Environmental Product Declaration

In accordance with
EN 15804:2012+A2:2019 and ISO 14025

Photo: ©Laurent Kronental

Solar Gard® LX (HILITE) series up to 3 mil

Date of issue: 2023-04-12
Validity: 5 years
Date of validity: 2028-04-12

Scope of the EPD®:
Europe and MEA/India
Version: 1

Programme: The International EPD® System, www.environdec.com
Programme operator: EPD International AB
Registration number S-P-06662

1. General Information

Manufacturer:	Saint-Gobain Solar Gard LLC, 4540 Viewridge Ave CA 92123 San Diego USA
Programme used:	International EPD System http://www.environdec.com/
EPD registration number/ declaration number:	S-P-06662
PCR identification:	EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declaration - core rules for the product category of construction product and The International EPD® System PCR 2019:14 version 1.11 for Construction products
Site of manufacture:	San Diego Plant
Owner of the declaration:	Saint-Gobain Innovative Materials Belgium SA / Solar Gard Karreweg 18, 9870, Zulte, Belgium
Product / product family name and manufacturer represented:	Solar Gard LX (HILITE) series up to 3 mil manufactured in San Diego plant - **in total 12 products**
Reference Product:	**Solar Gard 2 mil LX (HILITE) 70** (supplied as roll with dimensions 150 cm wide and 30,5 m long)
UN CPC code:	36920 – Articles of Plastic n.e.c.
Declaration issued:	2023-03-28 Valid until: 2028-03-27
Demonstration of verification:	An independent verification of the declaration was made, according to ISO 14025:2010. This verification was external and conducted by the following third party based on the PCR mentioned above.
EPD Prepared by:	Peter Staelens (Solar Gard) and Patricia Jimenez Diaz (Saint-Gobain LCA central team)
Contact:	Peter.Staelens@saint-gobain.com and Patricia.JimenezDiaz@saint-gobain.com
The declared unit is:	1m² of installed window film
Declaration of Hazardous substances:	(Candidate list of Substances of Very High Concern): none
Geographical scope of the EPD®:	Europe and MEA/India

Programme:	The international EPD® System
Adress:	EPD® International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
E-mail:	info@environdec.com

CEN standard EN 15804:2012 + A2:2019 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction Products, version 1.1
PCR review was conducted by: El Comité Técnico del Sistema Internacional EPD©
President: Claudia A. Peña. Contact via info@environdec.com

Independent third-party verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process certification ☒ EPD verification

Third party verifier: Yannick LE GUERN
ELYS-Conseil
In case of recognized individual verifiers: Approved by: The International EPD© System

Procedure for follow-up of data during EPD validity involves third part verifier:

☐ Yes ☒ No

The intended use of this EPD is for B2B communication.
The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804:2012 + A2:2019. For further information about comparability, see EN 15804:2012 + A2:2019 and ISO 14025.

2. Company Information

Introduction to the Saint-Gobain Group

Saint-Gobain's purpose is "Making the World a Better Home". With this purpose, the Saint-Gobain Group takes on the ambition to improve everyone's lives by making the planet a fairer, more harmonious and sustainable living space. Through its business model generally and its solutions in particular, Saint-Gobain has a tangible impact on the life of each individual, their environment and their way of working, caring for themselves and getting around.

The Group's purpose is the link between the infinitely small unit of each person's living space and the infinitely large one of our shared home: the planet.

HUMAN RESOURCES

166,000

EMPLOYEES

SALES

€44.2 bn

By committing to protect health and promote well-being, the Saint-Gobain Group affirms its desire to take action to maximize its positive impact and to avoid or to minimize any potential negative footprint related to its activity.
With regard to its employees, this involves promoting a healthy working environment and taking action to protect their health.
With regard to customers and end users, this involves, in particular, ensuring the safe use of its solutions. With regard to local residents and communities around the Group's sites, this involves complying with applicable regulations and striving to go beyond them, collaborating with local public health agencies, or participating in the social development of communities.

History of the Saint-Gobain Group

PRODUCTION

800

INDUSTRIAL SITES AROUND THE WORLD

INNOVATION

+400

PATENTS FILED EACH YEAR

R&D

3,600

RESEARCHERS

START-UP

50

AGREEMENTS SIGNED IN 2021

Saint-Gobain was founded in 1665 by Louis XIV, under the name of the "Royal Manufacture of Mirrors", in order to put an end to the technological and commercial supremacy of the Republic of Venice in the manufacturing of mirrors. Throughout the 19th century, the "Compagnie de Saint-Gobain" became a limited company and diversified its activities into sectors such as chemicals, glass products and the automotive industry. It quickly expanded into international markets, establishing itself in the United States in 1829, Germany in 1858, Italy in 1888 and Spain in 1905.

In 1970, the Group invested heavily in research and development, withdrew from its chemical activities and merged with Pont-à-Mousson, created in 1856 and specialized in cast iron pipes.

In 1982 Saint-Gobain was nationalized. But only for a short period: in 1986 Saint-Gobain was again privatized and this was a huge popular success as 1,500,000 shareholders subscribed to the operation.
In 1990, through the acquisition of NORTON® , the Group doubled its presence in the United States, opening up new markets and enabling it to develop its know-how.

In 2007, Saint-Gobain started to focus its strategy on sustainable housing, while continuing to serve many industrial markets and, thanks to its numerous locations, continued to expand in emerging countries.

2023, the Saint-Gobain Group has a commercial and/or manufacturing presence in approximately 75 countries.

Saint-Gobain Products and Solutions

Saint-Gobain provides construction and renovation solutions for both residential and commercial buildings. These solutions meet the needs of professional and private customers both in terms of building interiors and the distribution of spaces and building envelope.

For its customers in mobility markets, Saint-Gobain produces glazing that provides daily safety and comfort for motorists, but also for the aeronautical and rail sectors, the maritime sector and industrial vehicles. The Group also offers solutions to improve the performance of electric vehicles (energy efficiency, well-being, safety and connectivity), distributes replacement automotive glazing on the independent market, designs and supplies bearings and tolerance rings.
Saint-Gobain also offers high-performance technological solutions such as airborne and ground radomes.

For all its industrial customers, and notably for the construction industry, Saint-Gobain draws on its technological competencies (materials science, formulation, design of glass applications, ceramics, abrasive solutions, performance polymers and fiberglass) and its expertise in multiple cutting-edge applications that use the particular properties of its materials (resistance to high temperatures, abrasion, chemical stability, surface properties, etc.).

Many solutions are co-developed with customers, notably in high-performance plastics and refractories for metallurgy or the glass industry.

Due to the extensive portfolio of products and solutions in a wide range of segments there are many brands under the Saint-Gobain umbrella.

Solar Gard

Solar Gard builds on nearly 50 years of experience in the development and production of window films and has a presence in over 90 countries.

Solar Gard is a world leader in patented technologies for solar control and protective window film for both residential and commercial buildings, vehicles and public transport.

In 2011 Solar Gard became a part of Saint-Gobain as the “Thin Films” division. This allowed to cross-leverage sputtering technology that is used both for producing window films and low-E coatings on glass. In addition the integration created important synergies within the renovation and upgrade offering as well as in the mobility segment.

Solar Gard Products and Solutions

The Solar Gard architectural solar films provide solutions for upgrading and enhancing the performance of existing glass and facades of homes and commercial buildings thus improving both winter and summer thermal comfort, increasing visual comfort and reducing the need for cooling.

Solar Gard Decorative films are available in a variety of styles and opacities to help enhance any glazing system to create unique, functional and attractive spaces needing privacy or sophistication. The Series includes bird-control options to cost-effectively distinguish the glass to birds, preventing deadly collisions and promoting sustainability

The Solar Gard architectural safety films provide solutions for enhancing safety and security of existing glass and glass facades across all segments and reduces the risks of passengers, residents, employees being hurt by shreds of broken glass in the case of an explosion or any glass breakage and increases the level of protection in case of intrusion.

Solar Gard Anti-graffiti films are applied as sacrificial surface protection of surfaces against scratches, graffiti, etching, etc. be it glass or metal surfaces, in buildings but also in trains, trams.

In concrete terms Solar Gard Solutions help to:

- Reduce energy consumption with a payback time of up to 3 years.
- Improve the comfort of the indoor climate and make if much more pleasant.
- Introduce sustainable solutions in the context of LEED/BREEAM or HQE label.
- Increase occupants wellbeing and productivity.
- Protect people from broken glass in the event of an accident, explosion or aggression.
- Secure a building against burglary/intrusion.
- Protect occupants against dangerous UVA and UVB radiation with an equivalent SPF of > 285.
- Protect an interior, museum or shop against fading and the negative consequences of UV-radiation.

REFERENCE
Country: The Netherlands
Solution: LX 70

Solar Gard®
SAINT-GOBAIN

3. Sustainability

CO_2 EMISSIONS

- 23%

REDUCTION
FROM 2017 TO 2021*

WITHDRAWALS AVOIDED

9.952 Mt

OF NON-EXTRACTED
VIRGIN RAW MATERIALS

RESPONSIBLE PURCHASING

100%

OF PURCHASES
COVERED BY THE
SUPPLIERS' CHARTER**

Sustainability is a long standing commitment for Saint-Gobain.

"Making the world a better home," is the most precious of headings for Saint-Gobain to follow.
Saint-Gobain is a multi-local organization, driven by the global aim of working each day to make the world a more beautiful and more sustainable place to live. It is reflected in the design and manufacture of solutions which are key ingredients in the well-being of each and the future of all, while taking care of the planet at the same time.

In addition to the multiple actions that have been implemented over the past years across Saint-Gobain sites world-wide, Saint-Gobain has set in 2021 an ambitious target of **Carbon neutrality by 2050**

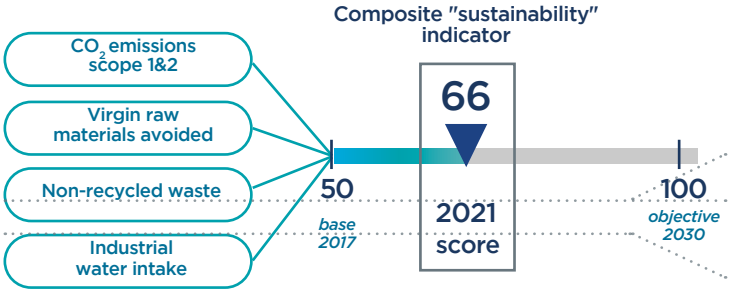
In this roadmap, **2030 is an intermediate but crucial stage**. The Group is committed to reducing by then its direct and indirect CO2 emissions by 66% compared to 2017.
In doing so, Saint-Gobain will make no concession toward the excellence of our products or our competitiveness.
Each year through to 2030, around €100 million is being reserved annually for industrial investments and research & development to reach these targets.

The Group have also adopted the target of reducing our Scope 3 (up and downstream from our operations) emissions by 16% by 2030 measured against the 2017 base line.

The Group also continues to reduce the water usage across all its sites and more in particular the Group is putting actions in place to reduce the water discharge by 80% vs the 2016 base line.

Also the sites in San Diego where the Solar Gard products are produced and the site in Belgium from which most products are supplied to Europe are working towards the Groups' targets.

2050 NET ZERO CARBON | Technologies to decarbonize our processes



4. Product description and use

This Environmental Product Declaration (EPD®) describes the **environmental impact of 1 m² of installed Solar Gard LX series up to 3 mil.**

These products have a **warranty period of 16 years.** (*) The expected average service life longer provided that the specified conditions for installation, use and maintenance are followed.

The products covered in this EPD can be obtained in different dimensions, more in particular in different widths, (namely: 0.91 m wide, 1.22 m wide, 1.50 m wide).
The width of 1.52 m (=60") is a representative average and correct as basis for the EPD.

As to the length: 100 ft (or 30,5 m) is the standard length. In some cases products with longer length are supplied (eg: 165 ft (50 m) or several custom-lengths) but these are in the same packaging as the standard 100 ft rolls. Hence, also for these products the reference is representative.

The reference product

In total this EPD covers 12 solar films of LX (HILITE) series.
The reference product for the group of products covered in this EPD is **Solar Gard 2 mil LX (HILITE) 70** (supplied as roll of 1.52 m (60") wide and 30.5 m (100 ft) long). The variability between any of the products covered in this EPD and the reference product 2mil LX (HILITE) 70 remains within ±10% as is required by the governing PCR.

If wished or required, detailed data for each and any of the products covered by this EPD can be obtained from SGIMB/Solar Gard.

Product classification

All products covered in this EPD meet the requirements of EN 15752-1 "Glass in building - Adhesive backed polymeric film - Part 1: Definitions and requirements".

The products are classified according to ICS under 83.140.10 "Films and sheets" and according to Central Product Classification (CPC), United Nations, New York, 2015 under section "Self-adhesive plates, sheets, film, foil, tape, strip and other flat shapes, of plastics" 3919 (HS 2007) resp. 36920 (CPC2), 2220 (ISIC 4).

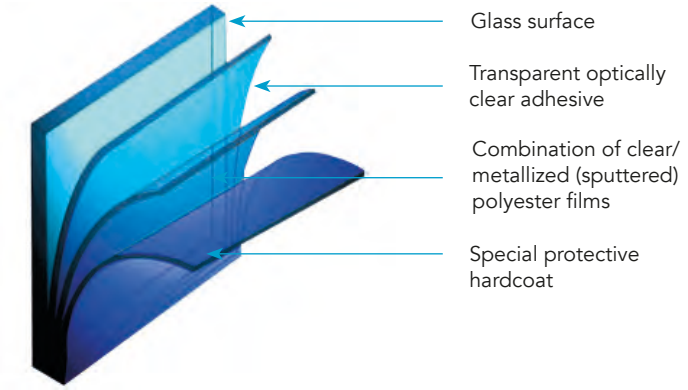
Table 1 gives an overview of the solar window films product references covered in this EPD.

Product description and performance

The Solar Gard LX (HILITE) films consist of multiple layers of PET with a combination of metalized layers incorporated in the construction.

The metalized layers are obtained through a process referred to as 'sputtering'.

The specific solar properties and esthetics of each product are obtained depending of the metal or the combination of metals used.



(*) Warranty is subject to conditions. Up to date information can be found on www.solargard.eu.

REFERENCE
Country: UK
Solution: LX 70

Table 1

List of the solar window film products covered in this EPD. The table contains the commercial names and the base metal in the sputtered layer that gives the film its specific functionality.

Product family Solar Films	Sputtered Metal Layer	Nominal thickness (µm)	Mounting Adhesive	Product Name
3 mil LX (HILITE)	Gold and silver based	75 µm	Acrylic PS	3 MIL LX (HILITE) 15
		75 µm	Acrylic PS	3 MIL LX (HILITE) 25
		75 µm	Acrylic PS	3 MIL LX (HILITE) 40
		75 µm	Acrylic PS	3 MIL LX (HILITE) 55
		75 µm	Acrylic PS	3 MIL LX (HILITE) 70
		75 µm	Acrylic PS	3 MIL LX (HILITE) 80
2 mil LX (HILITE)	Gold and silver based	50 µm	Acrylic PS	2 MIL LX (HILITE) 15
		50 µm	Acrylic PS	2 MIL LX (HILITE) 25
		50 µm	Acrylic PS	2 MIL LX (HILITE) 40
		50 µm	Acrylic PS	2 MIL LX (HILITE) 55
		50 µm	Acrylic PS	2 MIL LX (HILITE) 70
		50 µm	Acrylic PS	2 MIL LX (HILITE) 80

Each of the solar films has a particular balance between visible light transmission, visible light reflection and heat rejection. All the window films covered in this EPD reject more than 99% of the damaging UV rays.
Which product to choose for a particular application depends on the needs and requirements but also on the type of glass to which the window film is going to be applied.

Solar Gard offers technical support to do comfort and thermal balance calculations including the analysis of risk for thermal breakage.

The reference product 2 mil LX (HILITE) 70 has a total solar energy rejection (TSER) of 54% on single glass and 48% on an insulated glass unit (IGU) consisting of 2 standard clear panes. The Infrared Energy rejected (IRER) is 81% on single clear glass.

The table 2 gives an overview of the key solar energy protection performances of the films covered in this EPD. These values are based on spectral measurements and calculations according to EN 410.
The fading protection is measured and calculated according to Twd-ISO

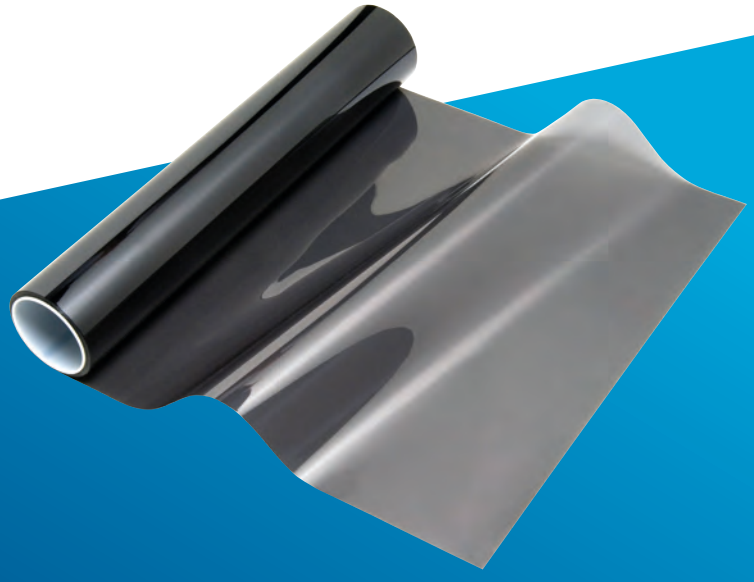


Table 2: Key performances

Product name	VLT (%)	VLR e/i (%)	TR (%)	IRER (%)	G-value	TSER (%)	SHGR (%)	TdW ISO (%)
3 MIL LX (HILITE) 15	11	5/5	13	79	0,28	72	68	8
3 MIL LX (HILITE) 25	21	5/5	18	80	0,31	69	64	14
3 MIL LX (HILITE) 40	40	6/6	27	80	0,39	61	57	27
3 MIL LX (HILITE) 55	57	7/7	34	80	0,43	57	51	38
3 MIL LX (HILITE) 70	71	8/8	39	81	0,46	54	47	45
3 MIL LX (HILITE) 80	80	9/10	55	58	0,60	40	30	54
2 MIL LX (HILITE) 15	11	5/5	13	79	0,28	72	68	8
2 MIL LX (HILITE) 25	21	5/5	18	80	0,31	69	64	14
2 MIL LX (HILITE) 40	40	6/6	27	80	0,39	61	57	27
2 MIL LX (HILITE) 55	57	7/7	34	80	0,43	57	51	38
2 MIL LX (HILITE) 70	71	8/8	39	81	0,46	54	47	45
2 MIL LX (HILITE) 80	80	9/10	55	58	0,60	40	30	54

In addition to the above light and solar energy performance characteristics, the products have other physicial performance characteristics as given in table 3. Full details, including the performance on other glazing combinations can be found on https://www.solargard.eu.

REFERENCE
Country: France
Solution: LX 70

Table 3A: Additional product characteristics

Products covered in this EPD meet also following requirements		
Chemical composition	Comply with REACH regulations	
Reaction to fire (European Construction Products Directive)	EN SBI 13238	B-s1, d0
Reaction to fire for public transport	EN 45545	R1, HL1/HL2/HL3
Reaction to Fire ASTM	ASTM E84	Class A (or Type I)
Volatile Organic Compounds (VOC)	EN ISO 16000 2,3 (2011) and 5,6 (2012)	Class A+
Abrasion resistance	Taber Abrasion (100 cycles, 1000 gr) ASTM D1003	<5%
VLT, VLR, solar and heat rejection	EN 15752-1 and EN 410	See table 2
UV rejection	EN 15752-1 and EN 410	>99%

REFERENCE
Country: The Netherlands
Solution: LX 70

Table 4: Content declarations

All raw materials composed the product and the packaging components are listed in the following table:.

Product components	Weight (%)	Post-consumer material weight (%)	Renewable material weight (%)
Reference product: 2 MIL LX (HILITE) 70	100%	0%	0%
PET film	59%	0%	0%
Acrylic adhesive	11%	0%	0%
Coating	0,70%	0%	0%
Release Liner	29%	0%	0%

Packaging materials	Mass per declared unit (g/m^2)	Weight versus the product (%)
Cardboard box	1,48 g/m^2	1,3%
Cardboard core	1,20 g/m^2	1,0%
LDPE sleeves	0,03 g/m^2	0,02%
Cardboard or HDPE end plug	0,09 g/m^2	0,1%
MDF end plates	0,82 g/m^2	0,70%
Pallet	3,44 g/m^2	2,9%
Shrink wrap	0,36 g/m^2	0,3%

Product	Weight kg/m^2
Total product weight	**0.118 kg/m^2**

The products covered in this EPD do not contain any hazardous substance listed in the “Candidate List of Substances of Very High Concern (SVHC) for authorization” version ECHA/NR/23/02 (dated January 2023).

The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

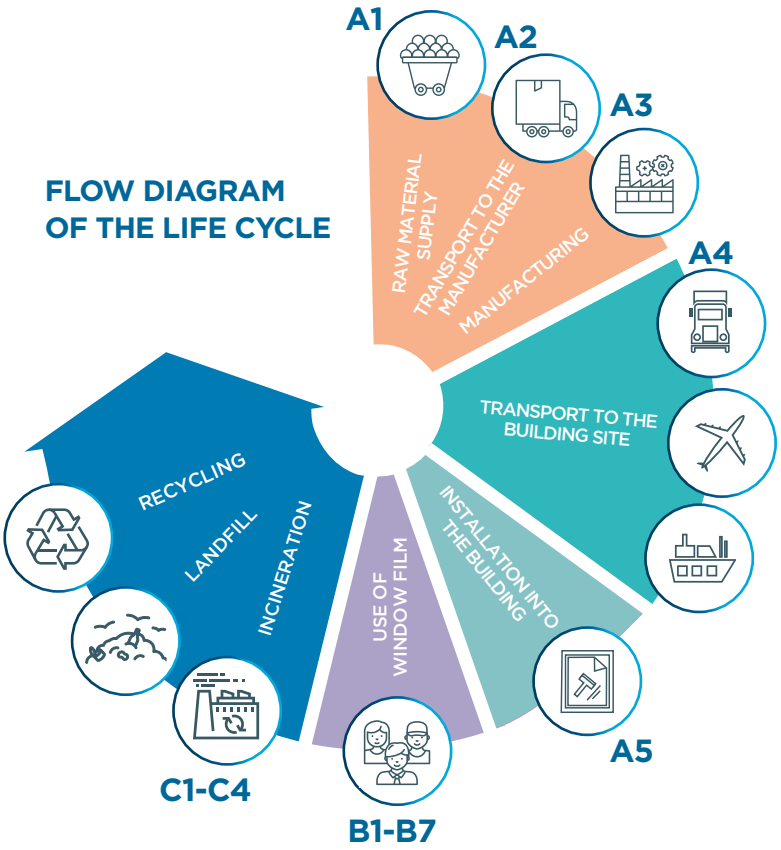
5. LCA calculation information

EPD TYPE DECLARED	Cradle to grave and module D
DECLARED UNIT	1 m^2 of installed window film
SYSTEM BOUNDARIES	Cradle to grave + Module D = A + B + C +D
REFERENCE SERVICE LIFE (RSL)	The Reference Service Life (RSL) of the windows film product is considered to be 16 years. This is equal to the warranty period, i.e. the amount of time that we recommend our products last for without refurbishment, however the life expectancy is between 15-20 years.
CUT-OFF RULES	Not applied, all the information is considered. Flows related to human activities such as employee transport are excluded. The construction of plants, production of machines and transportation systems are excluded since the related flows are supposed to be negligible compared to the production of the building product when compared at these systems lifetime level.
ALLOCATIONS	The data for the site has been allocated on the basis of a surface distribution considering that the manufacturing impacts per m^2 of product are the same regardless of the product manufactured. The polluter pays as well the modularity principles have been followed.
GEOGRAPHICAL COVERAGE AND TIME PERIOD	Scope includes: Europe and MEA/India Data is collected from one production site in San Diego, USA Data collected for the year 2019. Cradle to grave study. Background data: The databases, thinkstep 8.7 or ecoinvent v.3.6
PRODUCT CPC CODE	36920 – Articles of Plastic n.e.c.
VARIABILITY	Life cycle assessment calculations were carried out to cover the different categories of film families. The variable parameters are the number of layers, the existence of metal sputtering and the weight of each layer. An assessment of the influence of the variations on the overall life cycle results of the films was carried out for the following indicator: Climate change - fossil. The results of the sensitivity study show that the differences in the impacts of the different products do not exceed by + 10% the impacts of the product used as a reference: 2 mil LX (HILITE) 70.

According to EN 15804:2012+A2:2019, EPDs of construction products may not be comparable if they do not comply with this standard. According to ISO 21930, EPDs might not be comparable if they are from different programmes.

6. Life cycle stages

FLOW DIAGRAM OF THE LIFE CYCLE



Product stage, A1-A3

Description of the stage: the product stage of windows film products is subdivided into 3 modules A1, A2 and A3 respectively "Raw material supply", "transport to manufacturer" and "manufacturing".

A1, raw material supply.

This includes the extraction and processing of all raw materials and energy which occur upstream from the manufacturing process.

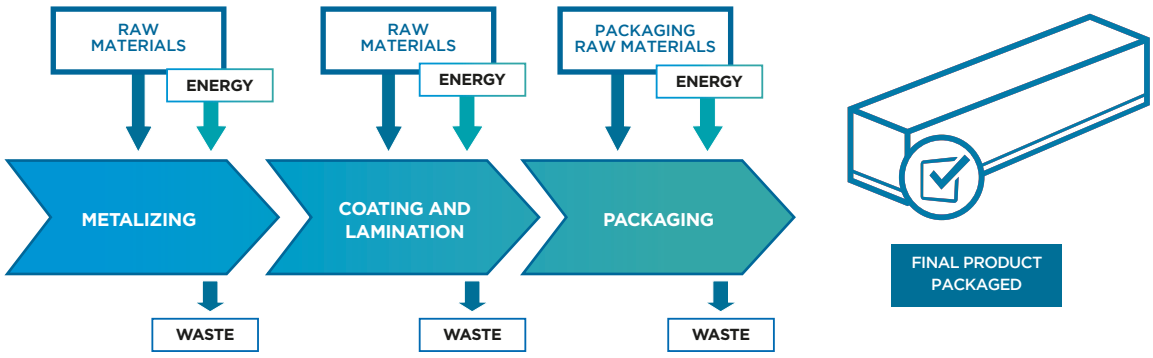
A2, transport to the manufacturer.

The raw materials are transported to the manufacturing site. The modelling includes road, boat, plane and/or train transportations of each raw material.

A3, manufacturing.

This module includes the manufacture of products and the manufacture of packaging. The production of packaging material is taken into account at this stage. The processing of any waste arising from this stage is also included.

MANUFACTURING PROCESS FLOW DIAGRAM



Manufacturing in detail:

The films are produced from one or more layers of PET film. One of the films is coated with a metal or a variety of metals (through a process of metal deposition by ionization under vacuum, called sputtering (*)). The performance of the final product is determined by the type and amount of the sputtered metal. The films (*) are then laminated together and an adhesive and a liner are applied to the film. The liner protects the adhesive during storage and transportation, and is removed prior to installation.

The packaging is made up of four components: core, sleeve, box, and pad plugs (or end-caps).
The core, a tube made of cardboard, is what the finished film is wrapped around.
The sleeve covers and protects the roll of film, and is made from low density polyethylene (LDPE).
A cardboard box is used to protect the film during transport, handling and storage. The boxes are also labelled with information of product name, type, dimensions and an unique batch number.
Pad plugs (end caps) are made from high density polyethylene (HDPE) or cardboard; there are 2 end caps in each box. The function of the end caps is to keep the roll away from touching the cardboard box and to core to keep the roll stable in the box.

(*) only for the solar window films. The Clear films do not have a sputtered layer in the construction.

Construction process stage, A4-A5

Description of the stage: the construction process is divided into 2 modules: A4, transport to the building site and A5, installation in the building.

A4, transport to the building site.

This module includes transport from the production gate to the building site. Transport is calculated on the basis of a scenario with the parameters described in the following table. Data is calculated from the arithmetic mean covering all sales destinations in Europe and MEA/India.

PARAMETER	VALUE (expressed per Declared unit)
Fuel type and consumption of vehicle or vehicle type used for transport e.g. long distance truck, boat, etc.	Transport, freight, lorry (mix of EURO 0-6) Transport, freight, sea, container ship Transport, freight, aircraft
Distance	Truck: 2923 km Ship: 8598 km Plane: 2056 km
Capacity utilisation (including empty returns)	Default value from Ecoinvent 3.6 for the 3 mode of transportation (lorry, container ship and aircraft)
Bulk density of transported products	Between 7440 – 3255 m^2 per pallet
Volume capacity utilisation factor	1 (default)

A5, installation into the building.

The accompanying table quantifies the parameters for installing the product at the building site.
All installation materials and their waste processing are included.

PARAMETER	VALUE (expressed per declared unit)
Ancillary materials for installation (specified by materials)	Soap 0.005 kg/m^2
Water use	1 kg/m^2
Other resource use	None
Quantitative description of energy type (regional mix) and consumption during the installation process	None
Wastage of materials on the building site before waste processing, generated by the product's installation (specified by type)	Film: 0.006 g/m^2 (5%)
Output materials (specified by type) as results of waste processing at the building site e.g. of collection for recycling, for energy recovering, disposal (specified by route)	Film: 0.006 kg/m^2 (5%) to landfill (46%[1]), recycling (15%[1]) and incineration with energy recovery (40%[1]) Cardboard box: 1.48 g/m^2 to landfill (69%[2]) and recycling (31%[2]) Cardboard core: 1.2 g/m^2 to landfill (69%[2]) and recycling (31%[2]) LDPE sleeves: 0.03 g/m^2 to landfill (46%[1]), recycling (15%[1]) and incineration with energy recovery (40%[1]) Cardboard or HDPE end plug: 0.09 g/m^2 to landfill MDF end plates: 0.82 g/m^2 to landfill (69%[2]) and recycling (31%[2]) Pallet: 3.44 g/m^2 to landfill (69%[2]) and recycling (31%[2]) Shrink wrap: 0.36 g/m^2 to landfill (46%[1]), recycling (15%[1]) and incineration with energy recovery (40%[1]) [1] *Data based on OECD (Organisation for Economic Co-operation and Development)* [2] *Data based on European statistic*
Direct emissions to ambient air, soil and water	None

Use stage (excluding potential savings), B1-B7

Description of the stage: The use stage, related to the building fabric includes:

B1, use or application of the installed product;

B2, maintenance;

B3, repair;

B4, replacement;

B5, refurbishment;

B6, operational energy use

B7, operational water use

The product has a reference service life of 12 years according to the warranty period. This assumes that the product will last in situ with no additional or specific requirements for maintenance, repair, replacement or refurbishment throughout this period. Therefore, it has no impact at this stage.

The water consumption for cleaning the windows is not considered as it is already included in the glass EPD, as requiered of the PCR.

End-of-life stage C1-C4

Description of the stage: This stage includes the next modules:

C1, de-construction, demolition;

C2, transport to waste processing;

C3, waste processing for reuse, recovery and/or recycling;

C4, disposal, including provision and all transport, provision of all materials, products and related energy and water use.

Description of the scenarios and additional technical information for the end-of-life:

PARAMETER	VALUE (expressed per Declared unit)
Collection process specified by type	46% collected with mixed deconstruction and demolition waste to landfill
Recovery system specified by type	15% to recycling disposal 40% to incineration with recovery of energy
Disposal specified by type	46% to landfill
Assumptions for scenario development (e.g. transportation)	50 km to landfill and incineration 100km to recycling disposal

Reuse/recovery/recycling potential, D

The scenario is 40% of wastes are incinerated with recovery of energy and 15% of wastes are recycled.
The benefits from recovery of energy and recycling are reported on stage D.

REFERENCE
Country: UAE
Solution: LX 70

7. LCA results

As specified in EN 15804:2012+A2:2019 and also the Product-Category Rules, the environmental impacts are declared and reported using the baseline characterization factors from EC-JRC, available in the next link: https://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml.
Specific data has been supplied by the plant, and generic data come from GABI and EcoInvent databases. All emissions to air, water, and soil, and all materials and energy used have been included.

All figures refer to a declared unit of 1 m^2 of installed windows film.

The following results corresponds to the reference product for the family of products in this EPD - namely 2 mil LX (HILITE) 70.

Description of the system boundary (X = Included in LCA, MNA = Module Not Assessed)

	PRODUCT STAGE			CON-STRUC-TION STAGE		USE STAGE							END OF LIFE STAGE				BENEFITS AND LOADS BEYOND THE SYSTEM BOUNDARY
	Raw material supply	Transport	Manufacturing	Transport	Construction-Installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-recovery
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Geography	US	US	US	EU / MEA/ India	EU / MEA/ India	-	-	-	-	-	-	-	EU / MEA/ India	EU / MEA/ India	EU / MEA/ India	EU / MEA/ India	-
Specific data used	>90% GWP- GHG					-	-	-	-	-	-	-	-	-	-	-	-
Variation products	< 10%					-	-	-	-	-	-	-	-	-	-	-	-
Variation sites	One site					-	-	-	-	-	-	-	-	-	-	-	-

Environmental Impacts

	Impacts Indicators	Product stage	Construction stage		Use stage							End of life stage				Reuse, Recovery Recycling
		A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
	Climate Change [kg CO_2 eq.]	3,02E+00	1,70E-01	1,97E-01	0	0	0	0	0	0	0	4,00E-04	9,00E-04	5,30E-03	1,03E-01	-1,03E-01
	Climate Change (fossil) [kg CO_2 eq.]	3,03E+00	1,70E-01	1,73E-01	0	0	0	0	0	0	0	4,00E-04	9,00E-04	4,00E-03	1,03E-01	-1,03E-01
	Climate Change (biogenic) [kg CO_2 eq.]	-1,41E-02	5,43E-05	1,67E-02	0	0	0	0	0	0	0	2,58E-06	4,19E-07	1,30E-03	5,99E-06	-7,88E-05
	Climate Change (land use change) [kg CO_2 eq.]	1,20E-03	3,28E-05	7,30E-03	0	0	0	0	0	0	0	5,65E-07	3,46E-07	4,52E-06	5,87E-07	-3,41E-05
	Ozone depletion [kg CFC-11 eq.]	6,56E-07	3,80E-08	3,57E-08	0	0	0	0	0	0	0	2,50E-11	2,00E-10	5,13E-10	2,92E-10	-6,66E-09
	Acidification terrestrial and freshwater [Mole of H+ eq.]	2,33E-02	1,20E-03	1,30E-03	0	0	0	0	0	0	0	1,79E-06	5,26E-06	2,06E-05	2,41E-05	-3,00E-04
	Eutrophication freshwater [kg P eq.]	6,26E-03	7,48E-07	3,00E-04	0	0	0	0	0	0	0	2,59E-08	9,15E-09	1,12E-07	2,32E-08	-1,78E-06
	Eutrophication freshwater [kg (PO4)3 eq.]	6,38E-03	2,30E-06	9,21E-04	0	0	0	0	0	0	0	7,94E-08	2,81E-08	3,43E-07	7,13E-08	-5,48E-06
	Eutrophication marine [kg N eq.]	8,12E-03	4,00E-04	5,00E-04	0	0	0	0	0	0	0	2,57E-07	1,85E-06	6,90E-06	1,79E-05	-5,78E-05
	Eutrophication terrestrial [Mole of N eq.]	9,40E-02	4,30E-03	5,20E-03	0	0	0	0	0	0	0	2,90E-06	2,04E-05	6,10E-05	1,00E-04	-6,00E-04
	Photochemical ozone formation - human health [kg NMVOC eq.]	2,27E-02	1,10E-03	1,20E-03	0	0	0	0	0	0	0	8,31E-07	5,83E-06	2,00E-05	3,04E-05	-2,00E-04
	Resource use, mineral and metals [kg Sb eq.][1]	5,20E-03	1,39E-06	3,00E-04	0	0	0	0	0	0	0	1,09E-08	2,30E-08	8,35E-08	2,21E-08	-1,02E-06
	Resource use, energy carriers [MJ][1]	5,12E+01	2,42E+00	2,76E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	7,15E-02	2,75E-02	-2,05E+00
	Water scarcity [m³ world equiv.][1]	9,17E-01	6,20E-03	1,17E-01	0	0	0	0	0	0	0	4,33E-02	7,15E-05	1,30E-03	7,00E-04	-3,19E-02

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

Resources Use

		Product stage	Construction stage		Use stage							End of life stage				Reuse, recovery, recycling
	Resources Use indicators	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
	Use of renewable primary energy (PERE) [MJ]	3,45E+00	1,57E-02	2,84E-01	0	0	0	0	0	0	0	6,00E-04	2,00E-04	2,90E-03	5,00E-04	-3,98E-02
	Primary energy resources used as raw materials (PERM) [MJ]	1,09E-01	0	4,90E-03	0	0	0	0	0	0	0	0	0	0	0	0
	Total use of renewable primary energy resources (PERT) [MJ]	3,55E+00	1,57E-02	2,89E-01	0	0	0	0	0	0	0	6,00E-04	2,00E-04	2,90E-03	5,00E-04	-3,98E-02
	Use of non-renewable primary energy (PENRE) [MJ]	4,87E+01	2,42E+00	2,65E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	4,68E-01	2,75E-02	-2,03E+00
	Non-renewable primary energy resources used as raw materials (PENRM) [MJ]	2,52E+00	0	1,04E-01	0	0	0	0	0	0	0	0	0	-3,97E-01	0	-1,82E-02
	Total use of non-renewable primary energy resources (PENRT) [MJ]	5,12E+01	2,42E+00	2,77E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	7,15E-02	2,75E-02	-2,05E+00
	Input of secondary material (SM) [kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Use of renewable secondary fuels (RSF) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Use of non-renewable secondary fuels (NRSF) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Use of net fresh water (FW) [m³]	2,14E-02	1,00E-04	2,70E-03	0	0	0	0	0	0	0	1,00E-03	1,67E-06	2,979E-05	1,55E-05	-7,00E-04

Output flows & Waste Category

	Product stage	Construction stage		Use stage							End of life stage				Reuse, recovery, recycling
Output Flows and Waste Category	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Hazardous waste disposed (HWD) [kg]	2,42E-02	6,1442E-06	1,20E-03	0	0	0	0	0	0	0	3,2272E-09	3,4648E-08	1,091E-07	1,1206E-07	-2,7473E-06
Non-hazardous waste disposed (NHWD) [kg]	2,79E+01	0,0574	1,41E+00	0	0	0	0	0	0	0	0,0002	0,001	0,0053	6,27E-02	-0,0258
Radioactive waste disposed (RWD) [kg]	1,24E-04	1,6884E-05	8,72E-06	0	0	0	0	0	0	0	2,1006E-08	8,9786E-08	2,387E-07	1,0326E-07	-1,3751E-06
Components for re-use (CRU) [kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Materials for Recycling (MFR) [kg]	**3,08E-02**	0	**4,60E-03**	0	0	0	0	0	0	0	0	0	**1,72E-02**	0	0
Material for Energy Recovery (MER) [kg]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported electrical energy (EEE) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Exported thermal energy (EET) [MJ]	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Additional voluntary indicators from EN 15804 (according to ISO 21930:2017)

	Product stage	Construction stage		Use stage							End of life stage				D Reuse, recovery, recycling
	A1 / A2 / A3	A4 Transport	A5 Installation	B1 Use	B2 Maintenance	B3 Repair	B4 Replacement	B5 Refurbishment	B6 Operational energy use	B7 Operational water use	C1 Deconstruction / demolition	C2 Transport	C3 Waste processing	C4 Disposal	D Reuse, recovery, recycling
Climate Change [kg CO_2 eq.][1]	3,03E+00	1,70E-01	1,73E-01	0	0	0	0	0	0	0	4,00E-04	9,00E-04	4,00E-03	1,03E-01	-1,03E-01

[1] The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus almost equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Information on biogenic carbon content

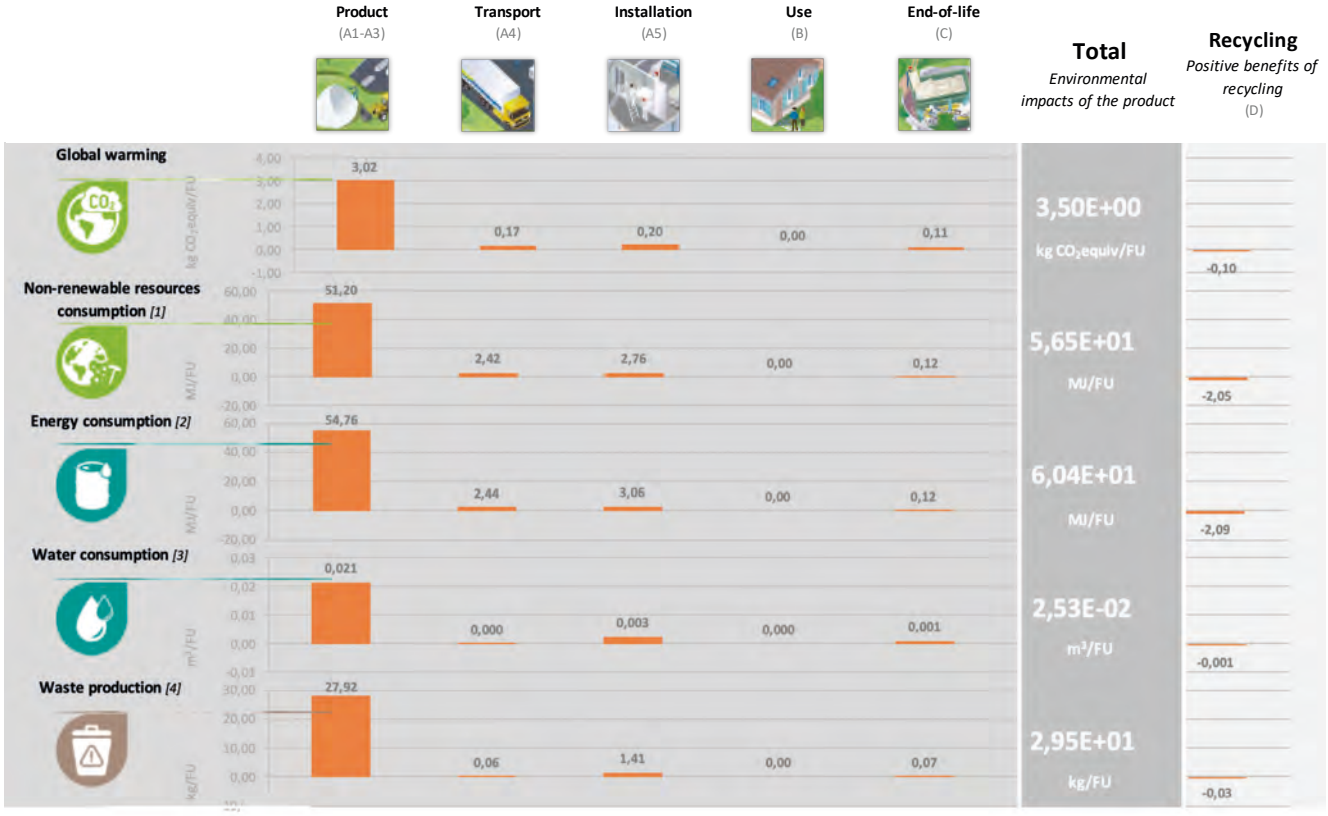
	Biogenic Carbon Content	Product stage
		A1 / A2 / A3
	Biogenic carbon content in product [kg]	0,00E+00
	Biogenic carbon content in packaging [kg]	3,80E-03

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO_2.

The product does not contain any quantity of biogenic carbon. Regarding packaging, wooden pallets, cardboard core, cardboard box and MDF end plates production is accounted for.

8. LCA results interpretation

The following figure refers to a declared unit of 1 m² of installed windows film of the reference product for the family of products in this EPD – namely 2 mil LX (HILITE) 70.



[1] This indicator corresponds to the abiotic depletion potential of fossil resources.
[2] This indicator corresponds to the totla use of primary energy.
[3] This indicator corresponds to the use of net fresh water.
[4] This indicator corresponds to the sumo f hazardous, non-hazardous and radioactive waste disposed.

Global Warming Potential (Climate Change) (GWP)

For GWP, the majority of contribution to this environmental impact is from the production modules (A1 – A3). This is primarily because the sources of greenhouse gas emissions are predominant in this part of the life cycle. CO2 emissions are generated upstream from the production of electricity and is also released on site by the combustion diesel and natural gas. Other sections of the life cycle also contribute to the GWP. However, the production modules contribute to over 85% of the contribution. Emissions from waste disposal in A5 (disposal after installation) and C (transport and disposal at the end of life) generate the second highest percentage of greenhouse gas emissions.

Non-renewable resources consumptions

The consumption of non – renewable resources is once more found to have the highest value in the production modules. Due to diesel and natural gas consumption within the factory. For non – renewable fuels such as coal and oil are used to generate electricity during manufacturing. The contribution to this impact from the other modules is very small and primarily due to the non – renewable resources consumed during installation.

Energy Consumptions

Modules A1 – A3 have the highest contribution to total energy consumption. Energy is consumed in the form of electricity, diesel and natural gas during the manufacturing process.

9. Additional information

Additional information on VOC indoor emission during the use stage

Based on the test conducted, Solar Gard window film products meet the requirements for VOC's according to the standards.

Additional information on emission on soil and water during the use stage

Without object as test is not conducted.

Declaration of additional scenario information in A4

The transport to the market (A4) on this EPD is calculated based on average distance that covers all the countries in Europe and in MEA/India.

Additional information is given in the table below regarding distances to other relevant markets and calculation factors for converting A4 to the specific market. Impact figures for A4 shall be multiplied by the multiplication factor in table 5.

Table 5

Details on multiplication factor due transport for different geographies:

Country	Average distance			Multiplication factor
	Truck	Ship	Plane	
Europe & MEA/India	2923	8682	1972	1
Austria	2855	8330	1854	0,95
Baltics	4085	8330	1809	1,06
Bahrain (ME)	925	6412	9269	3,16
Belgium	2119	8330	1809	0,86
Denmark	2995	8330	1809	0,95
Egypt	2675	13110	0	0,36
Finland	4435	8330	1809	1,10
Hungary	3090	8330	1854	0,98
Ireland	2495	8330	1809	0,90
India (North)	2781,2	14196	2900	1,33
India (South, East & Central)	931,2	14196	2900	1,14
India (west)	1681,2	14196	2900	1,22
Italy	3272	8330	1809	0,98
KSA (ME)	2282	9702	4023	1,61
Kuwait (ME)	908	6493	9008	3,08
Luxembourg	2335	8330	1809	0,88
Norway	3470	8330	1809	1,00
Poland	3285	8330	1809	0,98
Portugal	4035	8330	1809	1,06
Qatar (ME)	275	6736	9357	3,13
Romania	3711	8330	1854	1,04
South Africa	4218	14490	0	0,53
Spain	2935	8330	1809	0,95
Sweden	3511	8330	1809	1,00
Switzerland	2779	8330	1854	0,94
Turkey	2310	8330	1809	0,88
UAE (ME)	1817	13256	4026	1,59
United Kingdom	2536	8330	1809	0,90

Electricity description

TYPE OF INFORMATION	DESCRIPTION
Location	Representative of Electricity purchased by Saint-Gobain Solar Gard (US)
Geographical representativeness description	Split of energy sources of electricity grid mix in Western Electricity Coordinating Council, WECC (US) - natural gas: 31% - hydro: 24.63% - lignite: 14.79% - hard coal: 9,15% - wind: 7.25% - nuclear: 8.64% - geothermal: 2.21% - biomass: 0.94% - biogas: 0.45% - solar PV: 0.3% - solar thermal: 0.1% - oil: 0.1%
Reference year	2019
Type of data set	Cradle to gate from Ecoinvent 3.6 database
Source	Ecoinvent database from International Energy Agency - 2019
CO_2 emissions (EN15804+A2 Climate Change - fossil)	0.42 kg CO_2 eq. / kWh

Data quality

Inventory data quality is judged by geographical, temporal, and technological representativeness. To cover these requirements and to ensure reliable results, first-hand industry data crossed with LCA background datasets were used. The data was collected from internal records and reporting documents. After evaluating the inventory, according to the defined ranking in the LCA report, the assessment reflects good inventory data quality.

Geographical rating	Temporal rating	Technology Rating
2,3	2,0	2,0

REFERENCE
Country: Germany
Solution: LX 70

Additional information on energy saving and benefit

This section is focused on the **quantifying the energy gain** that the products potentially bring **during the Reference Service Life (RSL).**

Energy consumption in a building

Solar Gard LX (HILTE) series have as prime function to control the solar heat gain (see table 2 for base information). Solar Gard LX (HILITE) 70 rejects, as an example up to 54% of the solar energy incident on a single glass and as much as 81% of the Infrared solar heat (determined according to EN 410).

This reduces the need for cooling considerably because there is less heat transferred through the glazing. As a consequence, there is less energy consumed to keep air conditioning equipment running in the warmer months resulting in a reduction in the carbon footprint of the building.

The reduction depends on several factors: geography, location, orientation of the building, type of glazing, the efficiency of the air conditioning equipment and comfort levels that is required.

Identical buildings that are upgraded in the same way with the same Solar Gard architectural solar film, but that are located in different geographies and/or that are sourcing their energy differently, will have different net energy savings and also the environment impact of these energy savings will be different.

The **energy calculations** have been done using the most up-to-date version of **Efilm® v22.6.28 using EnergyPlus version 9.6.**

There are several energy simulations programs available throughout the regions covered in this EPD. It was decided to use Efilm because this simulation software is widely used within the window film industry and is supported by the IWFA, the International Window Film Association.

The Efilm software is based on EnergyPlus simulation engine, which is developed under the funding of United States Department of Energy (U.S. DOE). EnergyPlus is considered one of the most detailed and accurate energy simulation program on the market. EnergyPlus incorporates the best features of DOE 2.1E and BLAST and is also enhanced with the use of latest programming techniques. The program has been thoroughly tested and validated, and DOE is pledging full support only for the program developments in the future.
For more details and features of EnergyPlus can be accessed from: https://energyplus.net/

TABLES 6A : 2 mil LX (HILITE) 70 (reference product) applied on 4 mm clear glass (Saint-Gobain PLANICLEAR)

The usage savings and the net resulting savings of 2 mil LX (HILITE) 70 (reference product) applied on 4 mm clear glass (Saint-Gobain PLANICLEAR) for some cities in Europe, Middle East, Africa and India over the product's warranty period. The table also gives the potential energy savings (kWh/m²).

Table 6A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear LX (HILITE) 70 Copenhagen	Planiclear LX (HILITE) 70 Helsinki	Planiclear LX (HILITE) 70 Oslo	Planiclear LX (HILITE) 70 Stockholm	Planiclear LX (HILITE) 70 Warsaw	Planiclear LX (HILITE) 70 Berlin	Planiclear LX (HILITE) 70 Koln	Planiclear LX (HILITE) 70 Munich
	885 kWh per m²	668 kWh per m²	725 kWh per m²	789 kWh per m²	820 kWh per m²	906 kWh per m²	723 kWh per m²	1020 kWh per m²

Table 6A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear LX (HILITE) 70 Amsterdam	Planiclear LX (HILITE) 70 Brussels	Planiclear LX (HILITE) 70 Geneva	Planiclear LX (HILITE) 70 London	Planiclear LX (HILITE) 70 Luxembourg	Planiclear LX (HILITE) 70 Lyon	Planiclear LX (HILITE) 70 Paris
	770 kWh per m²	769 kWh per m²	1243 kWh per m²	879 kWh per m²	769 kWh per m²	1159 kWh per m²	919 kWh per m²

Table 6A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear LX (HILITE) 70 Barcelona	Planiclear LX (HILITE) 70 Istanbul	Planiclear LX (HILITE) 70 Jerusalem	Planiclear LX (HILITE) 70 Lisboa	Planiclear LX (HILITE) 70 Madrid	Planiclear LX (HILITE) 70 Milan	Planiclear LX (HILITE) 70 Rome
	1539 kWh per m²	1369 kWh per m²	2147 kWh per m²	1859 kWh per m²	1781 kWh per m²	1282 kWh per m²	1032 kWh per m²

Table 6A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear LX (HILITE) 70 Abu Dhabi	Planiclear LX (HILITE) 70 Cape Town	Planiclear LX (HILITE) 70 Chennai	Planiclear LX (HILITE) 70 Cairo	Planiclear LX (HILITE) 70 Johannesburg	Planiclear LX (HILITE) 70 Mumbai	Planiclear LX (HILITE) 70 Nairobi	Planiclear LX (HILITE) 70 Riyadh
	3916 kWh per m²	1778 kWh per m²	2832 kWh per m²	2147 kWh per m²	2098 kWh per m²	2981 kWh per m²	1724 kWh per m²	3790 kWh per m²

TABLES 7A : 2 mil LX (HILITE) 70 applied on an IGU (4/12/4 from Saint-Gobain PLANICLEAR)

The usage savings and the net resulting savings of 2 mil LX (HILITE) 70 applied on an IGU (4/12/4 from Saint-Gobain PLANICLEAR) for some cities in Europe, Middle East, Africa and India over the product's warranty period. The table also gives the potential energy savings (kWh/m²).

Table 7A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU LX (HILITE) 70 Copenhagen	Planiclear IGU LX (HILITE) 70 Helsinki	Planiclear IGU LX (HILITE) 70 Oslo	Planiclear IGU LX (HILITE) 70 Stockholm	Planiclear IGU LX (HILITE) 70 Warsaw	Planiclear IGU LX (HILITE) 70 Berlin	Planiclear IGU LX (HILITE) 70 Koln	Planiclear IGU LX (HILITE) 70 Munich
	586 kWh per m²	562 kWh per m²	537 kWh per m²	600 kWh per m²	654 kWh per m²	661 kWh per m²	525 kWh per m²	707 kWh per m²

Table 7A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU LX (HILITE) 70 Amsterdam	Planiclear IGU LX (HILITE) 70 Brussels	Planiclear IGU LX (HILITE) 70 Geneva	Planiclear IGU LX (HILITE) 70 London	Planiclear IGU LX (HILITE) 70 Luxembourg	Planiclear IGU LX (HILITE) 70 Lyon	Planiclear IGU LX (HILITE) 70 Paris
	573 kWh per m²	499 kWh per m²	798 kWh per m²	593 kWh per m²	499 kWh per m²	765 kWh per m²	615 kWh per m²

Table 7A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU LX (HILITE) 70 Barcelona	Planiclear IGU LX (HILITE) 70 Istanbul	Planiclear IGU LX (HILITE) 70 Jerusalem	Planiclear IGU LX (HILITE) 70 Lisboa	Planiclear IGU LX (HILITE) 70 Madrid	Planiclear IGU LX (HILITE) 70 Milan	Planiclear IGU LX (HILITE) 70 Rome
	1057 kWh per m²	910 kWh per m²	1420 kWh per m²	1163 kWh per m²	1233 kWh per m²	909 kWh per m²	709 kWh per m²

Table 7A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU LX (HILITE) 70 Abu Dhabi	Planiclear IGU LX (HILITE) 70 Cape Town	Planiclear IGU LX (HILITE) 70 Chennai	Planiclear IGU LX (HILITE) 70 Cairo	Planiclear IGU LX (HILITE) 70 Johannesburg	Planiclear IGU LX (HILITE) 70 Mumbai	Planiclear IGU LX (HILITE) 70 Nairobi	Planiclear IGU LX (HILITE) 70 Riyadh
	2724 kWh per m²	1217 kWh per m²	2021 kWh per m²	1427 kWh per m²	1415 kWh per m²	2233 kWh per m²	1284 kWh per m²	2667 kWh per m²

TABLES 8A : 2 mil LX (HILITE) 70 (reference product) applied on an IGU with low-E on side 3 (4/12/4 from Saint-Gobain PLANITHERM ONE)

The usage savings and the net resulting savings of 2 mil LX (HILITE) 70 (reference product) applied on an IGU with low-E on side 3 (4/12/4 from Saint-Gobain PLANITHERM ONE) for some cities in Europe, Middle East, Africa and India over the product's warranty period. The table also gives the potential energy savings (kWh/m²).

Table 8A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/Planitherm One LX (HILITE) 70 Copenhagen	IGU w/Planitherm One LX (HILITE) 70 Helsinki	IGU w/Planitherm One LX (HILITE) 70 Oslo	IGU w/Planitherm One LX (HILITE) 70 Stockholm	IGU w/Planitherm One LX (HILITE) 70 Warsaw	IGU w/Planitherm One LX (HILITE) 70 Berlin	IGU w/Planitherm One LX (HILITE) 70 Koln	IGU w/Planitherm One LX (HILITE) 70 Munich
	121 kWh per m²	102 kWh per m²	107 kWh per m²	114 kWh per m²	126 kWh per m²	120 kWh per m²	104 kWh per m²	149 kWh per m²

Table 8A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/Planitherm One LX (HILITE) 70 Amsterdam	IGU w/Planitherm One LX (HILITE) 70 Brussels	IGU w/Planitherm One LX (HILITE) 70 Geneva	IGU w/Planitherm One LX (HILITE) 70 London	IGU w/Planitherm One LX (HILITE) 70 Luxembourg	IGU w/Planitherm One LX (HILITE) 70 Lyon	IGU w/Planitherm One LX (HILITE) 70 Paris
	119 kWh per m²	100 kWh per m²	137 kWh per m²	102 kWh per m²	100 kWh per m²	161 kWh per m²	125 kWh per m²

Table 8A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/Planitherm One LX (HILITE) 70 Barcelona	IGU w/Planitherm One LX (HILITE) 70 Istanbul	IGU w/Planitherm One LX (HILITE) 70 Jerusalem	IGU w/Planitherm One LX (HILITE) 70 Lisboa	IGU w/Planitherm One LX (HILITE) 70 Madrid	IGU w/Planitherm One LX (HILITE) 70 Milan	IGU w/Planitherm One LX (HILITE) 70 Rome
	199 kWh per m²	182 kWh per m²	269 kWh per m²	232 kWh per m²	234 kWh per m²	136 kWh per m²	135 kWh per m²

Table 8A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/Planitherm One LX (HILITE) 70 Abu Dhabi	IGU w/Planitherm One LX (HILITE) 70 Cape Town	IGU w/Planitherm One LX (HILITE) 70 Chennai	IGU w/Planitherm One LX (HILITE) 70 Cairo	IGU w/Planitherm One LX (HILITE) 70 Johannesburg	IGU w/Planitherm One LX (HILITE) 70 Mumbai	IGU w/Planitherm One LX (HILITE) 70 Nairobi	IGU w/Planitherm One LX (HILITE) 70 Riyadh
	494 kWh per m²	239 kWh per m²	436 kWh per m²	311 kWh per m²	280 kWh per m²	418 kWh per m²	303 kWh per m²	461 kWh per m²

General Functioning of the Building and the Well-being of the Occupants

It is important to keep in mind that environmental requirements always need to be balanced with other requirements in relation to the operating and the use a building.

Such other requirements are:

- **Thermal comfort and well-being of the occupants:** an important improvement in thermal comfort is a positive measure in spite maybe of the fact that the Net Environmental Impact (NEI) is low or negative.
- **Visual comfort and well-being of the occupants:** solar window films reduce glare. Improving the visual comfort does not necessarily translate into a reduced energy usage but yet is key for the well-being and efficient functioning of the occupants in the building.
- **Fading reduction and skin protection:** window films block > 99% of the UVA (typically not stopped by standard glass). This is the form of radiation that causes skin aging, like spots and wrinkles, because it does reach so deeply into skin layers. UVA rays can tan skin right away, and are linked to cancer. This benefit is not considered in the NEI.
- **Safety and security:** safety films, typically clear films, have by definition little impact on the energy consumption in a building. Therefore, the NEI will always be negative. However, the function of safety and security films is to protect people and goods in case of glass breakage or to slow down intrusion efforts. The return on investment for these films is the reduction of risk that people get injured by shreds of broken glass or the reduced risks for intrusion.
- **Surface protection:** typically clear films with no impact on the energy balance of a building but yet very important in the maintenance budget as these solution reduce the costs for important repair or replacement costs.
- **Reduction of energy usage:** the NEI is the result of reduced energy consumption, but even if the NEI is not positive, the application of Solar Gard window films still can result in an important reduction of the energy of the building. This as such is already very important. And, in addition there is the purely economic factor in the reduced energy consumption means reduced operating costs.

10 reasons to consider Solar Gard window films

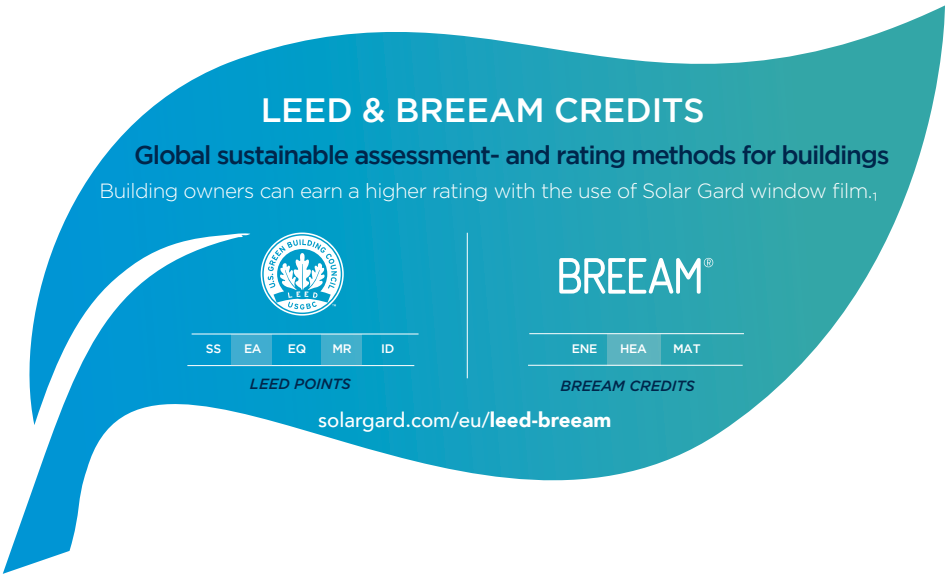
As a summary, Solar Gard window films offer a range of solutions to improve the performance of existing buildings and more in particular the performance of the glass and glazing in existing and to help the operators/users of a building to meet the functional requirements in situation where such is not the case.

It is important to evaluate the use of window films in their totality:

- Reduction of energy consumption
- Reduction of carbon footprint
- Improvement of the safety in case of glass breakage
- Improvement of security against intrusion
- Improvement of summer and winter comfort
- Improvement of the privacy
- Reduction of risk for fading
- Improvement the aesthetics of the building/façade
- Improvement of the visual comfort
- Improvement of cyber security and data protection

In addition window help to impact the ratings in some of the globally used assessment and rating methods for buildings like BREEAM® and LEED®.

When considering an upgrade or improvement measure of existing windows of glass facades, all the above needs are important points as well as the fact that window films allow to give a longer life to the existing glass (no additional environmental impact due to removal or demolition) and that the building's use is not disrupted at all during the application of the window films.



10. Deutsche Zusammenfassung

Zum Unternehmen Solar Gard

Solar Gard baut auf fast 50 Jahre Erfahrung in der Entwicklung und Herstellung von Flachglasfolien und ist in mehr als 90 Ländern vertreten.
Solar Gard ist ein führendes Unternehmen im Bereich patentierter Technologien für Sonnenschutz unter anderem Schutzfolien für Wohngebäude und für Geschäftsgebäude sowie Fahrzeuge und öffentliche Verkehrsmittel.
Solar Gard wurde Teil von Saint-Gobain 2011.

Produktbeschreibung

Name des Produkts / der Produktfamilie und der vertretende Hersteller in der forliegenden Umweltproduktdeklaration (EPD): Solar Gard Sonnenschutzfolien für Innenverlegung der LX (HILITE) Serien mit ein Nennstärke bis zu 3 mil (75 µm). Die Folien sind hergestellt im Solar Gard Werk in San Diego, USA.

Alle in dieser Umweltproduktdeklaration (EPD) aufgeführten Produkte erfüllen die Anforderungen nach DIN EN 15752-1 „Glas im Bauwesen - Selbstklebende Polymerfolie - Teil 1: Begriffe und Anforderungen“.

Die Produkte sind laut ICS einzuordnen unter 83.140.10 „Folien und Platten“.
Nach der Zentralen Gütersystematik der Vereinten Nationen mit Sitz in New York von 2015 gehören diese Produkte zum Bereich „Tafeln, Platten, Folien, Filme, Bänder, Streifen und andere Flacherzeugnisse, selbstklebend, aus Kunststoffen“ 3919 (HS 2007) bzw. 36920 (CPC2), 2220 (ISIC 4).

Insgesamt umfasst diese EPD 12 Sonnenschutzfolien (LX/HILITE).
Das Referenzprodukt für die in der EDP erfassten Produkte ist Solar Gard Solar Gard LX (HILITE) 70 (als Rollenware, in einer Breite von 1,52 m (60”) und einer Länge von 30,5 m (100 ft.)). Die Abweichungen zwischen den in der EPD erfassten Produkten und dem Referenzprodukt Solar Gard LX (HILITE) 70 bleibt in einem Bereich von ±10%, wie in den Produkt-Kategorieregeln (PCR) gefordert.

Details zur Berechnung der Ökobilanz (LCA)

- **Deklarierte Einheit:** 1m² des verlegten Produkts
- **Systemgrenzen:** die vorliegende Studie deckt alle Ökobilanzen des Produkts ab, „von der Wiege bis zur Bahre“, einschließlich Modul D.
- **Referenz-Lebensdauer:** die Referenz-Lebensdauer (RSL) des Fensterfolienprodukts wird auf 16 Jahre gelegt. Dies ist der Garantiezeitraum, den wir für unser Produkt empfehlen, ohne dass diese in diesem Zeitraum nachgerüstet werden muss. Dennoch liegt die Lebenserwartung bei 20 Jahren.
- **Geographischer Erfassungsbereich und Zeitraum:** geographisch werden Europa, der Mittlere Osten und Afrika, sowie Indien abgedeckt. Die verwendeten Produktionsdaten sind für das Jahr 2019 einer Produktionsstelle, nämlich das Werk in San Diego, USA.

Kontakt

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LCA Ergebnisse

Wie in EN 15804:2012+A2:2019 und den Produkt-Kategorieregeln festgelegt, werden die Umwelteinflüsse anhand der Basisfaktoren der Gemeinsamen Forschungsstelle (JCR) der Europäischen Kommission festgelegt. Diese findet man unter dem folgenden Link: https://eplca.jrc.ec.europa.eu/LCDN/developerEF.xhtml. Spezifische Daten wurden durch die Anlage ermittelt. Generische Daten stehen zur Verfügung aus den Datenbanken der GABI und Ecoinvent. Sämtliche Emissionen in die Luft, ins Wasser und den Grundboden sowie alle genutzten Materialien und Energieverbräuche wurden ebenfalls erfasst.

Sämtliche Zahlen beziehen sich auf den ausgewiesenen Bereich von 1m² der montierten Fensterfolie.

Die Tabellen im Abschnitt 7 „ LCA results“ beziehen sich auf das Referenzprodukt der Produktfamilie in dieser EPD – d.h. LX (HILITE) 70. Beschreibung der Systemgrenze (X = in LCA erfasst, MNA = Modul nicht bewertet).

11. Acronyms

ACRONYM	EXPLANATION
A (%)	Reflection of solar energy
ADP fossil [MJ]	Resource use, energy carriers [MJ]
ADP Min&Met [kg Sb eq.]	Resource use, mineral and metals [kg Sb eq.]
AP [Mole of H+ eq.]	Acidification terrestrial and freshwater [Mole of H+ eq.]
BREAK - kg/cm	Break resistance
BREEAM	Building Research Establishment Environmental Assessment Method
E	Emissivity
ELONG	Elongation
EN 12600	Humain impact
EN 12600	European norm Impact test
EN 356	Intrusion resistance
EN 356	European norm for Intrusion test
EP freshwater [kg P eq.]	Eutrophication freshwater [kg P eq.]
EP freshwater [kg PO4 eq]	Freshwater [kg PO4 eq]
EP marine [kg N eq.]	Eutrophication marine [kg N eq.]
EP terrestrial [Mole of N eq.]	Eutrophication terrestrial [Mole of N eq.]
EWFA	The International Window Film Association
FR (%)	Fade reduction coefficient
G	Solar heat gain coefficient (G-value)
GL (%)	Glare Reduction
GWP-biogenic [kg CO_2 eq.]	Climate Change (biogenic) [kg CO_2 eq.]
GWP-fossil [kg CO_2 eq.]	Climate Change (fossil) [kg CO_2 eq.]
GWP-Lulu [kg CO_2 eq.]	Climate Change (land use change) [kg CO_2 eq.]
GWP-total [kg CO_2 eq.]	Climate Change [kg CO_2 eq.]
HDPE	High Density Polyethylene
IGU	Insulated Glass Unit
IRER (%)	IR Energy Rejection @780-2500nm
ISO 16933, GSA, ASTM; INERIS	Explosion (bomb blast) tests
LDPE	Low Density Polyethylene
LEED	Leadership in Energy and Environmental Design
Low-E film	Window film with considerably reduced emissivity allowing to improve the U-value of the glass it is applied on
ODP [kg CFC-11 eq.]	Ozone depletion [kg CFC-11 eq.]
PCOP [kg NMVOC eq.]	Photochemical ozone formation - human health [kg NMVOC eq.]
PCR	Product Category Rule(s)
PEEL - g/cm	Peel resistance
PS	Pressure sensitive
PUNC - kg	Puncture resistance
R (%)	Absorption of solar energy
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
Re/Ri (%)	Visible light Reflectance Exterior/Interior
SC	Shading Coefficient
SHGR (%)	Solar heat gain reduction
SIRR (%)	Selective IR Energy Rejection @280-2500nm
SSI	Light to solar heat gain ratio (VLT/SHGC)
Tdw (%)	Fading factor (Tdw-ISO @300-700nm)
TEAR - kg	Tear resistance
Tnom / T(Qm)	Nominal thickness
VLT (%)	Visible Light Transmittance
TR (%)	Transmittance of solar energy
TS - kg/cm	Tensile strength
TSER (%)	Total solar energy rejected
TSER (%) -60º	Total solar energy rejected @60º angle
U (W/m K)	Winter U-factor (W/m^2 °C)
U Red (%)	Fade reduction coefficient
UV (%)	UV Blocked @300-380nm
WDP [m world equiv.]	Water scarcity [m^3 world equiv.]
YIELD - kg/cm	Tensile strength (5% elongation)

12. References

EPD International (2017) General Program Instructions for the International EPD® System. Version 3.0, dated 2017-12-11. www.environdec.com.

The International EPD System PCR 2019:14 (EN 15804: A2). Construction products and Construction services, (1.11)

EN 15804:2012+A2:2019 Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products

ISO 21930:2007 Sustainability in building construction – Environmental declaration of building products

ISO 14025:2006 Environmental labels and declarations – Type III environmental declarations – Principles and procedures

ISO 14040:2006 Environmental management. Life cycle assessment. Principles and framework

ISO 14044:2006 Environmental management. Life cycle assessment. Requirements and guidelines

European Chemical Agency, Candidate List of substances of very high concern for Authorization. http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp

The general program instructions (GPI) for the international EPD® (version 3.01: 2021)

LCA report Information for the environmental product declaration of windows films, Saint-Gobain Solar Gard, version 1, October 2022

Saint-Gobain INTEGRATED ANNUAL REPORT 2021 and 2022 (available on Saint-Gobain social media channels)

Saint-Gobain UNIVERSAL REGISTRATION DOCUMENT 2021 including the annual financial report, available on www.saint-gobain.com

Saint-Gobain annual report 2021 “Living Better’ available on www.saint-gobain.com

Information on E-film software https://energyplus.net/

REFERENCE
Country: The Netherlands
Solution: LX 70

SAINT-GOBAIN

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About Saint-Gobain Solar Gard®

Solar Gard is a world leader in patented technologies for solar control and protective window films for buildings and vehicles. As the "Thin Films" division of the global glass and building technology group Saint-Gobain – a company that originated more than 350 years ago with the Hall of Mirrors in the Palace of Versailles – Solar Gard builds on decades of experience in the development and production of window film. The Solar Gard product range provides solutions for upgrading and improving glass in vehicles, homes and large buildings for the comfort and protection of passengers, residents, visitors and employees.
Follow Solar Gard on Facebook, Twitter and Instagram. #SolarGard

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