0.00E+00								
FW	m ³	3.16E-03	0.00E+00							
Acronyms	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 re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water									

Waste indicators

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
Hazardous waste disposed	kg	7.95E-02	0.00E+00	2.68E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Non-hazardous waste disposed	kg	7.91E-02	0.00E+00	3.64E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E+00	0.00E+00
Radioactive waste disposed	kg	0.00E+00								

Output flow indicators

Results per functional or declared unit										
Indicator	Unit	A1-A3	A4	A5	B2	C1	C2	C3	C4	D
Components for re-use	kg	0.00E+00								
Material for recycling	kg	0.00E+00	0.00E+00	4.54E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Materials for energy recovery	kg	0.00E+00	0.00E+00	5.13E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Exported energy, electricity	MJ	0.00E+00								
Exported energy, thermal	MJ	0.00E+00	3.93E-01							

Information describing the biogenic carbon content

The carbon content is assumed to be 50% in the packaging of the declared unit defined. 1 kg biogenic carbon is equivalent to 44/12 kg of CO₂.

Biogenic carbon content	Unit	Value	Unit	Value
Biogenic carbon content in product	kg C	0.00E+00	Kg CO ₂ eq	0.00E+00
Biogenic carbon content in the accompanying packaging	kg C	4.76E-02	Kg CO ₂ eq	1.75E-01

Factors and results for different thicknesses

The results for the 1m² of Oryza BGT declared in this EPD report refer to a product with a thickness of 10mm. To enable the user of the EPD report to calculate the results for different thicknesses, the factors in the following table could be used for the calculation. The EPD results in chapter 3 have to be multiplied by these factors since the inputs are scaling upwards and downwards with other product thicknesses.

Factors for different thicknesses				
Thickness	3mm	5mm	10mm	20mm
Factor	0.30	0.50	1.00 (declared)	2.00

Specifically, the results of Oryza BGT products with different thicknesses during the product stage (A1-A3) and transportation (A4) are as follows:

Mandatory parameters describing environmental impacts for different thicknesses during the product stage (A1-A3) and transportation (A4)									
Indicators	Unit	Product stage (A1-A3)				Transportation (A4)			
		3mm	5mm	10mm	20mm	3mm	5mm	10mm	20mm
GWP-fossil	kg CO2 eq.	7.99E+00	1.33E+01	2.66E+01	5.33E+01	2.79E-01	4.66E-01	9.31E-01	1.86E+00
GWP-biogenic	kg CO2 eq.	-4.20E-02	-7.00E-02	-1.40E-01	-2.80E-01	1.06E-04	1.76E-04	3.52E-04	7.04E-04
GWP-LULUC	kg CO2 eq.	5.69E-03	9.48E-03	1.90E-02	3.79E-02	1.88E-04	3.14E-04	6.27E-04	1.25E-03
GWP-total	kg CO2 eq.	7.95E+00	1.33E+01	2.65E+01	5.30E+01	2.80E-01	4.66E-01	9.32E-01	1.86E+00
ODP	kg CFC11 eq.	7.74E-05	1.29E-04	2.58E-04	5.16E-04	4.77E-09	7.95E-09	1.59E-08	3.18E-08
AP	mol H ⁺ eq.	4.45E-02	7.41E-02	1.48E-01	2.97E-01	3.92E-03	6.54E-03	1.31E-02	2.61E-02
EP-freshwater	kg P eq.	2.17E-03	3.62E-03	7.24E-03	1.45E-02	1.93E-05	3.22E-05	6.44E-05	1.29E-04
EP-marine	kg N eq.	9.20E-03	1.53E-02	3.07E-02	6.13E-02	1.08E-03	1.81E-03	3.61E-03	7.22E-03
EP-terrestrial	mol N eq.	9.58E-02	1.60E-01	3.19E-01	6.38E-01	1.19E-02	1.98E-02	3.96E-02	7.92E-02
POCP	kg NMVOC eq.	3.13E-02	5.21E-02	1.04E-01	2.09E-01	3.43E-03	5.71E-03	1.14E-02	2.29E-02
ADP-M&M	kg Sb eq.	1.56E-04	2.59E-04	5.19E-04	1.04E-03	8.51E-07	1.42E-06	2.84E-06	5.68E-06
ADP-fossil	MJ	1.13E+02	1.89E+02	3.78E+02	7.56E+02	3.72E+00	6.19E+00	1.24E+01	2.48E+01
WDP	m ³	2.93E+00	4.88E+00	9.76E+00	1.95E+01	1.34E-02	2.23E-02	4.47E-02	8.93E-02

References

- EPD International PCR 2019:14 Construction products v1.3.2
- EPD International c-PCR-005 Thermal insulation products (EN 16783:2017)
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- ISO 14044:2006+A1:2018+A2:2020(2020) Environmental management - Life cycle assessment - Requirements and guidelines
- EN 15804:2012+A2:2019/AC:2021, Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products.
- ecoinvent Database, Version 3.9.1
- SimaPro Software, Version 9.5.0.0

