LUOYANG LANDVAC Ti-VIG CO., LTD

ENVIRONMENTAL PRODUCT DECLARATION

Vacuum insulating glass

No. 1, Northwest Corner of the Intersection of KeJi Avenue and Zhuge Road, Yibin District, Luoyang, Henan, China

in compliance with ISO 14025 and EN 15804

Program Operator	EPD China
Publisher	EPDItaly

Declaration Number	*EPD-CN-00053*
Registration Number	MR-EPDITALY0163

Issue Date	2026-05-28
Valid to	2031-05-27

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www.epditaly.it

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025, EN 15804 and TECHNICAL GUIDELINE to CORE PCR ICMQ 001 for:

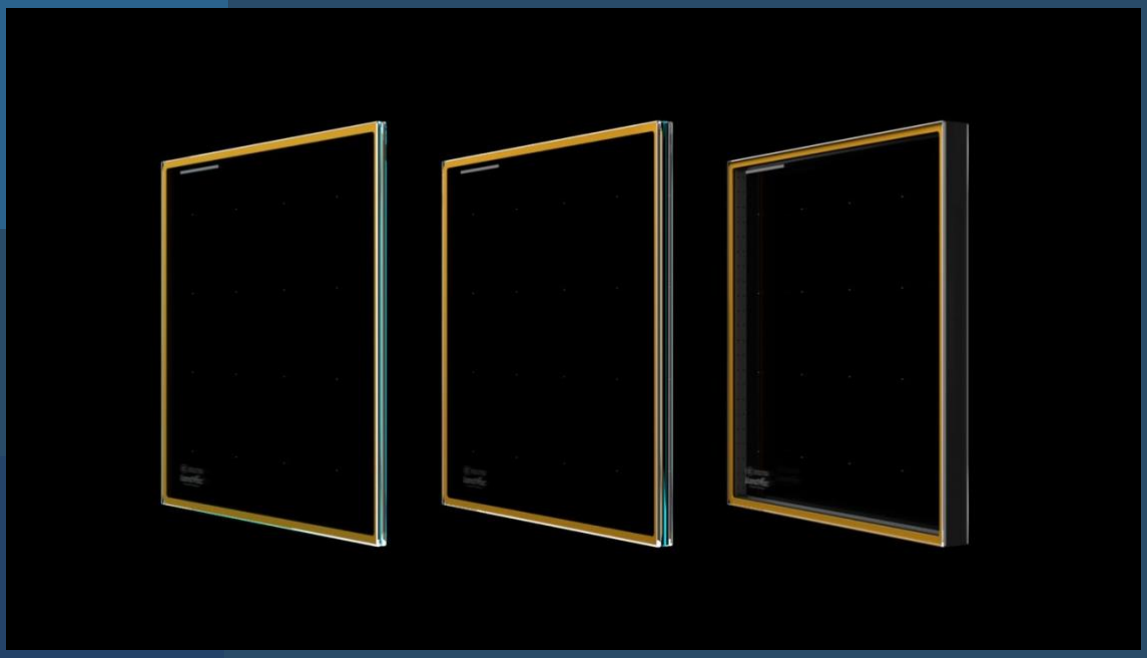
Vacuum insulating glass

- **Vacuum insulating glass（3.2TL+0.3V+3.2T, 4TL+0.3V+4T, 5TL+0.3V+5T, 6TL+0.3V+6T）**
- **Hybrid vacuum insulating glass (4T+0.3V+4TL+12A+4T, 5T+0.3V+5TL+12A+5T, 6T+0.3V+6TL+12A+6T)**
- **Laminated vacuum insulating glass (4T+0.3V+4TL+0.76PVB+4T, 5T+0.3V+5TL+1.52PVB+5T, 6T+0.3V+6TL+1.52PVB+6T)**

From

LUOYANG LANDVAC Ti-VIG CO., LTD

Declared product:



Programme operator:	EPD China
Registration number:	EPD-CN-00053
Issued date:	2026-05-28
Valid until:	2031-05-27

Programme Information

EPD Owner	LUOYANG LANDVAC Ti-VIG CO., LTD Contact: Li Ruiming, jerry@landglass.com Website: www.landvac.com/www.landvac.net
Product Name	Vacuum insulating glass
Production Site	No. 1, Northwest Corner of the Intersection of KeJi Avenue and Zhuge Road, Yibin District, Luoyang, Henan, China
Identification of product	UNCPC code: 371
Field of Application	LandVac vacuum insulating glass has the functions of thermal insulation, noise reduction, sound insulation, frost protection, energy saving etc., to meet the requirements of buildings with glass doors and windows, building curtain wall and skylight roof etc., and it can be used separately.
Programme Operator	EPD China Address of Headquarter: Tianping Road, Xuhui District, Shanghai Website: www.epdchina.cn Email: info@epdchina.cn | secretary@epdchina.cn
LCA Practitioner	Chao WANG, Ecovane environmental, support@1mi1.cn
Responsibility	The EPD owner has the sole ownership, liability, and responsibility for the EPD
Comparability	EPDs within same category of product in different programme operator are not suggested to be compared. Full conformance with a PCR allows EPD comparability only when all stages of a life cycle have been considered. However, variations and deviations are possible even applying the same PCR.
Liability	The EPD owner has the sole ownership, liability, and responsibility for the EPD.
Validity	The EPD is published on 2026-05-DD and valid to 2031-05-DD
LCA Software (version)	Simapro 10.3
LCI Dataset (version)	Ecoinvent 3.11
Year(s) of Primary Data	09/2024-08/2025
PCR	CORE PCR for CONSTRUCTION PRODUCTS AND SERVICES: ICMQ - 001, Rev. 4 (10/11/2025)
Other Reference Document	EN 15804:2012+A2:2019 Environmental product declaration - Core rules for the product category of construction products.
Verification statement according EN15804	
Independent verification of the declaration and data according to EN ISO 14025:2010 ☐ internal ☑ external Third-party institution verification: < Weifang Yao, WIT > is an approved certification body accountable for third-party verification Approved by: EPD China	
Procedure for follow-up of data during EPD validity involves a third-party certification body: ☐ Yes ☑ No	

1 General Information

1.1 Company information

Established in 2003, LandGlass is a high-tech enterprise specializing in the research, development, production, and sales of tempered glass equipment and tempered vacuum glass products. Over the past two decades, it has been granted 530 patents for vacuum glass technology, including over 170 international patents registered in dozens of countries and regions. LandGlass currently has over 350 employees. In addition to its headquarters located in downtown Luoyang City, it has established three manufacturing and R&D bases. LUOYANG LANDVAC Ti-VIG CO., LTD, is a wholly-owned subsidiary of LandGlass Technology Co., Ltd., which is a high-tech enterprise focusing on the R&D, production, and sales of LandVac glass (high-performance vacuum insulated glass). Based on the excellent thermal insulation, sound insulation, condensation resistance, and other characteristics of LandVac, LandGlass has developed three series of LandVac vacuum insulated glass products, including Energy Saving series, Noise Reduction series, and Anti-condensation series with LandVac and Hybrid VIG units to fulfill the various needs of customers and application scenarios. LandVac has received quality and performance certifications from many domestic and foreign authoritative bodies and is widely recognized by users worldwide.

LandVac has been awarded certificates for compliance with the following standards:

- ✧ ISO 9001:2015 - Quality Management System
- ✧ ISO 14001:2015 - Environmental Management System

1.2 Scope and type of EPD

System boundary: Cradle-to-grave

Table 1 Process stages and EPD modules

PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				BENEFITSAND LOADSBEYOND THESYSTEM BOUNDARIES
Raw material supply	**Transport**	**Production**	**Transport from the gate to the**	**Assembly**	**Use**	**Maintenance**	**Repair**	**Replacement**	**Refurbishment**	**Operational energy use**	**Operational water use**	**Deconstruction/ demolition**	**Transport**	**Waste processing**	**Disposal**	**reuse- recovery- recycling- potential**
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	x

Note: X=Declared Module, MND=Module not Declared in this LCA study

1.3 Declared unit

In this study the declared unit is defined as one square meter of vacuum insulating glass. And the defined mass of the product per declared unit is described in Table below.

Table 2 Declared unit details

Name		Value	Unit
Declared unit		1	m^2
Density	3.2TL+0.3V+3.2T	2405.69	kg/m3
	4TL+0.3V+4T	2423.87	kg/m3
	4T+0.3V+4TL+0.76PVB+4T	2368.22	kg/m3
	4T+0.3V+4TL+12A+4T	1283.71	kg/m3
	5TL+0.3V+5T	2438.65	kg/m3
	5T+0.3V+5TL+1.52PVB+5T	2332.93	kg/m3
	5T+0.3V+5TL+12A+5T	1417.37	kg/m3
	6TL+0.3V+6T	2448.63	kg/m3
	6T+0.3V+6TL+1.52PVB+6T	2358.22	kg/m3
	6T+0.3V+6TL+12A+6T	1524.56	kg/m3
Mass conversion factor	3.2TL+0.3V+3.2T	16.0618	kg/m2
	4TL+0.3V+4T	20.0618	kg/m2
	4T+0.3V+4TL+0.76PVB+4T	30.9004	kg/m2
	4T+0.3V+4TL+12A+4T	31.1404	kg/m2
	5TL+0.3V+5T	25.0618	kg/m2
	5T+0.3V+5TL+1.52PVB+5T	39.2390	kg/m2
	5T+0.3V+5TL+12A+5T	38.6404	kg/m2
	6TL+0.3V+6T	30.0618	kg/m2
	6T+0.3V+6TL+1.52PVB+6T	46.7390	kg/m2
	6T+0.3V+6TL+12A+6T	46.1404	kg/m2

Note: Environmental impacts may vary considerably across the product range due to differences in mass and material composition

2 Detailed Product Description

2.1 Description of the product

Vacuum insulating glass is composed of two layers of tempered glass (one piece is clear glass and the other one is low-e glass), separated by support pillars to form a 0.3 mm vacuum space (vacuum degree ≤ 0.1 Pa), with edges sealed using low-temperature metal solder, and the support pillars are cylindrical stainless steel arranged in a rectangular spacing pattern.

The composite structural products combining vacuum glass with insulated glass or laminated glass typically consist of three glass panels, with the main body still comprising two tempered vacuum glass panels. Hybrid vacuum insulating glass is formed by separating vacuum glass and a layer of tempered glass with spacers (containing desiccant molecular sieve) around the edges, sealed with butyl rubber and sealant to create a composite glass product with an air cavity; Laminated vacuum insulating glass is a composite glass product formed by bonding vacuum glass and a layer of tempered glass with a PVB interlayer.

LandVac vacuum insulating glass has the functions of thermal insulation, noise reduction, sound insulation, frost protection, energy saving etc., to meet the requirements of buildings with glass doors and windows, building curtain wall and skylight roof etc., and it can be used separately.

Figure 1 Picture of the declared product

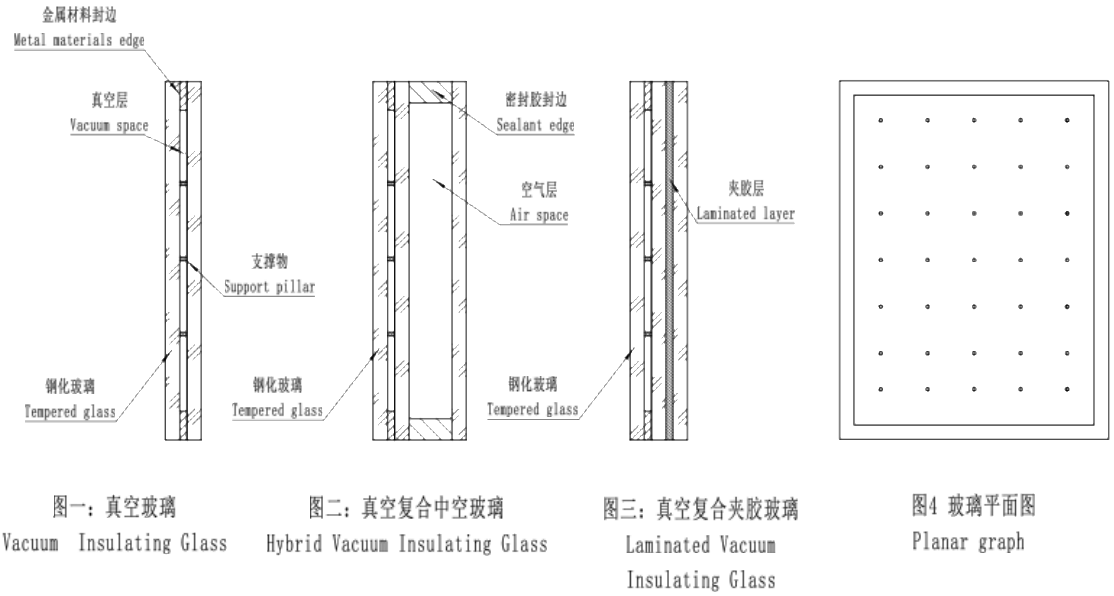


Figure 2 Structure of LandVac vacuum insulating glass

A detailed vacuum insulting glass product specification is depicted below.

Table 3 Specification of products

Product	Configuration	Thickness	Main specification
Vacuum insulating glass	3.2TL+0.3V+3.2T, 4TL+0.3V+4T, 5TL+0.3V+5T, 6TL+0.3V+6T	Glass thickness: 3.2/4/5/6 mm	-U value≤0.5 W/m2*K -Max. 80% visible light transmittance -Maximum size: 2400*4200mm -Minimum size: 300*300mm
Hybrid vacuum insulating glass	4T+0.3V+4TL+12A+4T, 5T+0.3V+5TL+12A+5T, 6+0.3V+6+12A+6	Insulated layer thickness: 6/9/12/16 mm t	
Laminated vacuum insulating glass	4T+0.3V+4TL+0.76PVB+4T, 5T+0.3V+5TL+1.52PVB+5T, 6T+0.3V+6TL+1.52PVB+6T	Laminated layer thickness: 0.76/1.52 mm	
For example, 4TL is 4mm tampered low-e glass, 0.3V is 0.3mm vacuum layer, 0.76PVB is 0.76mm PVB laminated layer, 12A is 12 mm insulated layer.			

Note that the contribution of the edge sealing material to the overall environmental impacts, and the variation in environmental impacts resulting from the difference in dimensions have been assessed as negligible (less than 10% difference). This assumption ensures the declared impacts remain representative despite variations in panel dimensions.

2.2 Description of the production process

The manufacturing process of vacuum insulating glass product mainly includes cutting, washing, polishing, printing, tempering, drying, bonding, exhausting, sealing and packaging, which involves raw materials, energy and emissions.

The type and ratio/weight of raw materials per declared unit are listed in table below.

Table 4 Main product components and packaging materials per declared unit

Raw material	Unit	3.2TL+0.3V+3.2T	4TL+0.3V+4T	4T+0.3V+4TL+0.76PVB+4T	4T+0.3V+4TL+12A+4T	5TL+0.3V+5T	5T+0.3V+5TL+1.52PVB+5T	5T+0.3V+5TL+12A+5T	6TL+0.3V+6T	6T+0.3V+6TL+1.52PVB+6T	6T+0.3V+6TL+12A+6T
Float glass	kg	8	10	20	20	12.5	25	25	15	30	30
Low-e glass	kg	8	10	10	10	12.5	12.5	12.5	15	15	15
Slurry	kg	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053	0.0053
Solder	kg	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537	0.0537
Getter	kg	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
PVB membrane	kg	-	-	0.8386	-	-	1.6772	-	-	1.6772	-
Insulated frame	kg	-	-	-	0.2163	-	-	0.2163	-	-	0.2163
Silicone sealant-A	kg	-	-	-	0.4903	-	-	0.4903	-	-	0.4903
Silicone sealant-B	kg	-	-	-	0.0409	-	-	0.0409	-	-	0.0409
Butyl	kg	-	-	-	0.0371	-	-	0.0371	-	-	0.0371
Molecular sieve	kg	-	-	-	0.294	-	-	0.294	-	-	0.294
Packaging											
Wood box	kg	1.3386	1.5594	2.21628	3.7674	1.8354	2.73516	4.1814	2.1114	3.14916	4.5954
Packaging film	kg	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016

3 LCA results according to EN 15804

3.1 Environmental Impacts

The results of the underlying LCA are provided in this section as environmental impacts, resource use, output flows and additional information on biogenic carbon. All pre-set parameters of EN 15804 are required.

Table 5 Environmental impacts for vacuum insulting glass (3.2TL+0.3V+3.2T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	3.38E+01	3.22E+00	3.74E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	1.61E-01	1.80E-02	5.05E-02	-5.14E-01
GWP-fossil	kg CO2 eq.	3.60E+01	3.22E+00	1.58E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	1.61E-01	1.79E-02	5.03E-02	-4.62E-01
GWP-biogenic	kg CO2 eq.	-2.16E+00	7.36E-04	2.16E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	3.68E-05	2.78E-05	1.30E-04	-5.10E-02
GWP-luluc	kg CO2 eq.	2.49E-02	1.46E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	7.30E-05	3.64E-05	2.97E-05	-6.29E-04
ODP	kg CFC 11 eq.	3.44E-07	4.38E-08	2.44E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	2.19E-09	1.53E-10	1.29E-09	-5.20E-09
AP	mol H+ eq.	2.91E-01	1.36E-02	8.13E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	6.80E-04	8.91E-05	3.49E-04	-2.45E-03
EP-freshwater	kg P eq.	1.21E-02	3.51E-04	4.39E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	1.75E-05	8.40E-06	5.10E-06	-1.15E-04
EP-marine	kg N eq.	5.72E-02	4.86E-03	1.34E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	2.43E-04	1.79E-05	1.35E-04	-7.81E-04
EP-terrestrial	mol N eq.	6.69E-01	5.29E-02	1.45E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	2.65E-03	1.79E-04	1.47E-03	-7.79E-03
POCP	kg NMVOC eq.	1.84E-01	1.84E-02	6.18E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	9.22E-04	5.70E-05	5.13E-04	-2.82E-03
ADPE	kg Sb eq.	4.79E-03	1.06E-05	1.93E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	5.32E-07	1.74E-08	9.32E-08	-2.22E-06
ADPF	MJ, net calorific value	3.91E+02	4.48E+01	2.38E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	2.24E+00	2.69E-01	1.13E+00	-6.14E+00
WDP	m3 world eq. deprived	7.37E+00	2.07E-01	4.74E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	1.04E-02	2.41E-03	7.39E-01	-2.61E-01
PM	Disease incidence	3.51E-06	2.56E-07	9.74E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	1.28E-08	8.16E-10	8.15E-09	-1.14E-07
IRP	kBq U235 eq.	7.12E-01	3.60E-02	4.90E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	1.80E-03	2.41E-03	8.71E-04	-2.08E-02
ETP-fw	CTUe	3.52E+02	8.18E+00	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	4.09E-01	4.11E-02	2.67E-01	-3.49E+00
HTP-c	CTUh	1.49E-08	5.41E-10	8.67E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	2.70E-11	1.90E-12	1.11E-11	-3.49E-09

HTP-nc	CTUh	3.08E-07	2.77E-08	4.64E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	1.39E-09	9.91E-11	2.38E-10	-4.52E-09
SQP	dimensionless	2.09E+02	2.63E+01	5.94E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	1.32E+00	3.48E-02	2.67E+00	-3.00E+01

Table 6 Environmental impacts for vacuum insulating glass (4TL+0.3V+4T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	**Unit**	**A1-A3**	**A4**	**A5**	**B1**	**B2**	**B3-B7**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-total	kg CO2 eq.	4.05E+01	4.02E+00	4.10E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	2.01E-01	2.24E-02	6.30E-02	-6.15E-01
GWP-fossil	kg CO2 eq.	4.30E+01	4.02E+00	1.58E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	2.01E-01	2.23E-02	6.28E-02	-5.50E-01
GWP-biogenic	kg CO2 eq.	-2.52E+00	9.19E-04	2.52E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	4.60E-05	3.47E-05	1.62E-04	-6.37E-02
GWP-luluc	kg CO2 eq.	2.79E-02	1.82E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	9.11E-05	4.54E-05	3.71E-05	-7.49E-04
ODP	kg CFC 11 eq.	4.17E-07	5.47E-08	2.44E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	2.73E-09	1.91E-10	1.61E-09	-6.16E-09
AP	mol H+ eq.	3.56E-01	1.70E-02	8.14E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	8.49E-04	1.11E-04	4.36E-04	-2.90E-03
EP-freshwater	kg P eq.	1.30E-02	4.38E-04	4.39E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	2.19E-05	1.05E-05	6.37E-06	-1.36E-04
EP-marine	kg N eq.	6.83E-02	6.07E-03	1.35E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	3.04E-04	2.23E-05	1.68E-04	-9.32E-04
EP-terrestrial	mol N eq.	8.03E-01	6.61E-02	1.46E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	3.31E-03	2.24E-04	1.83E-03	-9.24E-03
POCP	kg NMVOC eq.	2.23E-01	2.30E-02	6.19E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	1.15E-03	7.12E-05	6.41E-04	-3.34E-03
ADPE	kg Sb eq.	4.85E-03	1.33E-05	1.93E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	6.64E-07	2.17E-08	1.16E-07	-2.62E-06
ADPF	MJ, net calorific value	4.69E+02	5.59E+01	2.38E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	2.80E+00	3.36E-01	1.41E+00	-7.25E+00
WDP	m3 world eq. deprived	8.87E+00	2.59E-01	4.74E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	1.29E-02	3.00E-03	9.23E-01	-3.09E-01
PM	Disease incidence	4.25E-06	3.20E-07	9.76E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	1.60E-08	1.02E-09	1.02E-08	-1.39E-07
IRP	kBq U235 eq.	8.30E-01	4.50E-02	4.91E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	2.25E-03	3.01E-03	1.09E-03	-2.48E-02
ETP-fw	CTUe	4.02E+02	1.02E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	5.11E-01	5.13E-02	3.34E-01	-4.16E+00
HTP-c	CTUh	1.73E-08	6.75E-10	8.68E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	3.38E-11	2.38E-12	1.38E-11	-4.07E-09
HTP-nc	CTUh	3.50E-07	3.46E-08	4.64E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	1.73E-09	1.24E-10	2.97E-10	-5.38E-09
SQP	dimensionless	2.49E+02	3.29E+01	5.96E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	1.64E+00	4.35E-02	3.34E+00	-3.50E+01

Table 7 Environmental impacts for laminated vacuum insulating glass (4T+0.3V+4TL+0.76PVB+4T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	6.59E+01	6.19E+00	5.16E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	3.10E-01	3.45E-02	9.71E-02	-9.02E-01
GWP-fossil	kg CO2 eq.	6.94E+01	6.19E+00	1.59E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	3.09E-01	3.43E-02	9.68E-02	-8.03E-01
GWP-biogenic	kg CO2 eq.	-3.57E+00	1.42E-03	3.58E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	7.08E-05	5.34E-05	2.49E-04	-9.79E-02
GWP-luluc	kg CO2 eq.	4.80E-02	2.81E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.40E-04	6.98E-05	5.71E-05	-1.09E-03
ODP	kg CFC 11 eq.	7.34E-07	8.42E-08	2.45E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	4.21E-09	2.94E-10	2.48E-09	-8.93E-09
AP	mol H+ eq.	5.33E-01	2.62E-02	8.17E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.31E-03	1.71E-04	6.71E-04	-4.20E-03
EP-freshwater	kg P eq.	1.75E-02	6.75E-04	4.40E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	3.37E-05	1.61E-05	9.81E-06	-1.97E-04
EP-marine	kg N eq.	9.97E-02	9.35E-03	1.36E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	4.67E-04	3.43E-05	2.59E-04	-1.36E-03
EP-terrestrial	mol N eq.	1.16E+00	1.02E-01	1.47E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	5.09E-03	3.44E-04	2.82E-03	-1.34E-02
POCP	kg NMVOC eq.	3.36E-01	3.55E-02	6.23E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	1.77E-03	1.09E-04	9.88E-04	-4.84E-03
ADPE	kg Sb eq.	5.03E-03	2.05E-05	1.93E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.02E-06	3.33E-08	1.79E-07	-3.78E-06
ADPF	MJ, net calorific value	7.73E+02	8.62E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.31E+00	5.16E-01	2.18E+00	-1.05E+01
WDP	m3 world eq. deprived	1.58E+01	3.99E-01	4.75E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	1.99E-02	4.62E-03	1.42E+00	-4.46E-01
PM	Disease incidence	6.24E-06	4.93E-07	9.81E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	2.47E-08	1.57E-09	1.57E-08	-2.10E-07
IRP	kBq U235 eq.	1.54E+00	6.93E-02	4.91E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	3.47E-03	4.63E-03	1.68E-03	-3.64E-02
ETP-fw	CTUe	5.39E+02	1.57E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	7.86E-01	7.88E-02	5.14E-01	-6.06E+00
HTP-c	CTUh	2.50E-08	1.04E-09	8.69E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	5.20E-11	3.66E-12	2.13E-11	-5.80E-09
HTP-nc	CTUh	5.19E-07	5.33E-08	4.65E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	2.67E-09	1.90E-10	4.57E-10	-7.87E-09
SQP	dimensionless	3.57E+02	5.07E+01	6.01E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	2.53E+00	6.69E-02	5.14E+00	-4.99E+01

Table 8 Environmental impacts for hybrid vacuum insulating glass (4T+0.3V+4TL+12A+4T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	5.80E+01	6.24E+00	7.68E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	3.12E-01	3.48E-02	9.78E-02	-1.27E+00
GWP-fossil	kg CO2 eq.	6.40E+01	6.23E+00	1.60E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	3.12E-01	3.46E-02	9.75E-02	-1.17E+00
GWP-biogenic	kg CO2 eq.	-6.08E+00	1.43E-03	6.08E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	7.13E-05	5.39E-05	2.51E-04	-9.97E-02
GWP-luluc	kg CO2 eq.	3.95E-02	2.83E-03	1.91E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.41E-04	7.04E-05	5.75E-05	-1.59E-03
ODP	kg CFC 11 eq.	3.31E-06	8.49E-08	2.47E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	4.24E-09	2.97E-10	2.50E-09	-1.34E-08
AP	mol H+ eq.	5.16E-01	2.64E-02	8.24E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.32E-03	1.72E-04	6.77E-04	-6.41E-03
EP-freshwater	kg P eq.	1.67E-02	6.80E-04	4.42E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	3.40E-05	1.63E-05	9.89E-06	-3.00E-04
EP-marine	kg N eq.	9.84E-02	9.42E-03	1.38E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	4.71E-04	3.46E-05	2.61E-04	-1.96E-03
EP-terrestrial	mol N eq.	1.15E+00	1.03E-01	1.49E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	5.13E-03	3.47E-04	2.85E-03	-2.01E-02
POCP	kg NMVOC eq.	3.29E-01	3.57E-02	6.32E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	1.79E-03	1.10E-04	9.95E-04	-7.28E-03
ADPE	kg Sb eq.	5.00E-03	2.06E-05	1.94E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.03E-06	3.36E-08	1.81E-07	-5.86E-06
ADPF	MJ, net calorific value	7.18E+02	8.68E+01	2.41E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.34E+00	5.21E-01	2.20E+00	-1.60E+01
WDP	m3 world eq. deprived	1.52E+01	4.02E-01	4.76E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	2.01E-02	4.66E-03	1.43E+00	-6.86E-01
PM	Disease incidence	6.25E-06	4.97E-07	9.93E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	2.49E-08	1.58E-09	1.58E-08	-2.53E-07
IRP	kBq U235 eq.	1.23E+00	6.98E-02	4.93E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	3.49E-03	4.67E-03	1.69E-03	-5.11E-02
ETP-fw	CTUe	6.14E+02	1.59E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	7.93E-01	7.95E-02	5.18E-01	-8.83E+00
HTP-c	CTUh	3.66E-08	1.05E-09	8.72E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	5.24E-11	3.69E-12	2.15E-11	-9.71E-09
HTP-nc	CTUh	4.89E-07	5.37E-08	4.66E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	2.69E-09	1.92E-10	4.61E-10	-1.14E-08
SQP	dimensionless	4.42E+02	5.11E+01	6.14E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	2.55E+00	6.74E-02	5.18E+00	-8.33E+01

Table 9 Environmental impacts for vacuum insulating glass (5TL+0.3V+5T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	4.72E+01	5.02E+00	4.55E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	2.51E-01	2.80E-02	7.87E-02	-7.41E-01
GWP-fossil	kg CO2 eq.	5.01E+01	5.02E+00	1.58E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	2.51E-01	2.79E-02	7.85E-02	-6.61E-01
GWP-biogenic	kg CO2 eq.	-2.96E+00	1.15E-03	2.96E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	5.74E-05	4.34E-05	2.02E-04	-7.95E-02
GWP-luluc	kg CO2 eq.	3.09E-02	2.28E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.14E-04	5.67E-05	4.63E-05	-8.99E-04
ODP	kg CFC 11 eq.	4.90E-07	6.83E-08	2.45E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	3.41E-09	2.39E-10	2.01E-09	-7.36E-09
AP	mol H+ eq.	4.20E-01	2.12E-02	8.15E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.06E-03	1.39E-04	5.44E-04	-3.46E-03
EP-freshwater	kg P eq.	1.39E-02	5.47E-04	4.40E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	2.74E-05	1.31E-05	7.96E-06	-1.62E-04
EP-marine	kg N eq.	7.96E-02	7.58E-03	1.35E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	3.79E-04	2.79E-05	2.10E-04	-1.12E-03
EP-terrestrial	mol N eq.	9.37E-01	8.26E-02	1.46E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	4.13E-03	2.79E-04	2.29E-03	-1.11E-02
POCP	kg NMVOC eq.	2.61E-01	2.88E-02	6.21E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	1.44E-03	8.89E-05	8.01E-04	-3.99E-03
ADPE	kg Sb eq.	4.91E-03	1.66E-05	1.93E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	8.29E-07	2.71E-08	1.45E-07	-3.11E-06
ADPF	MJ, net calorific value	5.47E+02	6.99E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	3.49E+00	4.19E-01	1.77E+00	-8.65E+00
WDP	m3 world eq. deprived	1.04E+01	3.23E-01	4.74E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	1.62E-02	3.75E-03	1.15E+00	-3.68E-01
PM	Disease incidence	5.01E-06	4.00E-07	9.78E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	2.00E-08	1.27E-09	1.27E-08	-1.71E-07
IRP	kBq U235 eq.	9.50E-01	5.62E-02	4.91E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	2.81E-03	3.76E-03	1.36E-03	-2.99E-02
ETP-fw	CTUe	4.53E+02	1.28E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	6.38E-01	6.40E-02	4.17E-01	-4.99E+00
HTP-c	CTUh	2.00E-08	8.44E-10	8.68E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	4.22E-11	2.97E-12	1.73E-11	-4.80E-09
HTP-nc	CTUh	3.92E-07	4.33E-08	4.64E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	2.16E-09	1.54E-10	3.71E-10	-6.47E-09
SQP	dimensionless	2.91E+02	4.11E+01	5.98E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	2.05E+00	5.43E-02	4.17E+00	-4.13E+01

Table 10 Environmental impacts for laminated vacuum insulating glass (5T+0.3V+5TL+1.52PVB+5T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	8.59E+01	7.86E+00	6.01E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	3.93E-01	4.37E-02	1.23E-01	-1.13E+00
GWP-fossil	kg CO2 eq.	9.02E+01	7.86E+00	1.59E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	3.93E-01	4.36E-02	1.23E-01	-1.00E+00
GWP-biogenic	kg CO2 eq.	-4.41E+00	1.80E-03	4.41E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	8.99E-05	6.77E-05	3.17E-04	-1.24E-01
GWP-luluc	kg CO2 eq.	6.51E-02	3.57E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.78E-04	8.85E-05	7.25E-05	-1.36E-03
ODP	kg CFC 11 eq.	9.95E-07	1.07E-07	2.46E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	5.35E-09	3.73E-10	3.15E-09	-1.11E-08
AP	mol H+ eq.	6.70E-01	3.32E-02	8.19E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.66E-03	2.17E-04	8.52E-04	-5.22E-03
EP-freshwater	kg P eq.	2.12E-02	8.57E-04	4.41E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	4.29E-05	2.05E-05	1.25E-05	-2.45E-04
EP-marine	kg N eq.	1.23E-01	1.19E-02	1.36E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	5.94E-04	4.36E-05	3.29E-04	-1.70E-03
EP-terrestrial	mol N eq.	1.43E+00	1.29E-01	1.48E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	6.46E-03	4.36E-04	3.59E-03	-1.67E-02
POCP	kg NMVOC eq.	4.21E-01	4.50E-02	6.26E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	2.25E-03	1.39E-04	1.25E-03	-6.02E-03
ADPE	kg Sb eq.	5.19E-03	2.60E-05	1.94E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.30E-06	4.23E-08	2.28E-07	-4.69E-06
ADPF	MJ, net calorific value	1.02E+03	1.09E+02	2.40E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	5.47E+00	6.55E-01	2.77E+00	-1.30E+01
WDP	m3 world eq. deprived	2.17E+01	5.06E-01	4.75E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	2.53E-02	5.86E-03	1.81E+00	-5.54E-01
PM	Disease incidence	7.71E-06	6.26E-07	9.85E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	3.13E-08	1.99E-09	1.99E-08	-2.64E-07
IRP	kBq U235 eq.	2.19E+00	8.80E-02	4.92E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	4.40E-03	5.87E-03	2.13E-03	-4.55E-02
ETP-fw	CTUe	6.45E+02	2.00E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	9.99E-01	1.00E-01	6.53E-01	-7.56E+00
HTP-c	CTUh	3.12E-08	1.32E-09	8.70E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	6.60E-11	4.64E-12	2.71E-11	-7.17E-09
HTP-nc	CTUh	6.56E-07	6.77E-08	4.65E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	3.39E-09	2.41E-10	5.80E-10	-9.81E-09
SQP	dimensionless	4.42E+02	6.43E+01	6.05E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	3.22E+00	8.48E-02	6.53E+00	-6.17E+01

Table 11 Environmental impacts for hybrid vacuum insulating glass (5T+0.3V+5TL+12A+5T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	6.78E+01	7.74E+00	8.35E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	3.87E-01	4.31E-02	1.21E-01	-1.46E+00
GWP-fossil	kg CO2 eq.	7.45E+01	7.74E+00	1.61E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	3.87E-01	4.30E-02	1.21E-01	-1.33E+00
GWP-biogenic	kg CO2 eq.	-6.74E+00	1.77E-03	6.75E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	8.85E-05	6.68E-05	3.12E-04	-1.23E-01
GWP-luluc	kg CO2 eq.	4.39E-02	3.51E-03	1.91E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.76E-04	8.73E-05	7.14E-05	-1.81E-03
ODP	kg CFC 11 eq.	3.32E-06	1.05E-07	2.48E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	5.27E-09	3.68E-10	3.11E-09	-1.52E-08
AP	mol H+ eq.	6.12E-01	3.27E-02	8.25E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.64E-03	2.14E-04	8.39E-04	-7.25E-03
EP-freshwater	kg P eq.	1.80E-02	8.44E-04	4.42E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	4.22E-05	2.02E-05	1.23E-05	-3.40E-04
EP-marine	kg N eq.	1.15E-01	1.17E-02	1.39E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	5.85E-04	4.30E-05	3.24E-04	-2.24E-03
EP-terrestrial	mol N eq.	1.35E+00	1.27E-01	1.50E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	6.37E-03	4.30E-04	3.53E-03	-2.28E-02
POCP	kg NMVOC eq.	3.86E-01	4.44E-02	6.34E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	2.22E-03	1.37E-04	1.23E-03	-8.26E-03
ADPE	kg Sb eq.	5.09E-03	2.56E-05	1.94E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.28E-06	4.17E-08	2.24E-07	-6.61E-06
ADPF	MJ, net calorific value	8.34E+02	1.08E+02	2.42E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	5.39E+00	6.46E-01	2.72E+00	-1.81E+01
WDP	m3 world eq. deprived	1.75E+01	4.99E-01	4.76E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	2.49E-02	5.78E-03	1.78E+00	-7.75E-01
PM	Disease incidence	7.36E-06	6.17E-07	9.97E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	3.08E-08	1.96E-09	1.96E-08	-3.01E-07
IRP	kBq U235 eq.	1.40E+00	8.67E-02	4.94E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	4.33E-03	5.79E-03	2.10E-03	-5.87E-02
ETP-fw	CTUe	6.90E+02	1.97E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	9.83E-01	9.86E-02	6.43E-01	-1.01E+01
HTP-c	CTUh	4.07E-08	1.30E-09	8.72E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	6.50E-11	4.57E-12	2.67E-11	-1.08E-08
HTP-nc	CTUh	5.49E-07	6.67E-08	4.66E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	3.33E-09	2.38E-10	5.72E-10	-1.30E-08
SQP	dimensionless	5.04E+02	6.34E+01	6.17E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	3.17E+00	8.36E-02	6.43E+00	-9.27E+01

Table 12 Environmental impacts for vacuum insulating glass (6TL+0.3V+6T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	5.38E+01	6.02E+00	4.99E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	3.01E-01	3.36E-02	9.45E-02	-8.67E-01
GWP-fossil	kg CO2 eq.	5.72E+01	6.02E+00	1.58E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	3.01E-01	3.34E-02	9.42E-02	-7.71E-01
GWP-biogenic	kg CO2 eq.	-3.41E+00	1.38E-03	3.41E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	6.89E-05	5.20E-05	2.43E-04	-9.52E-02
GWP-luluc	kg CO2 eq.	3.40E-02	2.73E-03	1.90E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	1.37E-04	6.79E-05	5.55E-05	-1.05E-03
ODP	kg CFC 11 eq.	5.64E-07	8.19E-08	2.45E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	4.10E-09	2.87E-10	2.42E-09	-8.56E-09
AP	mol H+ eq.	4.85E-01	2.54E-02	8.17E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.27E-03	1.66E-04	6.53E-04	-4.02E-03
EP-freshwater	kg P eq.	1.49E-02	6.57E-04	4.40E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	3.28E-05	1.57E-05	9.55E-06	-1.89E-04
EP-marine	kg N eq.	9.08E-02	9.10E-03	1.35E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	4.55E-04	3.34E-05	2.52E-04	-1.31E-03
EP-terrestrial	mol N eq.	1.07E+00	9.91E-02	1.47E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	4.95E-03	3.35E-04	2.75E-03	-1.29E-02
POCP	kg NMVOC eq.	3.00E-01	3.45E-02	6.23E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	1.73E-03	1.07E-04	9.61E-04	-4.64E-03
ADPE	kg Sb eq.	4.97E-03	1.99E-05	1.93E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	9.95E-07	3.25E-08	1.74E-07	-3.61E-06
ADPF	MJ, net calorific value	6.25E+02	8.38E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.19E+00	5.03E-01	2.12E+00	-1.00E+01
WDP	m3 world eq. deprived	1.19E+01	3.88E-01	4.75E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	1.94E-02	4.50E-03	1.38E+00	-4.27E-01
PM	Disease incidence	5.76E-06	4.80E-07	9.80E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	2.40E-08	1.53E-09	1.52E-08	-2.03E-07
IRP	kBq U235 eq.	1.07E+00	6.74E-02	4.91E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	3.37E-03	4.51E-03	1.63E-03	-3.50E-02
ETP-fw	CTUe	5.04E+02	1.53E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	7.65E-01	7.67E-02	5.00E-01	-5.82E+00
HTP-c	CTUh	2.28E-08	1.01E-09	8.69E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	5.06E-11	3.56E-12	2.07E-11	-5.53E-09
HTP-nc	CTUh	4.34E-07	5.19E-08	4.65E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	2.59E-09	1.85E-10	4.45E-10	-7.56E-09
SQP	dimensionless	3.33E+02	4.93E+01	6.00E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	2.46E+00	6.51E-02	5.00E+00	-4.76E+01

Table 13 Environmental impacts for laminated vacuum insulating glass (6T+0.3V+6TL+1.52PVB+6T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	9.57E+01	9.36E+00	6.68E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	4.68E-01	5.21E-02	1.47E-01	-1.32E+00
GWP-fossil	kg CO2 eq.	1.01E+02	9.36E+00	1.59E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	4.68E-01	5.19E-02	1.46E-01	-1.17E+00
GWP-biogenic	kg CO2 eq.	-5.08E+00	2.14E-03	5.08E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	1.07E-04	8.07E-05	3.77E-04	-1.48E-01
GWP-luluc	kg CO2 eq.	6.95E-02	4.25E-03	1.91E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	2.12E-04	1.05E-04	8.64E-05	-1.59E-03
ODP	kg CFC 11 eq.	1.10E-06	1.27E-07	2.46E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	6.37E-09	4.45E-10	3.76E-09	-1.29E-08
AP	mol H+ eq.	7.65E-01	3.96E-02	8.21E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.98E-03	2.58E-04	1.02E-03	-6.06E-03
EP-freshwater	kg P eq.	2.25E-02	1.02E-03	4.41E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	5.10E-05	2.44E-05	1.48E-05	-2.84E-04
EP-marine	kg N eq.	1.40E-01	1.41E-02	1.37E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	7.07E-04	5.19E-05	3.92E-04	-1.99E-03
EP-terrestrial	mol N eq.	1.63E+00	1.54E-01	1.48E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	7.70E-03	5.20E-04	4.27E-03	-1.94E-02
POCP	kg NMVOC eq.	4.78E-01	5.37E-02	6.29E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	2.68E-03	1.65E-04	1.49E-03	-7.00E-03
ADPE	kg Sb eq.	5.28E-03	3.09E-05	1.94E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.55E-06	5.04E-08	2.71E-07	-5.43E-06
ADPF	MJ, net calorific value	1.13E+03	1.30E+02	2.40E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	6.52E+00	7.80E-01	3.30E+00	-1.51E+01
WDP	m3 world eq. deprived	2.39E+01	6.03E-01	4.75E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	3.02E-02	6.98E-03	2.15E+00	-6.43E-01
PM	Disease incidence	8.82E-06	7.46E-07	9.88E-08	0.00E+00	7.21E-08	0.00E+00	0.00E+00	3.73E-08	2.37E-09	2.37E-08	-3.12E-07
IRP	kBq U235 eq.	2.36E+00	1.05E-01	4.92E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	5.24E-03	6.99E-03	2.53E-03	-5.31E-02
ETP-fw	CTUe	7.20E+02	2.38E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	1.19E+00	1.19E-01	7.78E-01	-8.81E+00
HTP-c	CTUh	3.53E-08	1.57E-09	8.71E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	7.87E-11	5.52E-12	3.22E-11	-8.26E-09
HTP-nc	CTUh	7.16E-07	8.07E-08	4.65E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	4.03E-09	2.87E-10	6.91E-10	-1.14E-08
SQP	dimensionless	5.04E+02	7.66E+01	6.09E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	3.83E+00	1.01E-01	7.78E+00	-7.12E+01

Table 14 Environmental impacts for hybrid vacuum insulating glass (6T+0.3V+6TL+12A+6T)

RESULTS OF THE LCA - ENVIRONMENTAL IMPACT per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
GWP-total	kg CO2 eq.	7.77E+01	9.24E+00	9.03E+00	0.00E+00	7.38E-01	0.00E+00	0.00E+00	4.62E-01	5.15E-02	1.45E-01	-1.65E+00
GWP-fossil	kg CO2 eq.	8.50E+01	9.24E+00	1.61E+00	0.00E+00	3.14E-01	0.00E+00	0.00E+00	4.62E-01	5.13E-02	1.45E-01	-1.50E+00
GWP-biogenic	kg CO2 eq.	-7.41E+00	2.11E-03	7.42E+00	0.00E+00	2.33E-03	0.00E+00	0.00E+00	1.06E-04	7.97E-05	3.72E-04	-1.47E-01
GWP-luluc	kg CO2 eq.	4.82E-02	4.19E-03	1.91E-03	0.00E+00	4.22E-01	0.00E+00	0.00E+00	2.10E-04	1.04E-04	8.53E-05	-2.04E-03
ODP	kg CFC 11 eq.	3.34E-06	1.26E-07	2.48E-08	0.00E+00	8.45E-09	0.00E+00	0.00E+00	6.29E-09	4.40E-10	3.71E-09	-1.70E-08
AP	mol H+ eq.	7.08E-01	3.91E-02	8.27E-03	0.00E+00	4.20E-03	0.00E+00	0.00E+00	1.95E-03	2.55E-04	1.00E-03	-8.09E-03
EP-freshwater	kg P eq.	1.93E-02	1.01E-03	4.43E-04	0.00E+00	1.26E-04	0.00E+00	0.00E+00	5.04E-05	2.41E-05	1.47E-05	-3.79E-04
EP-marine	kg N eq.	1.32E-01	1.40E-02	1.39E-03	0.00E+00	4.08E-03	0.00E+00	0.00E+00	6.98E-04	5.13E-05	3.87E-04	-2.52E-03
EP-terrestrial	mol N eq.	1.55E+00	1.52E-01	1.51E-02	0.00E+00	1.50E-02	0.00E+00	0.00E+00	7.60E-03	5.14E-04	4.22E-03	-2.56E-02
POCP	kg NMVOC eq.	4.44E-01	5.30E-02	6.37E-03	0.00E+00	2.11E-03	0.00E+00	0.00E+00	2.65E-03	1.63E-04	1.47E-03	-9.24E-03
ADPE	kg Sb eq.	5.17E-03	3.05E-05	1.94E-05	0.00E+00	4.25E-06	0.00E+00	0.00E+00	1.53E-06	4.98E-08	2.68E-07	-7.36E-06
ADPF	MJ, net calorific value	9.50E+02	1.29E+02	2.42E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	6.43E+00	7.71E-01	3.25E+00	-2.02E+01
WDP	m3 world eq. deprived	1.97E+01	5.96E-01	4.76E-01	0.00E+00	8.37E-01	0.00E+00	0.00E+00	2.98E-02	6.90E-03	2.12E+00	-8.64E-01
PM	Disease incidence	8.47E-06	7.37E-07	1.00E-07	0.00E+00	7.21E-08	0.00E+00	0.00E+00	3.68E-08	2.34E-09	2.34E-08	-3.48E-07
IRP	kBq U235 eq.	1.57E+00	1.03E-01	4.94E-02	0.00E+00	1.20E-02	0.00E+00	0.00E+00	5.17E-03	6.91E-03	2.50E-03	-6.64E-02
ETP-fw	CTUe	7.65E+02	2.35E+01	1.38E+01	0.00E+00	1.53E+01	0.00E+00	0.00E+00	1.17E+00	1.18E-01	7.68E-01	-1.13E+01
HTP-c	CTUh	4.48E-08	1.55E-09	8.73E-10	0.00E+00	1.08E-09	0.00E+00	0.00E+00	7.77E-11	5.46E-12	3.18E-11	-1.19E-08
HTP-nc	CTUh	6.09E-07	7.96E-08	4.67E-08	0.00E+00	2.09E-08	0.00E+00	0.00E+00	3.98E-09	2.84E-10	6.83E-10	-1.46E-08
SQP	dimensionless	5.66E+02	7.57E+01	6.21E+00	0.00E+00	3.19E+01	0.00E+00	0.00E+00	3.78E+00	9.98E-02	7.68E+00	-1.02E+02

3.2 Resource use and waste categories

Table 15 Resource use of vacuum insulating glass (3.2TL+0.3V+3.2T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	3.91E+02	4.48E+01	2.38E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	2.24E+00	2.69E-01	1.13E+00	-6.14E+00
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	3.91E+02	4.48E+01	2.38E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	2.24E+00	2.69E-01	1.13E+00	-6.14E+00
PERT	MJ	7.61E+01	6.24E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	3.12E-02	3.07E-02	1.46E-02	-4.48E+00
PERM	MJ	1.85E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	5.76E+01	6.24E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	3.12E-02	3.07E-02	1.46E-02	-4.48E+00
FW	m3	1.97E-01	6.23E-03	1.23E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	3.11E-04	9.97E-05	1.72E-02	-6.68E-03
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 16 Waste categories of vacuum insulating glass (3.2TL+0.3V+3.2T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	2.52E-03	3.03E-04	3.74E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	1.52E-05	8.82E-07	8.04E-06	-6.39E-05
NHWD	kg	3.70E+00	2.08E-01	2.02E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	1.04E-01	4.26E-04	4.65E+00	-2.49E-01
RWD	kg	1.73E-04	8.82E-06	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	4.41E-07	5.88E-07	2.13E-07	-9.70E-06
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	1.99E+00	0.00E+00	1.34E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.14E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 17 Resource use of vacuum insulating glass (4TL+0.3V+4T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	4.69E+02	5.59E+01	2.38E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	2.80E+00	3.36E-01	1.41E+00	-7.25E+00
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	4.68E+02	5.59E+01	2.38E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	2.80E+00	3.36E-01	1.41E+00	-7.25E+00
PERT	MJ	8.14E+01	7.80E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	3.90E-02	3.83E-02	1.83E-02	-5.23E+00
PERM	MJ	2.16E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	5.98E+01	7.80E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	3.90E-02	3.83E-02	1.83E-02	-5.23E+00
FW	m3	2.35E-01	7.78E-03	1.23E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	3.89E-04	1.24E-04	2.15E-02	-7.91E-03
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 18 Waste categories of vacuum insulating glass (4TL+0.3V+4T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	2.91E-03	3.79E-04	3.74E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	1.89E-05	1.10E-06	1.00E-05	-7.50E-05
NHWD	kg	4.77E+00	2.60E-01	2.04E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	1.30E-01	5.31E-04	5.81E+00	-3.03E-01
RWD	kg	2.02E-04	1.10E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	5.51E-07	7.34E-07	2.66E-07	-1.15E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	2.49E+00	0.00E+00	1.56E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 19 Resource use of laminated vacuum insulating glass (4T+0.3V+4TL+0.76PVB+4T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	7.73E+02	8.62E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.31E+00	5.16E-01	2.18E+00	-1.05E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	7.73E+02	8.62E+01	2.39E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	4.31E+00	5.16E-01	2.18E+00	-1.05E+01
PERT	MJ	1.10E+02	1.20E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	6.00E-02	5.89E-02	2.81E-02	-7.44E+00
PERM	MJ	3.07E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	7.94E+01	1.20E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	6.00E-02	5.89E-02	2.81E-02	-7.44E+00
FW	m3	4.19E-01	1.20E-02	1.23E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	5.99E-04	1.91E-04	3.30E-02	-1.15E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 20 Waste categories of laminated vacuum insulating glass (4T+0.3V+4TL+0.76PVB+4T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	4.41E-03	5.84E-04	3.75E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	2.92E-05	1.69E-06	1.55E-05	-1.07E-04
NHWD	kg	7.53E+00	4.01E-01	2.08E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	2.00E-01	8.17E-04	8.94E+00	-4.51E-01
RWD	kg	3.77E-04	1.70E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	8.49E-07	1.13E-06	4.10E-07	-1.66E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.73E+00	0.00E+00	2.22E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.20E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 21 Resource use of hybrid vacuum insulating glass (4T+0.3V+4TL+12A+4T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	7.18E+02	8.68E+01	2.41E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.34E+00	5.21E-01	2.20E+00	-1.60E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	7.18E+02	8.68E+01	2.41E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	4.34E+00	5.21E-01	2.20E+00	-1.60E+01
PERT	MJ	1.20E+02	1.21E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	6.05E-02	5.94E-02	2.84E-02	-1.25E+01
PERM	MJ	5.20E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	6.81E+01	1.21E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	6.05E-02	5.94E-02	2.84E-02	-1.25E+01
FW	m3	3.99E-01	1.21E-02	1.24E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	6.04E-04	1.93E-04	3.33E-02	-1.74E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 22 Waste categories of vacuum insulating glass (4T+0.3V+4TL+12A+4T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	4.41E-03	4.40E-03	5.88E-04	3.76E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	2.94E-05	1.71E-06	1.56E-05
NHWD	kg	7.53E+00	7.86E+00	4.04E-01	2.18E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	2.02E-01	8.24E-04	9.01E+00
RWD	kg	3.77E-04	3.10E-04	1.71E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	8.55E-07	1.14E-06	4.13E-07
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.73E+00	0.00E+00	3.77E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.21E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 23 Resource use of vacuum insulating glass (5TL+0.3V+5T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	5.47E+02	6.99E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	3.49E+00	4.19E-01	1.77E+00	-8.65E+00
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	5.47E+02	6.99E+01	2.39E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	3.49E+00	4.19E-01	1.77E+00	-8.65E+00
PERT	MJ	8.71E+01	9.74E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	4.87E-02	4.78E-02	2.28E-02	-6.16E+00
PERM	MJ	2.54E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	6.18E+01	9.74E-01	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	4.87E-02	4.78E-02	2.28E-02	-6.16E+00
FW	m3	2.74E-01	9.72E-03	1.23E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	4.86E-04	1.55E-04	2.68E-02	-9.44E-03
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 24 Waste categories of vacuum insulating glass (5TL+0.3V+5T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	3.31E-03	4.73E-04	3.74E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	2.37E-05	1.37E-06	1.25E-05	-8.88E-05
NHWD	kg	5.85E+00	3.25E-01	2.06E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	1.62E-01	6.63E-04	7.25E+00	-3.69E-01
RWD	kg	2.32E-04	1.38E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	6.88E-07	9.16E-07	3.33E-07	-1.37E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.11E+00	0.00E+00	1.84E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.78E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 25 Resource use of laminated vacuum insulating glass (5T+0.3V+5TL+1.52PVB+5T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	1.02E+03	1.09E+02	2.40E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	5.47E+00	6.55E-01	2.77E+00	-1.30E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	1.02E+03	1.09E+02	2.40E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	5.47E+00	6.55E-01	2.77E+00	-1.30E+01
PERT	MJ	1.28E+02	1.52E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	7.62E-02	7.47E-02	3.57E-02	-9.19E+00
PERM	MJ	3.78E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	9.01E+01	1.52E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	7.62E-02	7.47E-02	3.57E-02	-9.19E+00
FW	m3	5.77E-01	1.52E-02	1.24E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	7.61E-04	2.43E-04	4.20E-02	-1.42E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 26 Waste categories of laminated vacuum insulating glass (5T+0.3V+5TL+1.52PVB+5T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	5.59E-03	7.41E-04	3.75E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	3.71E-05	2.15E-06	1.96E-05	-1.33E-04
NHWD	kg	9.57E+00	5.09E-01	2.11E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	2.54E-01	1.04E-03	1.14E+01	-5.67E-01
RWD	kg	5.40E-04	2.16E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	1.08E-06	1.43E-06	5.21E-07	-2.06E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	4.66E+00	0.00E+00	2.74E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.79E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 27 Resource use of hybrid vacuum insulating glass (5T+0.3V+5TL+12A+5T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	8.34E+02	1.08E+02	2.42E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	5.39E+00	6.46E-01	2.72E+00	-1.81E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	8.34E+02	1.08E+02	2.42E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	5.39E+00	6.46E-01	2.72E+00	-1.81E+01
PERT	MJ	1.28E+02	1.50E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	7.51E-02	7.37E-02	3.52E-02	-1.39E+01
PERM	MJ	5.77E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	7.08E+01	1.50E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	7.51E-02	7.37E-02	3.52E-02	-1.39E+01
FW	m3	4.56E-01	1.50E-02	1.24E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	7.49E-04	2.39E-04	4.13E-02	-1.97E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 28 Waste categories of hybrid vacuum insulating glass (5T+0.3V+5TL+12A+5T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	4.99E-03	7.30E-04	3.76E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	3.65E-05	2.12E-06	1.93E-05	-1.92E-04
NHWD	kg	9.44E+00	5.01E-01	2.21E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	2.50E-01	1.02E-03	1.12E+01	-6.75E-01
RWD	kg	3.51E-04	2.12E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	1.06E-06	1.41E-06	5.13E-07	-2.87E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	4.66E+00	0.00E+00	4.18E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.75E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 29 Resource use of vacuum insulating glass (6TL+0.3V+6T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	6.25E+02	8.38E+01	2.39E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	4.19E+00	5.03E-01	2.12E+00	-1.00E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	6.25E+02	8.38E+01	2.39E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	4.19E+00	5.03E-01	2.12E+00	-1.00E+01
PERT	MJ	9.28E+01	1.17E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	5.84E-02	5.73E-02	2.74E-02	-7.09E+00
PERM	MJ	2.91E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	6.37E+01	1.17E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	5.84E-02	5.73E-02	2.74E-02	-7.09E+00
FW	m3	3.13E-01	1.17E-02	1.23E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	5.83E-04	1.86E-04	3.21E-02	-1.10E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 30 Waste categories of vacuum insulating glass (6TL+0.3V+6T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	3.71E-03	5.68E-04	3.75E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	2.84E-05	1.65E-06	1.50E-05	-1.03E-04
NHWD	kg	6.93E+00	3.90E-01	2.07E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	1.95E-01	7.95E-04	8.70E+00	-4.36E-01
RWD	kg	2.61E-04	1.65E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	8.26E-07	1.10E-06	3.99E-07	-1.59E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	3.73E+00	0.00E+00	2.11E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.14E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 31 Resource use of laminated vacuum insulating glass (6T+0.3V+6TL+1.52PVB+6T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	1.13E+03	1.30E+02	2.40E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	6.52E+00	7.80E-01	3.30E+00	-1.51E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	1.13E+03	1.30E+02	2.40E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	6.52E+00	7.80E-01	3.30E+00	-1.51E+01
PERT	MJ	1.36E+02	1.82E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	9.08E-02	8.90E-02	4.26E-02	-1.06E+01
PERM	MJ	4.35E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	9.28E+01	1.82E+00	1.32E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	9.08E-02	8.90E-02	4.26E-02	-1.06E+01
FW	m3	6.34E-01	1.81E-02	1.24E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	9.06E-04	2.89E-04	5.00E-02	-1.65E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 32 Waste categories of laminated vacuum insulating glass (6T+0.3V+6TL+1.52PVB+6T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	6.17E-03	8.83E-04	3.76E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	4.41E-05	2.56E-06	2.34E-05	-1.54E-04
NHWD	kg	1.12E+01	6.06E-01	2.14E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	3.03E-01	1.23E-03	1.35E+01	-6.67E-01
RWD	kg	5.81E-04	2.57E-05	1.21E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	1.28E-06	1.71E-06	6.20E-07	-2.39E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	5.60E+00	0.00E+00	3.15E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.32E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 33 Resource use of hybrid vacuum insulating glass (6T+0.3V+6TL+12A+6T)

RESULTS OF THE LCA - Resource use per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
PENRT	MJ	9.50E+02	1.29E+02	2.42E+01	0.00E+00	3.20E+00	0.00E+00	0.00E+00	6.43E+00	7.71E-01	3.25E+00	-2.02E+01
PENRM	MJ	7.87E-02	0.00E+00	0.00E+00	0.00E+00	5.38E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PENRE	MJ	9.50E+02	1.29E+02	2.42E+01	0.00E+00	2.66E+00	0.00E+00	0.00E+00	6.43E+00	7.71E-01	3.25E+00	-2.02E+01
PERT	MJ	1.37E+02	1.79E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	8.96E-02	8.79E-02	4.20E-02	-1.53E+01
PERM	MJ	6.33E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
PERE	MJ	7.34E+01	1.79E+00	1.33E+00	0.00E+00	1.79E+01	0.00E+00	0.00E+00	8.96E-02	8.79E-02	4.20E-02	-1.53E+01
FW	m3	5.13E-01	1.79E-02	1.24E-02	0.00E+00	3.77E-02	0.00E+00	0.00E+00	8.95E-04	2.86E-04	4.93E-02	-2.20E-02
SM	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
RSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
NRSF	MJ	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 34 Waste categories of hybrid vacuum insulating glass (6T+0.3V+6TL+12A+6T)

RESULTS OF THE LCA – Waste production per declared unit												
Impact category	Unit	A1-A3	A4	A5	B1	B2	B3-B7	C1	C2	C3	C4	D
HWD	kg	5.57E-03	8.72E-04	3.77E-04	0.00E+00	4.84E-05	0.00E+00	0.00E+00	4.36E-05	2.53E-06	2.31E-05	-2.13E-04
NHWD	kg	1.10E+01	5.98E-01	2.23E-02	0.00E+00	6.00E-02	0.00E+00	0.00E+00	2.99E-01	1.22E-03	1.34E+01	-7.75E-01
RWD	kg	3.92E-04	2.53E-05	1.22E-05	0.00E+00	3.21E-06	0.00E+00	0.00E+00	1.27E-06	1.69E-06	6.12E-07	-3.20E-05
MER	kg	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
MFR	kg	5.60E+00	0.00E+00	4.60E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.28E+01	0.00E+00	0.00E+00
CRU	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EEE	MJ	0.00E+00	0.00E+00	1.23E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
EET	MJ	0.00E+00	0.00E+00	2.40E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

3.3 Information on biogenic carbon content

Information on biogenic carbon content which shall be included in the EPD as follows.

Table 35 Information describing the biogenic carbon content

Biogenic carbon content	Unit (expressed per functional unit or per declared unit)
Biogenic carbon content in product	0 kg C
Biogenic carbon content in accompanying packaging (3.2TL+0.3V+3.2T)	0.5890 kg C
Biogenic carbon content in accompanying packaging (4TL+0.3V+4T)	0.6861 kg C
Biogenic carbon content in accompanying packaging (5TL+0.3V+5T)	0.8076 kg C
Biogenic carbon content in accompanying packaging (6TL+0.3V+6T)	0.9290 kg C
Biogenic carbon content in accompanying packaging (4T+0.3V+4TL+0.76PVB+4T,)	0.9752 kg C
Biogenic carbon content in accompanying packaging (5T+0.3V+5TL+1.52PVB+5T)	1.2035 kg C
Biogenic carbon content in accompanying packaging (6T+0.3V+6TL+1.52PVB+6T)	1.3856 kg C
Biogenic carbon content in accompanying packaging (4T+0.3V+4TL+12A+4T)	1.6577 kg C
Biogenic carbon content in accompanying packaging (5T+0.3V+5TL+12A+5T)	1.8398 kg C
Biogenic carbon content in accompanying packaging (6T+0.3V+6TL+12A+6T)	2.0220 kg C
NOTE：1 kg biogenic carbon is equivalent to 44/12 kg of CO2.	

4 Supplementary information

4.1 Calculation rules

Assumptions

The main assumptions of this LCA study are as follows:

- The raw material getter, butyl glue, molecular sieve and slurry can't be found in background database, they were substituted by others from Ecoinvent database.
- Transport assumptions are made where it is not possible to obtain the specific data. When this occurs, it is clearly stated in the report.
- For simplification, all three types of vacuum insulating glass product are assumed use the same amounts of materials in installation.
- During the end-of-life stage, the transportation of the waste glass from the operation site to treatment facilities such as dismantling site and disposal facilities is assumed to be 50km for simplification.

Cut off rules

The following procedure was followed for the exclusion of inputs and outputs:

- All inputs and outputs to a (unit) process will be included in the calculation for which data is available. Data gaps may be filled by conservative assumptions with average or generic data. Any assumptions for such choices will be documented.
- In case of insufficient input data or data gaps for a unit process, according to the EN 15804 requirement, the cut-off criteria chosen is 1% of renewable and non-renewable primary energy usage and 1% of the total mass of that unit process. The total neglected input flows of the cradle to grave stage, e.g. per module A1-A3, A4-A5, B1-B7, C1-C4 and module D shall be a maximum of 5% of energy usage and mass.

Data quality

The data quality requirements for this study were as follows:

- Existing LCI data were, at most, 10 years old. Newly collected LCI data were current or up to 3 years old.
- The LCI data related to the geographical locations in which the processes occurred, e.g. electricity and transportation data from China, disposal in China and SEA.
- The technology represented the average technologies at the time of data collection.

In the study the key parameters for producer-specific foreground data are based on 1 year of averaged data. In case of gap of data from Ecoinvent database, to avoid using dummy (empty) processes in the study, and also to use as much regional data as possible in some cases, alternative database is also referred to.

This report covers vacuum insulating glass in Luoyang and provided data for the period from September 2024 to August 2025. The products site is powered by State Grid and PV. This report covers transport to, and end-of-life in China and EU. Background data was sourced from the Ecoinvent 3.11 database.

Allocations

Allocation refers to partitioning of input or output flows of a process or a product system between the product systems under study and one or more other product systems.

In this report, in plant recycling for substrate production is assumed as a close loop, meaning all of the environment impact from recycling of substrate scraps, and glass scraps from cutting and edging treatment and benefit of using recycled material to avoid waste treatment for production are allocated to the process of vacuum insulating glass production.

For recycling and disposal process at the end-of-life stage, to be conservative, the benefit of recycling and recovery is not included in the product system and will not be allocated to vacuum insulating glass product.

For process-related allocations, a distinction is made between multi-input and multi-output processes.

Multi-input processes

For data sets in this study, the allocation of the inputs from coupled processes is generally carried out via the mass. For literature data, the source is generally referred to. Specially in allocating the energy within the production site i.e. electricity, allocation is via both mass and size of the product produced on a yearly average. The principle for choosing the mass and size is based on the relationship of the input to the output (of product) to the environmental impacts.

Multi-output processes

In this study, there is no other by-products produced from the production line, hence there is quite little occasion that requires allocation for multi-output processes. One allocation occurs on the environmental emissions allocation, especially in the area of waste treatment. In the end-of-life stage, the allocation within the disposal scenario follows mass allocation, which applies to waste treatment process inventory adopted from Ecoinvent data.

Electricity mix

In this report, the grid mix data on electricity of for the site in Luoyang is based on the State Grid Cooperation of China Central Branch (CCG) and PV (HE), accounting for 60% and 40% respectively. Electricity mix has been modelled from Ecoinvent database 3.11, which is valid from 2021 to 2024. The electricity inventory is based on the year of 2022 for Chinese electricity generation (China Energy Statistics).

In Chinese map of electricity generation, thermal power is the principal part of total national installed capacity and electricity generation in China. Development of hydropower is slower than the speed of thermal power development, and nuclear power is still in its initial step of development in China. Power generation from renewable energy resources, such as wind, solar energy and tide, is usually not included due to the small share in electricity generation in China, however the renewable energy was also considered in this study by taking into account the small ratio of wind, solar and other renewable energy generation in China. The GHG emission of CCG and PV (HE) are 0.861 kg CO2-eq/kWh and 0.089 kg CO2-eq/kWh respectively.

Moreover, the electricity consumption of offices has not been considered in this LCA report.

4.2 Scenarios and additional technical information

Raw material acquisition

All of the raw materials are sourced from LandVac in Luoyang China. The type and ratio/weight of raw materials per product are listed in table 4.

Raw materials transportation

The raw materials transportation mainly takes place on the upstream of raw material supply.

Manufacturing

The manufacturing process of vacuum insulating glass product mainly includes cutting, washing, polishing, printing, tempering, drying, bonding, exhausting, sealing and packaging, which involves raw materials, energy and emissions. The life cycle inventory data of vacuum insulating glass products including input and output data of energy and other packaging materials. And all the life cycle inventory data of manufacturing is calculated and submitted by the factory.

Transportation of products

According to LandVac, most of vacuum insulating glass product are consumed in China and Europe. Oceanic and road transportation distance for product delivery is estimated with reference from external resources. Sourcing: https://sea-distances.org.

Table 36 Transportation of products

Market location	Ratio	Distance (km)	Vehicle
China	42%	1000	Lorry
EU	58%	1000	Lorry
		10800	Ship

Installation

The installation of vacuum insulating glass product is an important task, and a few materials such as sealant and adhesive tape are necessary for installation. For simplification, all three types of vacuum insulating glass product are consumed use the same amounts of materials in installation.

Table 37 Materials use in installation of vacuum insulating glass

Material type	Amount	Unit
Sealant adhesive	0.05	kg
Sealant strip	4	m

In this LCA study we assume the vacuum insulating glass is flat, and the energy or material required for vacuum insulating glass preparation is omitted. As tools like bearing pad and protective pad are reusable, the production and disposal stage of tools is omitted.

The disposal of packaging materials is also included in the installation stage. According to LandVac, the target market of vacuum insulating glass products including China and Europe. The disposal of packaging materials will adopt a rough country and region weighted average disposal mode following literature review.

Table 38 Packaging disposal in the target market

Nation	Ratio	Packaging type	Recycling rate	Landfill rate	Incineration rate
China	42%	Wood	51.4%	38.1%	10.5%
		Plastic	25%	56%	19%
EU	58%	Wood	32%	39%	29%
		Plastic	41%	39%	20%

Table 39 Scenario and additional technical information of installation

Name	Value	Unit
Ancillary materials	2.45	kg
Water use	-	m^3
Other resources	-	kg
Electricity consumption	-	kWh
Other energy carriers	-	MJ
Product loss per functional unit	0	m^2/ m^2
Waste materials at the construction site before waste processing, generated by product installation	0	m^2/ m^2
Output materials resulting from on-site waste processing	-	kg
Mass of packaging waste specified by type	Wood:1.6639/2.4958/4.3677 Plastics:0.0016	kg
Biogenic carbon contained in packaging	0.78/1.17/2.05	kg C
Direct emissions to ambient air, soil and water	-	kg
VOC emissions	N/A	μg/m^3

The VOC emissions shall be determined in accordance with "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources using Environmental Chambers- version 1.2" CA Specification 01350.

Use

Very little effort is required in order to use vacuum insulating glass products, hence in the usage stage the focus is put on maintaining the glass in terms of protecting its integrity and functionality. In normal condition, routine cleaning is required. The water and detergent consumption data are based on estimation from EN 17074, the table below demonstrates the amount used in this LCA study.

Table 40 Inputs in maintenance stage

Input component	Amount	Unit
Water	0.2	L/m2/a
Detergent	0.01	L/m2/a

Table 41 Parameters of the reference conditions for the use of the product and justifying the RSL

Parameters	Value
RSL (reference service life)	50 years
Declared properties of the product (at the exit of the factory)	-U value≤0.5 W/m2*K -Max. 80% visible light transmittance

Theoretical application parameters (if specified by the manufacturer), including references to appropriate requirements and application codes	EN 19916-1:2018
Maintenance scenario for maintenance	Water and detergent

The only module taken into account in the lifecycle step is the maintenance module (B2), the product must be cleaned with detergent and water for maintenance. Repair (B3), replacement (B4) and rehabilitation (B5) are not included. Vacuum insulating glass does not require these operations during its lifetime under normal use. Finally, the product does not cause any consumption or emissions during use (B1).

Table 42 Maintenance parameters

Parameters	Value
Maintenance process	Cleaning by water and detergent
Maintenance cycle	Once a year for 50 years
Auxiliary inputs for maintenance	Tap water 0.2L/m2/a Detergent 0.01L/m2/a
Waste consumption from maintenance	Waste water
Net Freshwater Consumption During Maintenance	0.01 m3
Energy consumption during maintenance	0 kWh

End-of-life

According to LandVac, most of vacuum insulating glass products are used in China and Europe. The disposal of the used vacuum insulating glass product will adopt a region average disposal mode following literature review. Disassembly is assumed to be carried out manually. Although the product dimensions and weight are significant, no electrical or fossil-fuel-based equipment is allocated to the dismantling process in this assessment. Therefore, C1 results are reported as zero. For the waste scenario, 50km of road transportation (C2) from construction site to waste treatment site is assumed. Waste processing (C3) stage of the vacuum insulating glass will be assumed by loading, uploading, sorting and crushing, and end of life disposal treatment process (C4) from Ecoinvent will be used in this study.

Table 43 Product disposal in target market

Nation	Ratio	Recycling rate	Landfill rate	Incineration rate
China	42%	45%	55%	0%
EU	58%	90%	10%	0%

Benefits and loads beyond the system boundaries

The raw materials of vacuum insulating glass products are non-degradable, and the benefits of the waste products is from the substitution of primary glass with net scrap.

4.3 Dangerous substances

There are no dangerous substances into indoor air, oil and water during the use stage.

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