Solar Gard®
SAINT-GOBAIN

EPD®
THE INTERNATIONAL EPD® SYSTEM

ECO PLATFORM
EPD
VERIFIED

EPD VERIFIED

Environmental Product Declaration

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

Photo: ©Laurent Kronental

Solar Gard® internal solar films and clear safety films up to 4 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-06660

An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com.

SAINT-GOBAIN

REFERENCE
Country: France
Solution: Graffitigard 4 mil

Photo: ©Laurent Kronental

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-06660
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 internal solar films and clear safety films up to 4 mil manufactured in San Diego plant – **in total 34 solar films and 6 clear safety films**
Reference Product:	**Solar Gard STERLING 40** (supplied as roll with dimensions 152 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:	1m^2 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 range of 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.

The Solar Gard range of 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: Qatar
Solution: TrueVue 5

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**

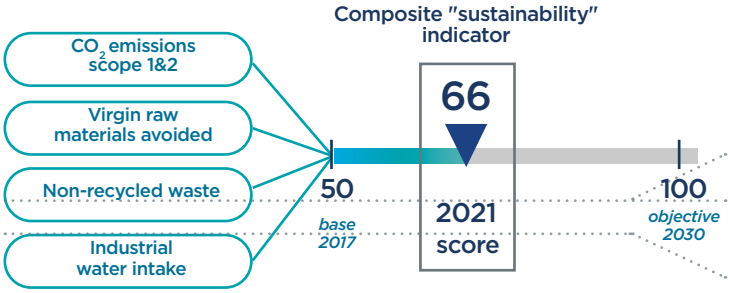
In this roadmap, **2030 is an intermediate but crucial stage**. The Group is committed to reducing by then its direct and indirect CO2 emissions by 66% compared to 2017.
In doing so, Saint-Gobain will make no concession toward the excellence of our products or our competitiveness.
Each year through to 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 Window Film for internal use and of clear safety films for internal use up to a thickness of 4 mil nominal thickness.**

These products have a **warranty period of 12 years.** (*) The expected average service life longer provided when 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, 1.52 m wide and 1.82 m wide) and lengths (100 ft (or 30,5 m), 165 ft (50 m) or several custom-lengths). 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 34 solar window films and 6 clear safety films. **The reference product** for the group of products covered in this EPD is Solar Gard **STERLING 40** (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 STERLING 40 remains within 10% for GWP as 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).

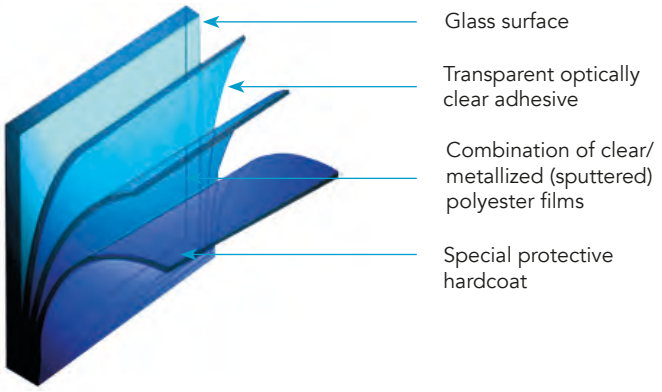
Table 1A gives an overview of the solar window films product references covered in this EPD.
Table 1B gives an overview of the clear and safety films product references covered in this EPD.

Product description and performance

The Solar Gard internal solar films all consist of multiple layers of PET with a metalized layer incorporated in the construction. The metalized layer is 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 in the sputtered metal layer.

The Saint-Gobain Solar Gard clear films are used either as surface protection films or as safety films for glass retention. These products do not include sputtered layers and consist of clear PET mono-layer with a thickness up to 100 µm (4 mil) thick.



Different mounting adhesives are used depending on the function of the product.

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

©Getty Images

Table 1A

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	Mounting Adhesive	Product name
Silver	Aluminium based	Acrylic PS	Silver 20
		Acrylic PS	Silver 35
		Acrylic PS	Silver 50
		Acrylic PS	Silver 70
Stainless Steel	Stainless steel based	Acrylic PS	Stainless Steel 20
		Acrylic PS	Stainless Steel 35
		Acrylic PS	Stainless Steel 50
Bronze	Copper based	Acrylic PS	Solar Bronze 20
		Acrylic PS	Solar Bronze 35
		Acrylic PS	Solar Bronze 50
Sterling	Silver based	Acrylic PS	Sterling 20
		Acrylic PS	Sterling 40
		Acrylic PS	Sterling 50
		Acrylic PS	Sterling 60
		Acrylic PS	Sterling 70
TrueVue (Dual reflective)	Aluminium based	Acrylic PS	TrueVue 5 PS
		Acrylic PS	TrueVue 15 PS
		Acrylic PS	TrueVue 30 PS
		Acrylic PS	TrueVue 40 PS
Slate (Dual reflective)	Silver based	Acrylic PS	SLATE 10 PS HC
		Acrylic PS	SLATE 20 PS HC
		Acrylic PS	SLATE 30 PS HC
		Acrylic PS	SLATE 40 PS HC
NightSky	Aluminium based	Acrylic PS	NIGHT SKY 10 PS
		Acrylic PS	NIGHT SKY 20 PS
		Acrylic PS	NIGHT SKY 30 PS
ULR	nano-ceramic	Acrylic PS	ULR 70
CX		Acrylic PS	CX 35 SG PS
		Acrylic PS	CX50 SG PS
		Acrylic PS	CX60 SG PS
Grey/Silver/Grey	Aluminium based	Acrylic PS	Grey/Silver/Grey 10
Quantum/Silver/Quantum	Aluminium based	Acrylic PS	Quant/Sil/Quant 10 PS
		Acrylic PS	Quant/Sil/Quant 20 PS
SHADE films	Aluminium based	---	Stainless Steel 30 Shade

Table 1B

List of the clear window film products covered in this EPD.
The table contains the commercial names and the type of mounting adhesive.

Product Family Clear Films	Mounting Adhesive	Product name
75 micron (nominal thickness)	Removable PS	WSP 3PLUS
		IGPF
Safety films 100 micron (nominal thickness)	Safety PS	AC 4 mil CLEAR
Print films	Removable PS	PCR4
Graffiti films	Removable PS	4 mil GraffitiGard
Antimicrobial films	Removable PS	4 mil SG AM

Each of the solar films have a particular balance between visible light transmission, visible light reflection and heat rejection. All the window films 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 the necessary comfort and thermal balance calculations including the analysis of potential risk for thermal breakage.

The reference product STERLING 40 has a total solar energy rejection (TSER) of 63% on single glass and 56% on an insulated glass unit consisting of 2 standard clear panes. The Infrared Energy rejected (IRER) is 74% 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.

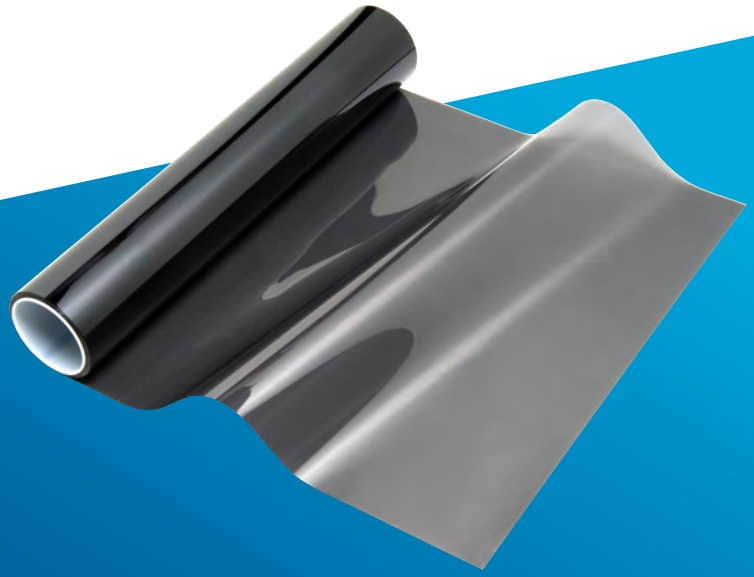


Table 2: Key performances

Product family Solar Films	VLT (%)	VLR e/i (%)	TR (%)	IRER (%)	G-value	TSER (%)	SHGR (%)	TdW ISO (%)
Silver 20	16	58/58	12	84	0.20	80	77	14
Silver 35	34	38/36	26	71	0.35	65	60	28
Silver 50	53	23/22	41	58	0.49	51	44	40
Silver 70	68	12/11	56	60	0.65	35	23	49
Stainless Steel 20	24	28/25	21	65	0.34	66	60	16
Stainless Steel 35	42	15/13	38	49	0.50	50	42	29
Stainless Steel 50	48	13/11	44	45	0.54	46	37	34
Solar Bronze 20	22	37/36	13	87	0.21	79	75	13
Solar Bronze 35	35	29/27	22	81	0.30	70	66	19
Solar Bronze 50	45	23/21	30	73	0.38	62	56	27
Sterling 20	23	45/42	16	84	0.24	76	73	19
Sterling 40	41	33/30	29	74	0.37	63	58	33
Sterling 50	49	26/24	36	67	0.43	57	50	38
Sterling 60	64	17/16	49	53	0.56	44	35	45
Sterling 70	75	13/12	17	60	0.66	34	24	52
Truevue 5 PS	5	45/8	6	85	0.16	0.32	84	5
Truevue 15 PS	12	45/23	9	85	0.19	0.63	81	10
Truevue 30 PS	31	22/13	27	66	0.37	63	57	23
Truevue 40 PS	39	14/12	36	53	0.46	54	46	28
ULR 70	73	8/8	51	52	0.61	39	29	52
CX 35 SG PS	37	17/15	26	68	0.39	61	55	25
CX50 SG PS	51	13/11	38	56	0.50	50	43	33
CX60 SG PS	61	11/9	49	45	0.59	41	32	40
Grey/Silver/Grey 10	5	10/10	10	74	0.26	74	70	5
Silver /grey 20 HC	12	10/36	14	72	0.29	71	67	11
Quant/Sil/Quant 10 PS	10	22/25	7	77	0.25	75	71	8
Quant/Sil/Quant 20 PS	24	10/12	21	62	0.38	62	56	17
Stainless Steel 30 Shade	34	20/17	31	57	0.43	57	50	24
WSP 3PLUS	88	10/10	78	19	0.81	19	6	63
IGPF	88	10/10	78	19	0.81	19	6	63
AC 4 mil CLEAR	88	10/10	78	19	0.81	19	6	63
PCR4	88	10/10	78	19	0.81	19	6	63
4 mil GraffitiGard	88	10/10	78	19	0.81	19	6	63
4 mil SG AM	88	10/10	78	19	0.81	19	6	63

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.

Table 3: 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+
Impact (AC 4 mil Clear)	ANSI Z97.1	Class B
	CPPC, CFR 1201	CAT I
	EN 12600	2B2
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 3
UV rejection	EN 15752-1 and EN 410	>99%

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: Sterling 40	100%	0%	0%
PET film	59%	0%	0%
Acrylic adhesive	11%	0%	0%
Coating	0.004%	0%	0%
Release Liner	30%	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	**0.117 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).

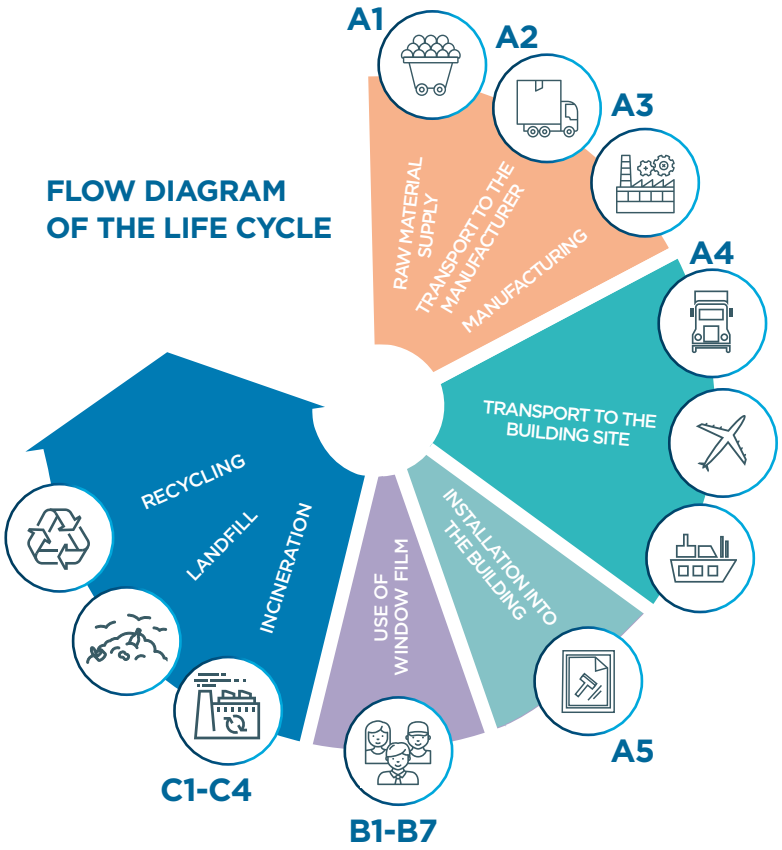
The verifier and the program operator do not make any claim nor have any responsibility of the legality of the product.

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 12 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: STERLING 40.

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



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.

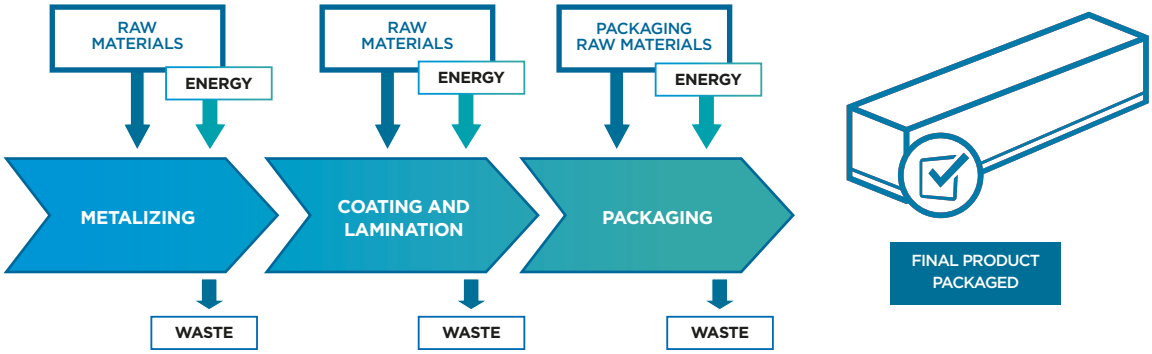
A2, transport to the manufacturer.

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 100 km 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: Sweden
Solution: Silver 35

Photo: Solklart AB

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 STERLING 40.

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.]	1,54E+00	1,69E-01	1,22E-01	0	0	0	0	0	0	0	4,00E-04	9,00E-04	5,30E-03	1,02E-01	-1,02E-01
	Climate Change (fossil) [kg CO_2 eq.]	1,55E+00	1,69E-01	9,83E-02	0	0	0	0	0	0	0	4,00E-04	9,00E-04	4,00E-03	1,02E-01	-1,02E-01
	Climate Change (biogenic) [kg CO_2 eq.]	-1,72E-02	5,39E-05	1,66E-02	0	0	0	0	0	0	0	2,58E-06	4,17E-07	1,30E-03	5,78E-06	-7,82E-05
	Climate Change (land use change) [kg CO_2 eq.]	5,03E-04	3,25E-05	7,30E-03	0	0	0	0	0	0	0	5,65E-07	3,45E-07	4,49E-06	5,69E-07	-3,39E-05
	Ozone depletion [kg CFC-11 eq.]	4,39E-07	3,77E-08	2,49E-08	0	0	0	0	0	0	0	2,50E-11	1,99E-10	5,09E-10	2,89E-10	-6,61E-09
	Acidification terrestrial and freshwater [Mole of H+ eq.]	4,35E-03	1,20E-03	4,00E-04	0	0	0	0	0	0	0	1,79E-06	5,23E-06	2,05E-05	2,39E-05	-3,00E-04
	Eutrophication freshwater [kg P eq.]	7,75E-05	7,42E-07	4,58E-06	0	0	0	0	0	0	0	2,59E-08	9,11E-09	1,11E-07	2,26E-08	-1,77E-06
	Eutrophication freshwater [kg (PO4)3 eq.]	2,01E-04	2,28E-06	1,41E-05	0	0	0	0	0	0	0	7,94E-08	2,80E-08	3,41E-07	6,94E-08	-5,44E-06
	Eutrophication marine [kg N eq.]	9,17E-04	4,00E-04	1,00E-04	0	0	0	0	0	0	0	2,57E-07	1,85E-06	6,85E-06	1,78E-05	-5,74E-05
	Eutrophication terrestrial [Mole of N eq.]	9,30E-03	4,20E-03	1,00E-03	0	0	0	0	0	0	0	2,90E-06	2,03E-05	6,06E-05	1,00E-04	-6,00E-04
	Photochemical ozone formation - human health [kg NMVOC eq.]	3,25E-03	1,10E-03	3,00E-04	0	0	0	0	0	0	0	8,31E-07	5,81E-06	1,99E-05	3,02E-05	-2,00E-04
	Resource use, mineral and metals [kg Sb eq.][1]	1,53E-05	1,38E-06	1,13E-06	0	0	0	0	0	0	0	1,09E-08	2,29E-08	8,29E-08	2,19E-08	-1,02E-06
	Resource use, energy carriers [MJ][1]	2,92E+01	2,41E+00	1,65E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	7,10E-02	2,72E-02	-2,03E+00
	Water scarcity [m³ world equiv.][1]	5,73E-01	6,20E-03	9,95E-02	0	0	0	0	0	0	0	4,33E-02	7,12E-05	1,30E-03	7,00E-04	-3,17E-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]	2,41E+00	1,56E-02	2,32E-01	0	0	0	0	0	0	0	6,00E-04	2,00E-04	2,80E-03	5,00E-04	-3,95E-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]	2,52E+00	1,56E-02	2,37E-01	0	0	0	0	0	0	0	6,00E-04	2,00E-04	2,80E-03	5,00E-04	-3,95E-02
	Use of non-renewable primary energy (PENRE) [MJ]	2,67E+01	2,41E+00	1,55E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	4,65E-01	2,72E-02	-2,01E+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	-3,94E-01	0	-1,80E-02
	Total use of non-renewable primary energy resources (PENRT) [MJ]	2,92E+01	2,41E+00	1,66E+00	0	0	0	0	0	0	0	5,90E-03	1,39E-02	7,10E-02	2,72E-02	-2,03E+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]	1,34E-02	1,00E-04	2,30E-03	0	0	0	0	0	0	0	1,00E-03	1,66E-06		1,53E-05	-7,00E-04

Output Flows and 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]	2,41E-02	6,1012E-06	1,20E-03	0	0	0	0	0	0	0	3,2272E-09	3,4497E-08	1,084E-07	1,1118E-07	-2,7274E-06
Non-hazardous waste disposed (NHWD) [kg]	4,57E-01	0,057	3,65E-02	0	0	0	0	0	0	0	0,0002	0,001	0,0053	6,22E-02	-0,0256
Radioactive waste disposed (RWD) [kg]	3,67E-05	0,000016766	2,94E-06	0	0	0	0	0	0	0	2,1006E-08	8,9392E-08	2,37E-07	1,0223E-07	-1,3651E-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	1,71E-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]	1,55E+00	1,69E-01	9,83E-02	0	0	0	0	0	0	0	4,00E-04	9,00E-04	4,00E-03	1,02E-01	-1,02E-01

[1] [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 STERLING 40.

[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 80% 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: Belgium
Solution: Silver 50 / 4 mil Graffitigard

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 architectural Solar films reduce the solar heat gain (see table 2 for base information).
Solar Gard STERLING 40 rejects, as an example up to 63% of the solar energy incident on a single glass and as much as 74% 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.

Technically 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.

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 : STERLING 40 (reference product) applied on 4 mm clear glass (Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of STERLING 40 (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.

Table 6A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear STERLING 40 Copenhagen	Planiclear STERLING 40 Helsinki	Planiclear STERLING 40 Oslo	Planiclear STERLING 40 Stockholm	STERLING 40 Warsaw	Planiclear STERLING 40 Berlin	Planiclear STERLING 40 Koln	Planiclear STERLING 40 Munich
	712 kWh per m²	579 kWh per m²	591 kWh per m²	661 kWh per m²	708 kWh per m²	767 kWh per m²	604 kWh per m²	843 kWh per m²

Table 6A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear STERLING 40 Amsterdam	Planiclear STERLING 40 Brussels	Planiclear STERLING 40 Geneva	Planiclear STERLING 40 London	Planiclear STERLING 40 Luxembourg	Planiclear STERLING 40 Lyon	Planiclear STERLING 40 Paris
	630 kWh per m²	599 kWh per m²	1018 kWh per m²	710 kWh per m²	599 kWh per m²	943 kWh per m²	771 kWh per m²

Table 6A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear STERLING 40 Barcelona	Planiclear STERLING 40 Istanbul	Planiclear STERLING 40 Jerusalem	Planiclear STERLING 40 Lisboa	Planiclear STERLING 40 Madrid	Planiclear STERLING 40 Milan	Planiclear STERLING 40 Rome
	1290 kWh per m²	1107 kWh per m²	1782 kWh per m²	1469 kWh per m²	1511 kWh per m²	1041 kWh per m²	860 kWh per m²

Table 6A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear STERLING 40 Abu Dhabi	Planiclear STERLING 40 Cape Town	Planiclear STERLING 40 Chennai	Planiclear STERLING 40 Cairo	Planiclear STERLING 40 Johannesburg	Planiclear STERLING 40 Mumbai	Planiclear STERLING 40 Nairobi	Planiclear STERLING 40 Riyadh
	3304 kWh per m²	1481 kWh per m²	2441 kWh per m²	1787 kWh per m²	1775 kWh per m²	2542 kWh per m²	1418 kWh per m²	3186 kWh per m²

TABLES 6B : SILVER 20 applied on 4 mm clear glass (Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of SILVER 20 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.

Table 6B-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear SILVER 20 Copenhagen	Planiclear SILVER 20 Helsinki	Planiclear SILVER 20 Oslo	Planiclear SILVER 20 Stockholm	Planiclear SILVER 20 Warsaw	Planiclear SILVER 20 Berlin	Planiclear SILVER 20 Koln	Planiclear SILVER 20 Munich
	790 kWh per m²	691 kWh per m²	704 kWh per m²	783 kWh per m²	853 kWh per m²	870 kWh per m²	711 kWh per m²	976 kWh per m²

Table 6B-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear SILVER 20 Amsterdam	Planiclear SILVER 20 Brussels	Planiclear SILVER 20 Geneva	Planiclear SILVER 20 London	Planiclear SILVER 20 Luxembourg	Planiclear SILVER 20 Lyon	Planiclear SILVER 20 Paris
	753 kWh per m²	693 kWh per m²	1121 kWh per m²	802 kWh per m²	693 kWh per m²	1091 kWh per m²	868 kWh per m²

Table 6B-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear SILVER 20 Barcelona	Planiclear SILVER 20 Istanbul	Planiclear SILVER 20 Jerusalem	Planiclear SILVER 20 Lisboa	Planiclear SILVER 20 Madrid	Planiclear SILVER 20 Milan	Planiclear SILVER 20 Rome
	1491 kWh per m²	1282 kWh per m²	1961 kWh per m²	1653 kWh per m²	1779 kWh per m²	1256 kWh per m²	1045 kWh per m²

Table 6B-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear SILVER 20 Abu Dhabi	Planiclear SILVER 20 Cape Town	Planiclear SILVER 20 Chennai	Planiclear SILVER 20 Cairo	Planiclear SILVER 20 Johannesburg	Planiclear SILVER 20 Mumbai	Planiclear SILVER 20 Nairobi	Planiclear SILVER 20 Riyadh
	3939 kWh per m²	1731 kWh per m²	3002 kWh per m²	2062 kWh per m²	2061 kWh per m²	3087 kWh per m²	1571 kWh per m²	3820 kWh per m²

TABLES 6C : TRUEVUE 30 applied on 4 mm clear glass (Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of TRUVUE 30 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.

Table 6C-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear TRUEVUE 30 Copenhagen	Planiclear TRUEVUE 30 Helsinki	Planiclear TRUEVUE 30 Oslo	Planiclear TRUEVUE 30 Stockholm	Planiclear TRUEVUE 30 Warsaw	Planiclear TRUEVUE 30 Berlin	Planiclear TRUEVUE 30 Koln	Planiclear TRUEVUE 30 Munich
	672 kWh per m²	569 kWh per m²	558 kWh per m²	640 kWh per m²	693 kWh per m²	694 kWh per m²	561 kWh per m²	786 kWh per m²

Table 6C-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear TRUEVUE 30 Amsterdam	Planiclear TRUEVUE 30 Brussels	Planiclear TRUEVUE 30 Geneva	Planiclear TRUEVUE 30 London	Planiclear TRUEVUE 30 Luxembourg	Planiclear TRUEVUE 30 Lyon	Planiclear TRUEVUE 30 Paris
	606 kWh per m²	562 kWh per m²	890 kWh per m²	654 kWh per m²	562 kWh per m²	856 kWh per m²	692 kWh per m²

Table 6C-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear TRUEVUE 30 Barcelona	Planiclear TRUEVUE 30 Istanbul	Planiclear TRUEVUE 30 Jerusalem	Planiclear TRUEVUE 30 Lisboa	Planiclear TRUEVUE 30 Madrid	Planiclear TRUEVUE 30 Milan	Planiclear TRUEVUE 30 Rome
	1221 kWh per m²	1032 kWh per m²	1679 kWh per m²	1365 kWh per m²	1415 kWh per m²	956 kWh per m²	810 kWh per m²

Table 6C-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear TRUEVUE 30 Abu Dhabi	Planiclear TRUEVUE 30 Cape Town	Planiclear TRUEVUE 30 Chennai	Planiclear TRUEVUE 30 Cairo	Planiclear TRUEVUE 30 Johannesburg	Planiclear TRUEVUE 30 Mumbai	Planiclear TRUEVUE 30 Nairobi	Planiclear TRUEVUE 30 Riyadh
	3079 kWh per m²	1386 kWh per m²	2255 kWh per m²	1664 kWh per m²	1664 kWh per m²	2370 kWh per m²	1346 kWh per m²	2952 kWh per m²

TABLES 7A : STERLING 40 (reference product) applied on an IGU (4/12/4 from Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of STERLING 40 (reference product) 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.

Table 7A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU STERLING 40 Copenhagen	Planiclear IGU STERLING 40 Helsinki	Planiclear IGU STERLING 40 Oslo	Planiclear IGU STERLING 40 Stockholm	Planiclear IGU STERLING 40 Warsaw	Planiclear IGU STERLING 40 Berlin	Planiclear IGU STERLING 40 Koln	Planiclear IGU STERLING 40 Munich
	512 kWh per m²	500 kWh per m²	477 kWh per m²	541 kWh per m²	592 kWh per m²	590 kWh per m²	461 kWh per m²	664 kWh per m²

Table 7A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU STERLING 40 Amsterdam	Planiclear IGU STERLING 40 Brussels	Planiclear IGU STERLING 40 Geneva	Planiclear IGU STERLING 40 London	Planiclear IGU STERLING 40 Luxembourg	Planiclear IGU STERLING 40 Lyon	Planiclear IGU STERLING 40 Paris
	506 kWh per m²	428 kWh per m²	694 kWh per m²	524 kWh per m²	428 kWh per m²	660 kWh per m²	573 kWh per m²

Table 7A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU STERLING 40 Barcelona	Planiclear IGU STERLING 40 Istanbul	Planiclear IGU STERLING 40 Jerusalem	Planiclear IGU STERLING 40 Lisboa	Planiclear IGU STERLING 40 Madrid	Planiclear IGU STERLING 40 Milan	Planiclear IGU STERLING 40 Rome
	911 kWh per m²	819 kWh per m²	1248 kWh per m²	1026 kWh per m²	1119 kWh per m²	828 kWh per m²	622 kWh per m²

Table 7A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU STERLING 40 Abu Dhabi	Planiclear IGU STERLING 40 Cape Town	Planiclear IGU STERLING 40 Chennai	Planiclear IGU STERLING 40 Cairo	Planiclear IGU STERLING 40 Johannesburg	Planiclear IGU STERLING 40 Mumbai	Planiclear IGU STERLING 40 Nairobi	Planiclear IGU STERLING 40 Riyadh
	2464 kWh per m²	1095 kWh per m²	1817 kWh per m²	1266 kWh per m²	1253 kWh per m²	1972 kWh per m²	1136 kWh per m²	2372 kWh per m²

TABLES 7B : SILVER 20 applied on an IGU (4/12/4 from Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of SILVER 20 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.

Table 7B-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU SILVER 20 Copenhagen	Planiclear IGU SILVER 20 Helsinki	Planiclear IGU SILVER 20 Oslo	Planiclear IGU SILVER 20 Stockholm	Planiclear IGU SILVER 20 Warsaw	Planiclear IGU SILVER 20 Berlin	Planiclear IGU SILVER 20 Koln	Planiclear IGU SILVER 20 Munich
	663 kWh per m²	628 kWh per m²	621 kWh per m²	678 kWh per m²	746 kWh per m²	750 kWh per m²	615 kWh per m²	850 kWh per m²

Table 7B-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU SILVER 20 Amsterdam	Planiclear IGU SILVER 20 Brussels	Planiclear IGU SILVER 20 Geneva	Planiclear IGU SILVER 20 London	Planiclear IGU SILVER 20 Luxembourg	Planiclear IGU SILVER 20 Lyon	Planiclear IGU SILVER 20 Paris
	631 kWh per m²	553 kWh per m²	872 kWh per m²	659 kWh per m²	553 kWh per m²	903 kWh per m²	718 kWh per m²

Table 7B-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU STERLING 40 Barcelona	Planiclear IGU STERLING 40 Istanbul	Planiclear IGU STERLING 40 Jerusalem	Planiclear IGU STERLING 40 Lisboa	Planiclear IGU STERLING 40 Madrid	Planiclear IGU STERLING 40 Milan	Planiclear IGU STERLING 40 Rome
	1162 kWh per m²	1047 kWh per m²	1506 kWh per m²	1233 kWh per m²	1468 kWh per m²	1052 kWh per m²	787 kWh per m²

Table 7B-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU SILVER 20 Abu Dhabi	Planiclear IGU SILVER 20 Cape Town	Planiclear IGU SILVER 20 Chennai	Planiclear IGU SILVER 20 Cairo	Planiclear IGU SILVER 20 Johannesburg	Planiclear IGU SILVER 20 Mumbai	Planiclear IGU SILVER 20 Nairobi	Planiclear IGU SILVER 20 Riyadh
	3219 kWh per m²	1332 kWh per m²	2387 kWh per m²	1623 kWh per m²	1564 kWh per m²	2530 kWh per m²	1405 kWh per m²	3019 kWh per m²

TABLES 7C : TRUEVUE 30 applied on an IGU (4/12/4 from Saint-Gobain PLANICLEAR)

The potential energy saving (kWh/m²) of TRUVUE 30 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.

Table 7C-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU TRUEVUE 30 Copenhagen	Planiclear IGU TRUEVUE 30 Helsinki	Planiclear IGU TRUEVUE 30 Oslo	Planiclear IGU TRUEVUE 30 Stockholm	Planiclear IGU TRUEVUE 30 Warsaw	Planiclear IGU TRUEVUE 30 Berlin	Planiclear IGU TRUEVUE 30 Koln	Planiclear IGU TRUEVUE 30 Munich
	445 kWh per m²	440 kWh per m²	419 kWh per m²	479 kWh per m²	506 kWh per m²	502 kWh per m²	420 kWh per m²	575 kWh per m²

Table 7C-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU TRUEVUE 30 Amsterdam	Planiclear IGU TRUEVUE 30 Brussels	Planiclear IGU TRUEVUE 30 Geneva	Planiclear IGU TRUEVUE 30 London	Planiclear IGU TRUEVUE 30 Luxembourg	Planiclear IGU TRUEVUE 30 Lyon	Planiclear IGU TRUEVUE 30 Paris
	440 kWh per m²	373 kWh per m²	623 kWh per m²	453 kWh per m²	373 kWh per m²	597 kWh per m²	488 kWh per m²

Table 7C-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU TRUEVUE 30 Barcelona	Planiclear IGU TRUEVUE 30 Istanbul	Planiclear IGU TRUEVUE 30 Jerusalem	Planiclear IGU TRUEVUE 30 Lisboa	Planiclear IGU TRUEVUE 30 Madrid	Planiclear IGU TRUEVUE 30 Milan	Planiclear IGU TRUEVUE 30 Rome
	761 kWh per m²	696 kWh per m²	1019 kWh per m²	882 kWh per m²	955 kWh per m²	710 kWh per m²	543 kWh per m²

Table 7C-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planiclear IGU TRUEVUE 30 Abu Dhabi	Planiclear IGU TRUEVUE 30 Cape Town	Planiclear IGU TRUEVUE 30 Chennai	Planiclear IGU TRUEVUE 30 Cairo	Planiclear IGU TRUEVUE 30 Johannesburg	Planiclear IGU TRUEVUE 30 Mumbai	Planiclear IGU TRUEVUE 30 Nairobi	Planiclear IGU TRUEVUE 30 Riyadh
	2062 kWh per m²	929 kWh per m²	1533 kWh per m²	1055 kWh per m²	1073 kWh per m²	1695 kWh per m²	977 kWh per m²	2007 kWh per m²

TABLES 8A : STERLING 40 (reference product) applied on IGU with low-E on side 3 (4/12/4 from Saint-Gobain PLANITHERM ONE)

The potential energy saving (kWh/m²) of STERLING 40 (reference product) applied on 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.

Table 8A-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One STERLING 40 Copenhagen	IGU w/ Planitherm One STERLING 40 Helsinki	IGU w/ Planitherm One STERLING 40 Oslo	IGU w/ Planitherm One STERLING 40 Stockholm	IGU w/ Planitherm One STERLING 40 Warsaw	IGU w/ Planitherm One STERLING 40 Berlin	IGU w/ Planitherm One STERLING 40 Koln	IGU w/ Planitherm One STERLING 40 Munich
	203 kWh per m²	164 kWh per m²	186 kWh per m²	193 kWh per m²	202 kWh per m²	215 kWh per m²	189 kWh per m²	264 kWh per m²

Table 8A-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One STERLING 40 Amsterdam	IGU w/ Planitherm One STERLING 40 Brussels	IGU w/ Planitherm One STERLING 40 Geneva	IGU w/ Planitherm One STERLING 40 London	IGU w/ Planitherm One STERLING 40 Luxembourg	IGU w/ Planitherm One STERLING 40 Lyon	IGU w/ Planitherm One STERLING 40 Paris
	215 kWh per m²	195 kWh per m²	331 kWh per m²	262 kWh per m²	195 kWh per m²	316 kWh per m²	259 kWh per m²

Table 8A-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One STERLING 40 Barcelona	IGU w/ Planitherm One STERLING 40 Istanbul	IGU w/ Planitherm One STERLING 40 Jerusalem	IGU w/ Planitherm One STERLING 40 Lisboa	IGU w/ Planitherm One STERLING 40 Madrid	IGU w/ Planitherm One STERLING 40 Milan	IGU w/ Planitherm One STERLING 40 Rome
	420 kWh per m²	376 kWh per m²	617 kWh per m²	544 kWh per m²	513 kWh per m²	358 kWh per m²	307 kWh per m²

Table 8A-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One STERLING 40 Abu Dhabi	IGU w/ Planitherm One STERLING 40 Cape Town	IGU w/ Planitherm One STERLING 40 Chennai	IGU w/ Planitherm One STERLING 40 Cairo	IGU w/ Planitherm One STERLING 40 Johannesburg	IGU w/ Planitherm One STERLING 40 Mumbai	IGU w/ Planitherm One STERLING 40 Nairobi	IGU w/ Planitherm One STERLING 40 Riyadh
	941 kWh per m²	489 kWh per m²	819 kWh per m²	620 kWh per m²	529 kWh per m²	788 kWh per m²	490 kWh per m²	921 kWh per m²

TABLES 8B : SILVER 20 applied on IGU with low-E on side 3 (4/12/4 from Saint-Gobain PLANITHERM ONE)

The potential energy saving (kWh/m²) of SILVER 20 applied on 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.

Table 8B-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One SILVER 20 Copenhagen	IGU w/ Planitherm One SILVER 20 Helsinki	IGU w/ Planitherm One SILVER 20 Oslo	IGU w/ Planitherm One SILVER 20 Stockholm	IGU w/ Planitherm One SILVER 20 Warsaw	IGU w/ Planitherm One SILVER 20 Berlin	IGU w/ Planitherm One SILVER 20 Koln	IGU w/ Planitherm One SILVER 20 Munich
	374 kWh per m²	332 kWh per m²	343 kWh per m²	367 kWh per m²	387 kWh per m²	396 kWh per m²	346 kWh per m²	461 kWh per m²

Table 8B-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One SILVER 20 Amsterdam	IGU w/ Planitherm One SILVER 20 Brussels	IGU w/ Planitherm One SILVER 20 Geneva	IGU w/ Planitherm One SILVER 20 London	IGU w/ Planitherm One SILVER 20 Luxembourg	IGU w/ Planitherm One SILVER 20 Lyon	IGU w/ Planitherm One SILVER 20 Paris
	382 kWh per m²	337 kWh per m²	552 kWh per m²	424 kWh per m²	337 kWh per m²	546 kWh per m²	451 kWh per m²

Table 8B-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One SILVER 20 Barcelona	IGU w/ Planitherm One SILVER 20 Istanbul	IGU w/ Planitherm One SILVER 20 Jerusalem	IGU w/ Planitherm One SILVER 20 Lisboa	IGU w/ Planitherm One SILVER 20 Madrid	IGU w/ Planitherm One SILVER 20 Milan	IGU w/ Planitherm One SILVER 20 Rome
	707 kWh per m²	629 kWh per m²	1018 kWh per m²	878 kWh per m²	865 kWh per m²	612 kWh per m²	525 kWh per m²

Table 8B-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	IGU w/ Planitherm One SILVER 20 Abu Dhabi	IGU w/ Planitherm One SILVER 20 Cape Town	IGU w/ Planitherm One SILVER 20 Chennai	IGU w/ Planitherm One SILVER 20 Cairo	IGU w/ Planitherm One SILVER 20 Johannesburg	IGU w/ Planitherm One SILVER 20 Mumbai	IGU w/ Planitherm One SILVER 20 Nairobi	IGU w/ Planitherm One SILVER 20 Riyadh
	1658 kWh per m²	853 kWh per m²	1375 kWh per m²	1024 kWh per m²	956 kWh per m²	1426 kWh per m²	877 kWh per m²	1631 kWh per m²

TABLES 8C : TRUEVUE 30 applied on IGU with low-E on side 3 (4/12/4 from Saint-Gobain PLANITHERM ONE)

The potential energy saving (kWh/m²) of TRUVUE 30 applied on 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.

Table 8C-1

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planitherm One TRUEVUE 30 Copenhagen	Planitherm One TRUEVUE 30 Helsinki	Planitherm One TRUEVUE 30 Oslo	Planitherm One TRUEVUE 30 Stockholm	Planitherm One TRUEVUE 30 Warsaw	Planitherm One TRUEVUE 30 Berlin	Planitherm One TRUEVUE 30 Koln	Planitherm One TRUEVUE 30 Munich
	143 kWh per m²	102 kWh per m²	127 kWh per m²	124 kWh per m²	133 kWh per m²	138 kWh per m²	135 kWh per m²	172 kWh per m²

Table 8C-2

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planitherm One TRUEVUE 30 Amsterdam	Planitherm One TRUEVUE 30 Brussels	Planitherm One TRUEVUE 30 Geneva	Planitherm One TRUEVUE 30 London	Planitherm One TRUEVUE 30 Luxembourg	Planitherm One TRUEVUE 30 Lyon	Planitherm One TRUEVUE 30 Paris
	153 kWh per m²	133 kWh per m²	248 kWh per m²	200 kWh per m²	133 kWh per m²	216 kWh per m²	188 kWh per m²

Table 8C-3

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planitherm One TRUEVUE 30 Barcelona	Planitherm One TRUEVUE 30 Istanbul	Planitherm One TRUEVUE 30 Jerusalem	Planitherm One TRUEVUE 30 Lisboa	Planitherm One TRUEVUE 30 Madrid	Planitherm One TRUEVUE 30 Milan	Planiclear TRUEVUE 30 Rome
	300 kWh per m²	273 kWh per m²	424 kWh per m²	382 kWh per m²	358 kWh per m²	243 kWh per m²	224 kWh per m²

Table 8C-4

ENERGY SAVINGS PER M² OVER WARRANTY PERIOD	Planitherm One TRUEVUE 30 Abu Dhabi	Planitherm One TRUEVUE 30 Cape Town	Planitherm One TRUEVUE 30 Chennai	Planitherm One TRUEVUE 30 Cairo	Planitherm One TRUEVUE 30 Johannesburg	Planitherm One TRUEVUE 30 Mumbai	Planitherm One TRUEVUE 30 Nairobi	Planitherm One TRUEVUE 30 Riyadh
	627 kWh per m²	330 kWh per m²	555 kWh per m²	432 kWh per m²	357 kWh per m²	521 kWh per m²	326 kWh per m²	618 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.

9 reasons to consider Solar Gard window films

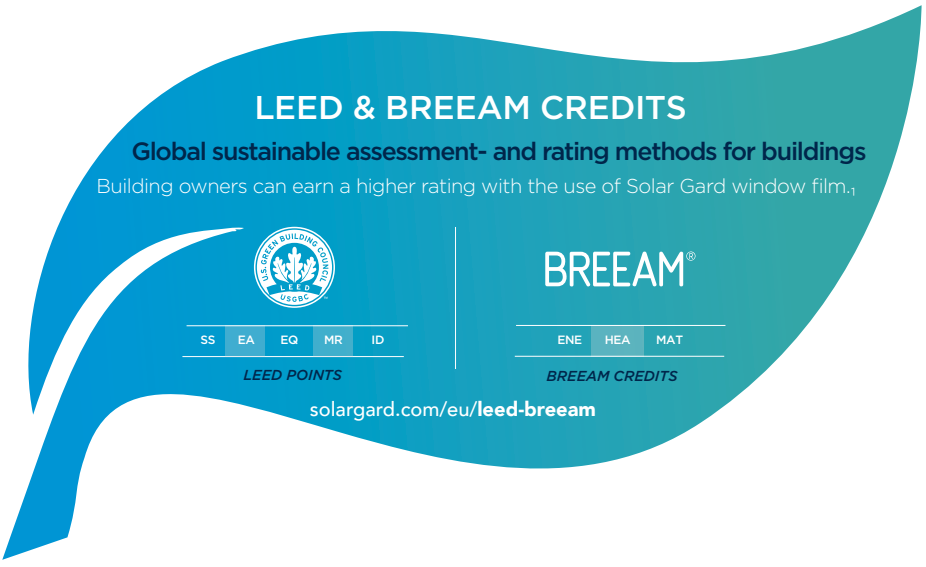
As a summary, Solar Gard window films offer a range of solutions to improve the performance of existing buildings and more in particular the performance of the glass and glazing in existing and to help the operators/users of a building to meet the functional requirements in situation where such is not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

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 bzw. glasklare Sicherheitsfolien mit ein Nennstärke bis zu 4 mil (100 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 34 Sonnenschutzfolien und 6 glasklare Sicherheitsfolien. Das Referenzprodukt für die in der EDP erfassten Produkte ist Solar Gard STERLING 40 (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 STERLING 40 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 12 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 15-20 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. STERLING 40. 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^2	Tensile strength
TSER (%)	Total solar energy rejected
TSER (%) -60º	Total solar energy rejected @60º angle
U (W/m^2 K)	Winter U-factor (W/m^2 °C)
U Red (%)	Fade reduction coefficient
UV (%)	UV Blocked @300-380nm
WDP [m^2 world equiv.]	Water scarcity [m^3 world equiv.]
YIELD - kg/cm^2	Tensile strength (5% elongation)

12. References

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

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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: Sterling 70

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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.
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