# Sklo v celém životním cyklu

OD SUROVIN A VÝROBY AŽ PO KONEC POUŽÍVÁNÍ

Srozumitelný přehled vlastností, složení a environmentálních dopadů vakuového izolačního skla.



**Vakuové**



**Hybridní**



**Vrstvené**

**1 m² skla • 10 skladeb • referenční životnost 50 let**
Podklad sleduje výrobu, dopravu, montáž, údržbu i nakládání se sklem po skončení používání.

Brožura ViGlass obsah původního dokumentu vysvětluje vlastními slovy. Technické hodnoty a výsledky výpočtů zůstávají převzaté z dodané EPD výrobce **LUOYANG LANDVAC Ti-VIG CO., LTD**.

EPD se vztahuje ke konkrétním výrobkům a výrobnímu závodu LandVac. Použití údajů pro výrobek prodávaný jako ViGlass vyžaduje shodu s deklarovanou skladbou a původem. Brožura sama nepředstavuje certifikaci značky ViGlass.

# Co tento dokument dokládá

IDENTIFIKACE PŮVODNÍ ENVIRONMENTÁLNÍ DEKLARACE

| Údaj | Hodnota v dodaném dokumentu |
|---|---|
| Vlastník EPD | LUOYANG LANDVAC Ti-VIG CO., LTD |
| Výrobní místo | Luoyang, oblast Yibin, provincie Henan, Čína; severozápadní roh křižovatky KeJi Avenue a Zhuge Road, č. 1 |
| Číslo deklarace | EPD-CN-00053 |
| Registrace u EPDItaly | MR-EPDITALY0163 |
| Program / zveřejnění | EPD China / EPDItaly; vzájemné uznávání programů |
| Vydání / platnost | 28. 5. 2026 / do 27. 5. 2031 |
| Základní pravidla | ISO 14025; EN 15804:2012+A2:2019; CORE PCR ICMQ-001, rev. 4 (10. 11. 2025) a technický pokyn k PCR |
| Externí ověření | Weifang Yao, WIT; schváleno EPD China |
| Zpracování LCA | Chao WANG, Ecovane environmental |
| Výpočtové nástroje | SimaPro 10.3; databáze Ecoinvent 3.11 |
| Období výrobních dat | Září 2024 až srpen 2025 |
| Kód výrobku | UNCPC 371 |

Data platnosti jsou převzata z titulních stran. Jedna informační tabulka originálu obsahuje nevyplněné „DD“. Dodaný dokument uvádí, že následné sledování dat během platnosti nezahrnuje třetí certifikační subjekt.

# Tři konstrukce zasklení

STEJNÝ VAKUOVÝ ZÁKLAD, RŮZNÉ KOMBINACE



**Vakuové**



**Hybridní**



**Vrstvené**

## Vakuové izolační sklo

Dvě tepelně tvrzené tabule, z nichž jedna má nízkoemisní povlak, odděluje vakuová mezera 0,3 mm. Tlak ve vakuu je nejvýše 0,1 Pa. Hrany jsou uzavřeny nízkoteplotní kovovou pájkou. Válcové podpěry jsou v EPD popsány jako nerezové, uspořádané v pravoúhlé síti.

## Hybridní vakuové sklo

Vakuová jednotka je doplněna další tabulí a vzduchovou dutinou. Distanční rámeček obsahuje vysoušedlo; obvodové těsnění tvoří butyl a těsnicí tmel.

## Vrstvené vakuové sklo

Vakuová jednotka je spojena s další tvrzenou tabulí pomocí mezivrstvy PVB.

Použití uvedené v EPD: prosklené dveře a okna, fasády a střešní světlíky. Dokument zmiňuje tepelnou a zvukovou izolaci, omezení námrazy a úsporu energie.

# Parametry a čtení skladeb

TECHNICKÉ ÚDAJE PODLE TÉTO EPD

| Vlastnost | Údaj |
|---|---|
| Součinitel prostupu tepla U | ≤ 0,5 W/(m²·K) |
| Propustnost viditelného světla | Nejvýše 80 % |
| Maximální rozměr | 2 400 × 4 200 mm |
| Minimální rozměr | 300 × 300 mm |
| Tloušťky jednotlivých tabulí | 3,2 / 4 / 5 / 6 mm |
| Vakuová mezera | 0,3 mm |
| Dutiny u hybridních provedení | 6 / 9 / 12 / 16 mm; posuzované skladby mají 12 mm |
| PVB u vrstvených provedení | 0,76 / 1,52 mm |

## Příklad: 4TL + 0,3V + 4T

**4TL** = 4 mm tvrzené sklo s nízkoemisním povlakem.
**0,3V** = vakuová mezera široká 0,3 mm.
**4T** = 4 mm tvrzené sklo.
**12A** = vzduchová izolační dutina 12 mm.
**0,76PVB** = polymerní mezivrstva 0,76 mm.

Tyto hodnoty patří k rozsahu této EPD. Nepřebíráme sem odlišné hodnoty z jiné reklamní brožury. Konkrétní provedení musí odpovídat technickému návrhu.

# Deset posuzovaných skladeb

DEKLAROVANÁ JEDNOTKA: 1 m² ZASKLENÍ

| Kód | Skladba (zápis originálu) | kg/m² | kg/m³ |
|---|---|---|---|
| S1 | 3.2TL+0.3V+3.2T | 16,0618 | 2405,69 |
| S2 | 4TL+0.3V+4T | 20,0618 | 2423,87 |
| S3 | 4T+0.3V+4TL+0.76PVB+4T | 30,9004 | 2368,22 |
| S4 | 4T+0.3V+4TL+12A+4T | 31,1404 | 1283,71 |
| S5 | 5TL+0.3V+5T | 25,0618 | 2438,65 |
| S6 | 5T+0.3V+5TL+1.52PVB+5T | 39,2390 | 2332,93 |
| S7 | 5T+0.3V+5TL+12A+5T | 38,6404 | 1417,37 |
| S8 | 6TL+0.3V+6T | 30,0618 | 2448,63 |
| S9 | 6T+0.3V+6TL+1.52PVB+6T | 46,7390 | 2358,22 |
| S10 | 6T+0.3V+6TL+12A+6T | 46,1404 | 1524,56 |

Kódy S1–S10 jsou doplněné pouze pro snadné čtení této brožury. Ve všech následujících tabulkách označují stejné skladby. Hustota a plošná hmotnost jsou převzaté bez přepočtu.

**Proč není jedna hodnota pro celé portfolio?**
S větší hmotností a jiným složením se mění také environmentální dopady. Proto má každá skladba vlastní výsledky.

EPD hodnotí příspěvek obvodového těsnění a odlišných rozměrů jako zanedbatelný v rámci deklarovaného rozsahu: odchylka je podle podkladu menší než 10 %.

# Od surovin po recyklaci

CO ZAHRNUJE POSOUZENÍ ŽIVOTNÍHO CYKLU

| Modul | Co představuje |
|---|---|
| A1–A3 | Suroviny, doprava do výroby a výroba skla. |
| A4 | Doprava hotového výrobku k použití. |
| A5 | Montáž, pomocné materiály a nakládání s obaly. |
| B1 | Používání výrobku. |
| B2 | Údržba a čištění. |
| B3–B5 | Opravy, výměny a renovace. |
| B6–B7 | Provozní energie a voda. |
| C1–C4 | Demontáž, doprava odpadu, jeho zpracování a odstranění. |
| D | Potenciální přínosy a zátěže za hranicí systému, například náhrada primárních surovin recyklátem. |

Rozsah je „od kolébky do hrobu“: od získání surovin po konec životnosti. Modul D je uváděn odděleně od vlastního životního cyklu výrobku.

**Nula v tabulce neznamená nulový dopad budovy.**
Model nevyčísluje úsporu vytápění konkrétního domu. U běžného používání předpokládá pouze čištění, bez oprav a výměn během referenčních 50 let.

EPD různých programů nebo výrobků nelze automaticky porovnat. Je nutné ověřit shodná pravidla, rozsah, funkci a zahrnuté fáze. Ani použití stejného PCR samo neodstraňuje všechny rozdíly.

# Klimatická stopa výroby

GWP-TOTAL PRO 1 m² SKLA • MODULY A1–A3

| Skladba | Výroba A1–A3 | Doprava A4 | Montáž A5 | Modul D* |
|---|---|---|---|---|
| S1 | 33,80 | 3,22 | 3,74 | -0,514 |
| S2 | 40,50 | 4,02 | 4,10 | -0,615 |
| S3 | 65,90 | 6,19 | 5,16 | -0,902 |
| S4 | 58,00 | 6,24 | 7,68 | -1,270 |
| S5 | 47,20 | 5,02 | 4,55 | -0,741 |
| S6 | 85,90 | 7,86 | 6,01 | -1,130 |
| S7 | 67,80 | 7,74 | 8,35 | -1,460 |
| S8 | 53,80 | 6,02 | 4,99 | -0,867 |
| S9 | 95,70 | 9,36 | 6,68 | -1,320 |
| S10 | 77,70 | 9,24 | 9,03 | -1,650 |

**Jednotka všech čísel: kg $CO_2$ ekv. na 1 m².**
S1–S10 odpovídají skladbám na straně 5. Údaje jsou přesně převzaté z vědeckého zápisu tabulek EPD.

### Jak tabulku číst

Například skladba S2 má pro výrobu A1–A3 hodnotu 40,50 kg $CO_2$ ekv./m². Není to celkový dopad za celou životnost ani úspora emisí dosažená v konkrétní budově.

* Modul D je vykázán zvlášť. Jeho záporná hodnota vyjadřuje modelovaný potenciální přínos za hranicí systému. Zde jej od výroby neodečítáme. Všechny zbývající moduly i další ukazatele zůstávají v technické příloze.

# Výroba, materiály a energie

Z ČEHO VÝSLEDKY VYCHÁZEJÍ

Výroba zahrnuje řezání, mytí, broušení či leštění, tisk, tepelné tvrzení, sušení, spojování, odsávání vzduchu, utěsnění a balení. Výrobní údaje o materiálech, energiích a emisích dodal závod.

## Materiálové složení

Základ tvoří čiré a nízkoemisní sklo. Součástí jsou pasta, pájka a getter, který pohlcuje zbytkové plyny. Vrstvené skladby přidávají PVB; hybridní navíc rámeček, dvě složky silikonového tmelu, butyl a molekulové síto. Balení tvoří dřevěná bedna a plastová fólie.

## Elektřina v modelu závodu

| Zdroj | Podíl | Emisní faktor |
|---|---|---|
| Síť CCG, Čína | 60 % | 0,861 kg $CO_2$ ekv./kWh |
| Fotovoltaika PV (HE) | 40 % | 0,089 kg $CO_2$ ekv./kWh |

Výrobní data pokrývají jeden rok. Databázový mix elektřiny je modelován z Ecoinvent 3.11; originál uvádí platnost dat 2021–2024 a čínskou energetickou statistiku roku 2022. Spotřeba kanceláří není zahrnuta.

## Uhlík v obalech

Samotný výrobek obsahuje podle EPD 0 kg biogenního uhlíku. Ten je přítomen v obalech, zejména ve dřevě. Hodnoty pro jednotlivé skladby jsou v tabulce 35 v příloze. Přepočet: 1 kg biogenního uhlíku odpovídá 44/12 kg $CO_2$.

# Doprava, montáž a údržba

SCÉNÁŘE VÝPOČTU, NIKOLI MONTÁŽNÍ PŘEDPIS

| Oblast / činnost | Předpoklad EPD |
|---|---|
| Čínský trh: 42 % výrobků | 1 000 km silniční dopravy. |
| Evropský trh: 58 % výrobků | 1 000 km silniční + 10 800 km lodní dopravy. |
| Montáž 1 m² | 0,05 kg lepicího/těsnicího materiálu a 4 m těsnicí pásky. |
| Ztráty při montáži | 0 m² na deklarovanou jednotku. |
| Údržba | Čištění jednou ročně po dobu 50 let. |
| Roční spotřeba na 1 m² | 0,2 l vody a 0,01 l čisticího prostředku. |
| Voda za 50 let | 0,01 m³ na 1 m²; energie na údržbu 0 kWh. |

Ve všech třech typech zasklení model předpokládá stejné množství montážních materiálů. Opakovaně používané pomůcky a příprava skla před osazením jsou vynechány. Likvidace obalů je zahrnuta do montáže.

## Nakládání s obaly v modelu

| Trh / materiál | Recyklace | Skládka | Spalování |
|---|---|---|---|
| Čína / dřevo | 51,4 % | 38,1 % | 10,5 % |
| Čína / plast | 25 % | 56 % | 19 % |
| EU / dřevo | 32 % | 39 % | 29 % |
| EU / plast | 41 % | 39 % | 20 % |

Modelové spotřeby nejsou doporučením pro skutečné dávkování tmelu či čištění. Použijte technické pokyny konkrétního systému.

# Konec životnosti a výpočtová pravidla

PŘEDPOKLADY DŮLEŽITÉ PRO SPRÁVNÉ ČTENÍ VÝSLEDKŮ

Demontáž se v modelu provádí ručně, proto je C1 vykázáno jako nula. Odpadní sklo následně cestuje 50 km po silnici. Zpracování zahrnuje manipulaci, třídění a drcení.

| Trh | Recyklace | Skládkování | Spalování |
|---|---|---|---|
| Čína (42 %) | 45 % | 55 % | 0 % |
| EU (58 %) | 90 % | 10 % | 0 % |

Potenciální přínos po životnosti vychází z náhrady primárního skla recyklovaným materiálem. Recyklace uvnitř závodu je posouzena jako uzavřená smyčka a přiřazena k výrobě.

## Kvalita dat a zjednodušení

• Chybějící databázové materiály (getter, butyl, molekulové síto, pasta) byly nahrazeny zástupnými daty.

• Hranice pro vynechání vstupů je 1 % energie a 1 % hmotnosti procesu; celkem nejvýše 5 % v příslušných skupinách modulů.

• Starší databázová data mají stáří nejvýše 10 let, nově získaná data nejvýše 3 roky.

• Rozdělení zátěží mezi produkty vychází převážně z hmotnosti; elektřina také z rozměrů a ročních průměrů.

EPD uvádí, že při používání nedochází k uvolňování nebezpečných látek do vnitřního ovzduší a dalších prostředí. Nejde o samostatný protokol o emisích VOC.

# Co znamenají ukazatele

ČESKÝ KLÍČ K PŮVODNÍM VÝSLEDKOVÝM TABULKÁM

| Zkratka | Význam |
|---|---|
| GWP-total / fossil / biogenic / luluc | Celkový vliv na změnu klimatu; fosilní a biogenní složka; využití půdy a jeho změny. |
| ODP | Poškozování ozonové vrstvy. |
| AP | Okyselování prostředí. |
| EP-freshwater / marine / terrestrial | Obohacování živinami: sladká voda, mořské prostředí a pevnina. |
| POCP | Tvorba přízemního fotochemického ozonu. |
| ADPE / ADPF | Úbytek nerostných a kovových zdrojů / fosilních zdrojů. |
| WDP | Potenciál nedostatku vody. |
| PM / IRP | Dopad jemných prachových částic / ionizujícího záření. |
| ETP-fw / HTP-c / HTP-nc | Sladkovodní ekotoxicita / toxicita pro člověka, karcinogenní a nekarcinogenní účinky. |
| SQP | Potenciální dopady na kvalitu půdy. |
| PERT / PERE / PERM | Obnovitelná primární energie: celkem / energetické využití / využití jako surovina. |
| PENRT / PENRE / PENRM | Neobnovitelná primární energie: celkem / energetické využití / využití jako surovina. |
| FW / SM / RSF / NRSF | Čistá spotřeba sladké vody / druhotné materiály / obnovitelná a neobnovitelná druhotná paliva. |
| HWD / NHWD / RWD | Nebezpečný / ostatní / radioaktivní odpad. |
| MER / MFR / CRU | Materiály k energetickému využití / k recyklaci / díly k opětovnému použití. |
| EEE / EET | Exportovaná elektrická / tepelná energie. |

Vědecký zápis: 4,05E+01 = 40,5; 7,38E−01 = 0,738. Jednotky a znaménka je nutné zachovat. Různé ukazatele se nesčítají mezi sebou.

# Původ dokumentu a technická příloha

JAK ZŮSTÁVÁ ZACHOVANÝ OBSAH PODKLADU

Původní EPD patří společnosti LUOYANG LANDVAC Ti-VIG CO., LTD, dceřiné společnosti LandGlass Technology Co., Ltd. LandGlass vznikla roku 2003 a zaměřuje se na zařízení pro tvrzení skla a vakuové sklo.

Dokument uvádí 530 patentů, z nich více než 170 mezinárodních, přes 350 zaměstnanců a tři výrobní a vývojové základny. Zmiňuje systémy řízení ISO 9001:2015 a ISO 14001:2015 a řady zaměřené na úsporu energie, hluk a omezení kondenzace.

## Co obsahuje následující příloha

Původní tabulky materiálového složení, všech environmentálních dopadů, spotřeby zdrojů, odpadů a biogenního uhlíku jsou připojené **beze změny hodnot a v původním anglickém znění**. Český klíč zkratek je na předchozí straně.

Příloha obsahuje původní číslované strany 7–28, montážní tabulku 39 a bibliografii. Zbytek věcného obsahu je vysvětlen v hlavní části. Kontaktní údaje ani reklamní kontaktní stránku do brožury nepřebíráme.

**Identita ověření zůstává původní.**
ViGlass je název této brožury. Čísla EPD, původ výrobku a rozsah ověření zůstávají spojeny s původním výrobcem. Text je přeformulovaný; výsledkové tabulky nejsou změněny.

Prameny zahrnují ISO 14025, ISO 14040, ISO 14044, EN 15804+A2, EN 17074 a PCR ICMQ-001. Úplný seznam odkazů je v příloze. Platnost ani autenticita dodaného dokumentu nebyly nezávisle ověřovány.

## 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. | |

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<br>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.

# References


1. ISO 14025 (2010): Environmental labels and declarations - Type III environmental declarations - Principles and procedures.
2. ISO 14040 (2006): Environmental Management - Life Cycle Assessment - Principles and Framework
3. ISO 14044 (2006): Environmental Management - Life Cycle Assessment - Requirements and Guidelines
4. EN 15804:2012+A2:2019 Environmental product declaration - Core rules for the product category of construction products.
5. CORE PCR for CONSTRUCTION PRODUCTS AND SERVICES: ICMQ - 001, Rev. 4 (10/11/2025)
6. TECHNICAL GUIDELINE to CORE PCR ICMQ 001
7. EN 17074:2019 Glass in building - Environmental product declaration - Product category rules for flat glass products
8. China Statistical Yearbook, 2022. National Bureau of Statistics of China
9. Eurostat, Recovery and recycling rates for packaging.
10. Geyer, R. Production, use, and fate of all plastics ever made. Science Advances.
11. Nelles, M. et al. Recycling and Recovery of the biogenic fractions from municipal solid waste in the PR China. Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety.
12. TECHNICAL GUIDELINE to CORE PCR ICMQ 001