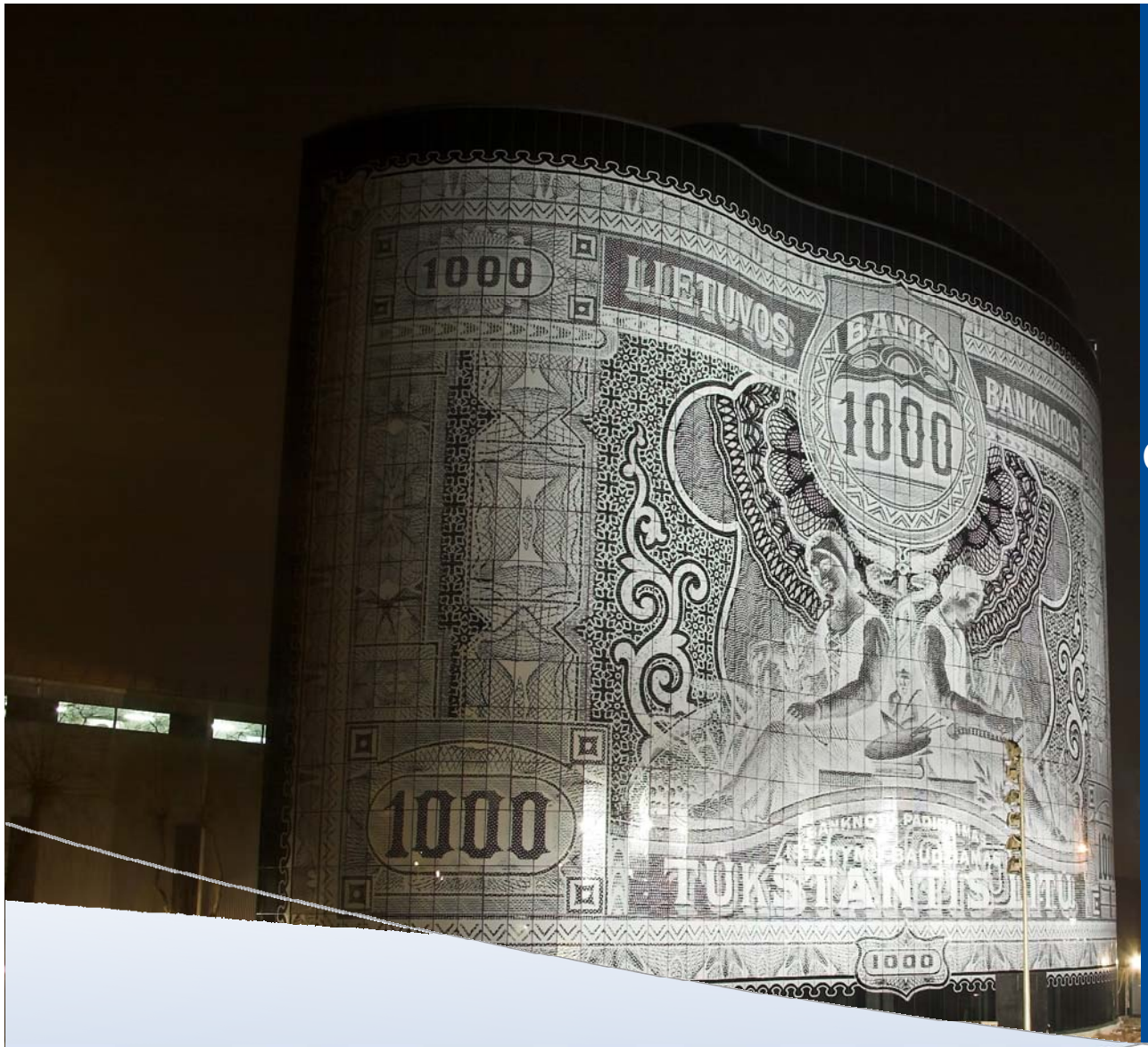


Saint-Gobain Glass Seminar

Gertrud Dederichs-Wimmer
Pascal Chartier

SGG Exprover

Vilnius, April 17th, 2012

SAINT-GOBAIN
GLASS

Agenda

Saint-Gobain Glass presentation

References

Modern glass for energy efficient buildings

Discussion

SAINT-GOBAIN
GLASS

SAINT-GOBAIN & SAINT-GOBAIN GLASS

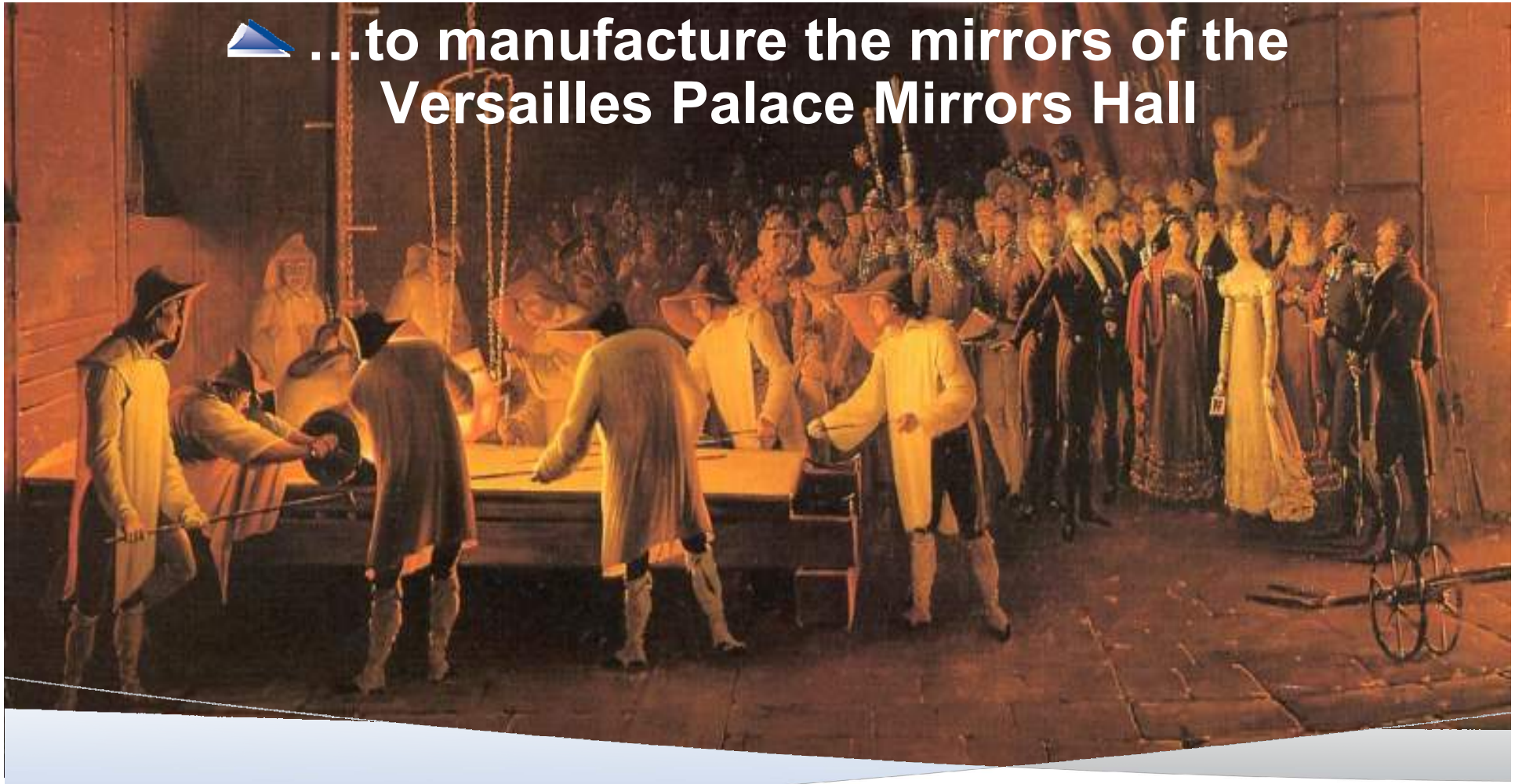
Flat glass business

SGG EXPROVER

Vilnius, April 17, 2012

SAINT-GOBAIN GLASS

1665 : creation of Saint-Gobain…

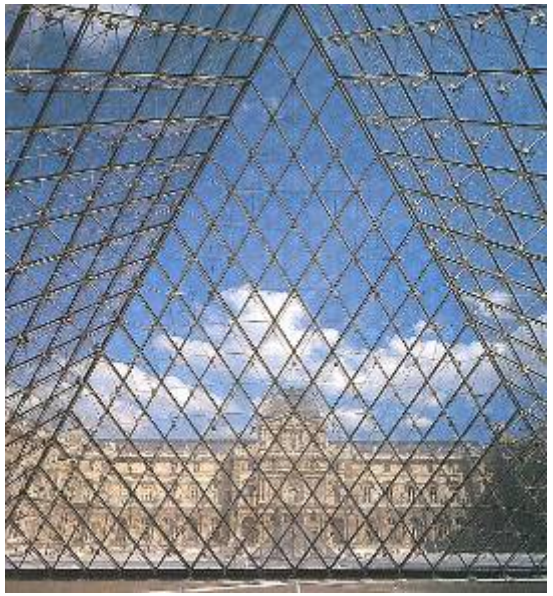


SAINT-GOBAIN
GLASS

Three centuries of prestigious projects…

Hall of Mirrors,
Versailles, 1678

Paris Exhibition, 1937



Louvre Pyramid, 1988

SAINT-GOBAIN
GLASS

…and today

Swiss Re London – Foster & Partners

SAINT-GOBAIN
GLASS

Saint-Gobain : a long international tradition

1665	France
1857	Germany
1889	Italy
1900	Belgium
1904	Netherlands
1909	Spain
1917	Japan
1937	Brazil
1938	Australia
1939	Switzerland
1950	New-Zealand
1952	Mexico
1956	Argentina
1959	U.S.A.
1960	Sweden
1962	Portugal
1967	India
1976	Denmark
1977	Columbia
1985	U.K.
1986	Norway
1988	Malaysia
1988	Finland
1989	Estonia
1989	Yugoslavia
1990	China
1991	Indonesia
1991	Korea
1991	Hungary
1993	Czech Republic
1993	Poland
1995	Slovakia
1996	Greece
1996	Venezuela
1996	Thailand
1997	South-Africa
1998	Turkey
2000	Russia
2007	UAE
2008	Egypt

SAINT-GOBAIN
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Saint-Gobain, one of the world's TOP 100 industrial groups

Operations in
64 countries

Over
190,000 employees

15 R&D centers

361 patents
in 2010

2010	€Bn
Sales	40.1
Operating income	3.1
Recurring net income	1.3
Capital expenditure	1.4
Cash flow from operations	3.0

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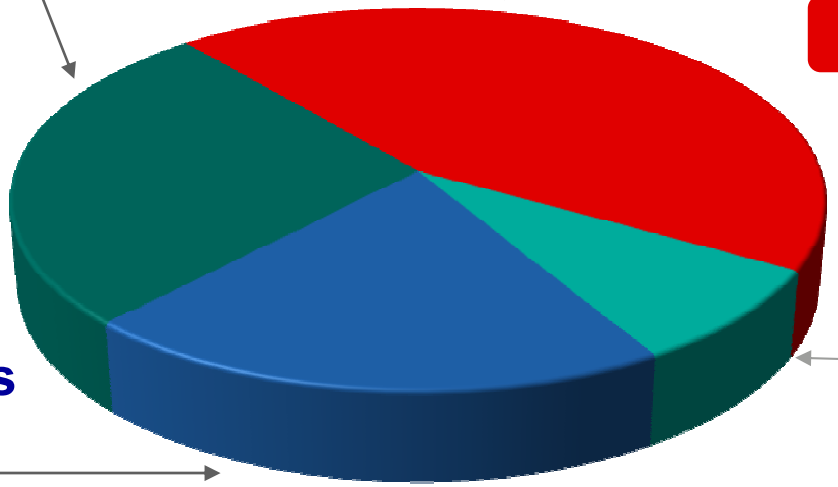
GLASS

Split of Turnover by Business Sector 2010



Construction Products

25%

Interior Solutions
Exterior Solutions

#1 worldwide

Building Distribution

43%

#1 in Europe

Verallia (Packaging)

9%

#1 in Europe
#2 worldwide

Innovative Materials

23%

Glass: 13%

HPM: 10%

Glass

#1 in Europe - #2 worldwide

HPM

#1 worldwide

World or European LEADER

A vision of Saint-Gobain

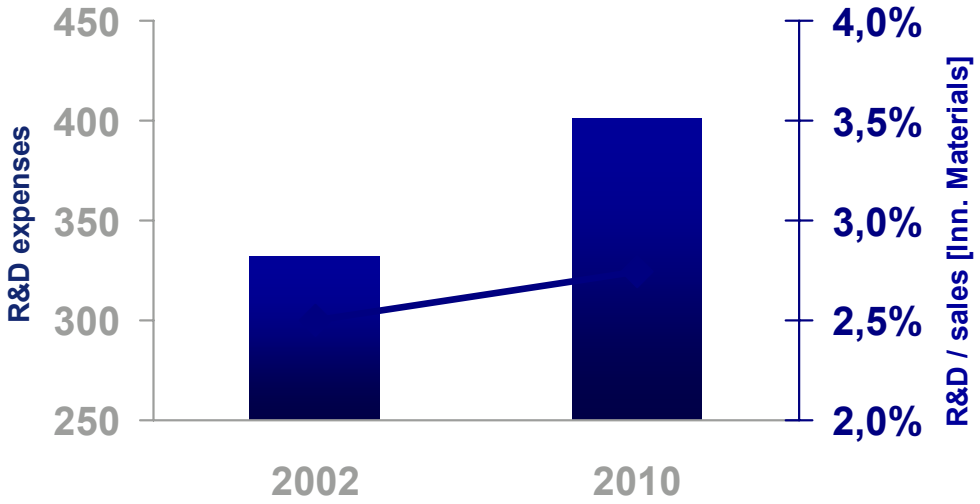
SAINT-GOBAIN

World leader** of the **habitat** market, offering **innovative solutions** to today's critical challenges of **growth, energy and the environment.

THE reference
in sustainable Habitat

Strong R&D centers, to prepare for the future

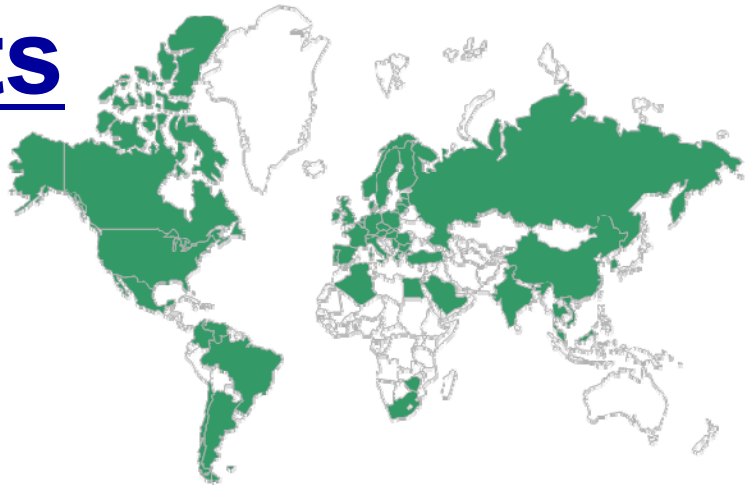
- 20 research centers
  + 101 development units
- 3,500 people
- € 400 m in 2009
- ~ 400 patents per year



6 large R&D multi-business centers

4 of them are working on glass products

Construction Products



- World leader in all businesses
  - Offering global solutions
  - Extending geographic coverage
  - Developing new products

2010 sales: € 10.9 bn

45.000 employees

Pipes | Mortars | Exterior products | Gypsum | Insulation

SAINT-GOBAIN GLASS

Building Distribution

- #1 in Europe
  - Maintain steady external growth
  - Develop customers services and new selling concepts
  - Reinforce specialized networks

2010 sales : € 17.3 bn

66.000 employees

Dahl

Optimera

Lapeyre

Point.P

SGBD UK

Raab-Karcher

Packaging

- #1 in Europe
- Over 30 bn bottles and jars sold annually
  - Increase added value by customizing products
  - Develop in emerging markets

2010 sales : € 3.5 bn

14,500 employees

Bottles & Jars

High Performance Materials

- #1 or #2 worldwide leader in most sectors
  - Investing in emerging countries
  - Strengthening leadership through acquisitions
  - Strengthening leadership through R&D and technological synergies

2010 sales: € 4.1 bn

26.000 employees

Ceramics | Grains & Powders | Crystals | Plastics | Abrasives | Textile solutions

SAINT-GOBAIN GLASS

Saint-Gobain Glass in details

The manufacturing of industrial glass products

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Saint-Gobain Glass

- **An international manufacturing organisation**
  - **36** Floats *(of which 8 are JVs)* + **4** under construction *(of which 3 are JVs)*
  - **15** Coaters + **1** under construction
  - One unique brand
- **9,655** employees
- **Products**
  - Clear and colored glass, patterned glass, laminated glass
  - Coated glass
  - Specialties

Worldwide leader for coated glass (more than 60 millions sqm /yr)

SAINT-GOBAIN GLASS

The major glass market segments

Residential

Commercial

Interior

Appliances

Automotive

Solar Energy

SAINT-GOBAIN GLASS

The main industrial glass families

Float glass :

- Clear glass : SGG PLANILUX
- Extra-clear glass : SGG DIAMANT
- Body tinted glass : SGG PARSOL

Coated glass :

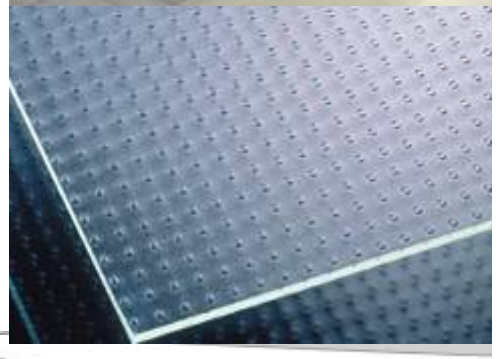
- Low-E glass : SGG PLANITHERM, SGG PLANISTAR
- Solar control glass : SGG COOL-LITE, SGG ANTELIO, SGG REFLECTASOL
- Self-cleaning glass : SGG BIOCLEAN
- Anti-reflective glass : SGG VISION-LITE

Mirror : SGG MIRALITE REVOLUTION

Acid etched glass : SGG SATINOVO

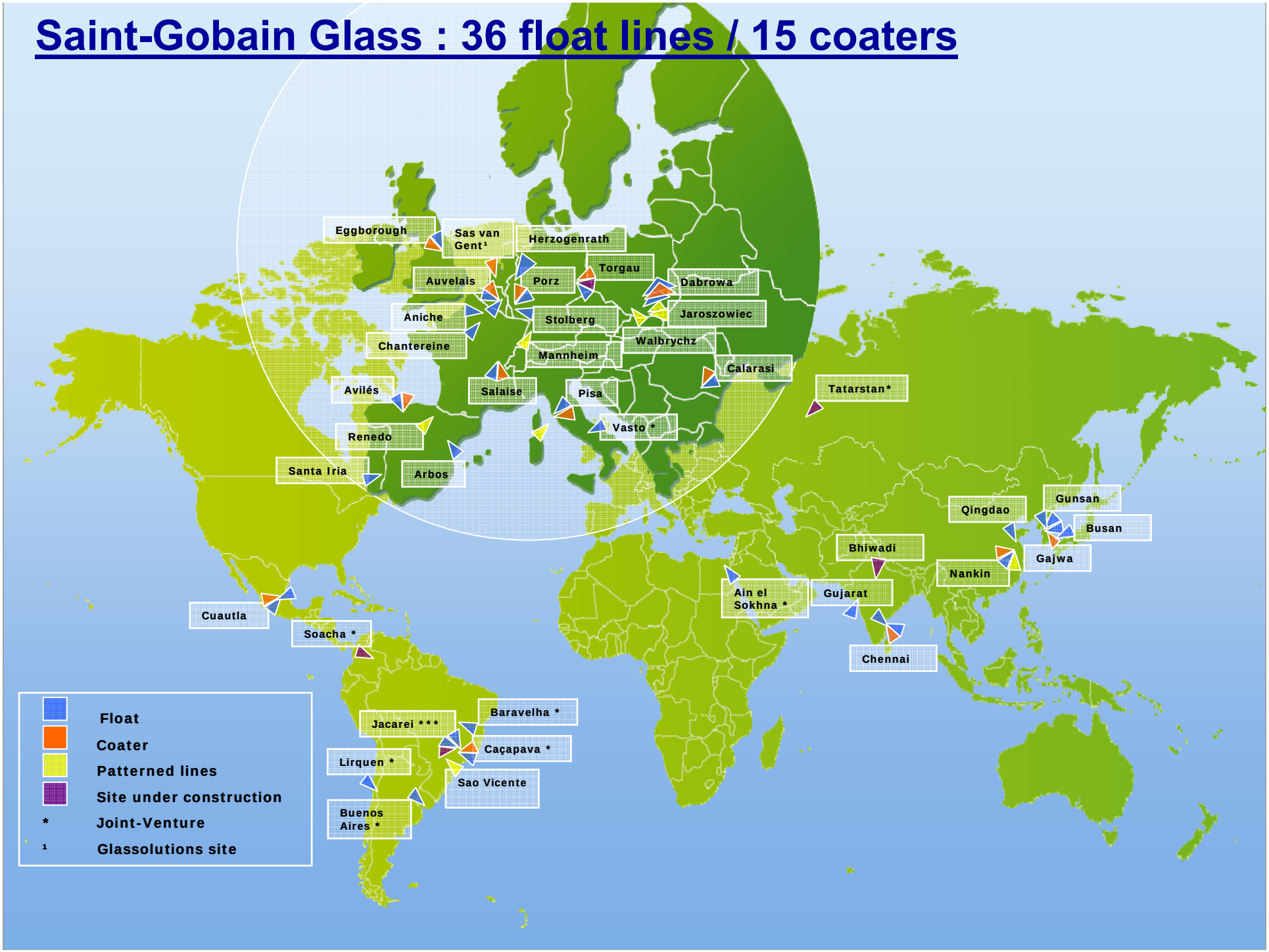
Patterned glass : SGG DECORGLASS, SGG MASTERGLASS SGG ALBARINO

Laminated glass : SGG STADIP, SGG STADIP SILENCE



SAINT-GOBAIN GLASS

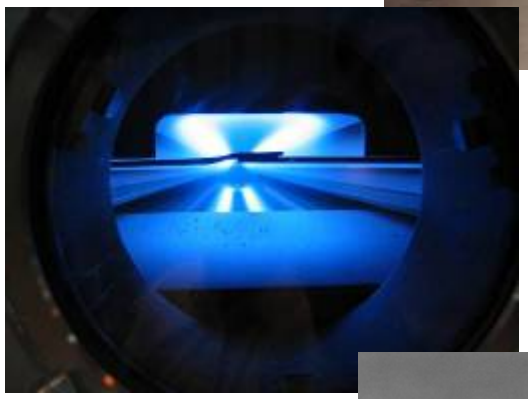
Saint-Gobain Glass : 36 float lines / 15 coaters

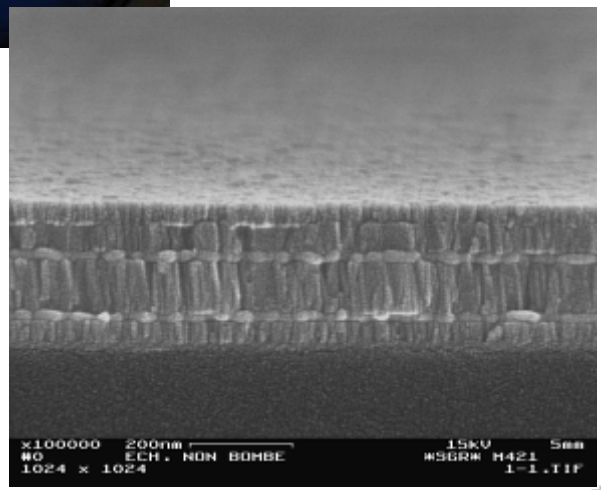


Coated glass

- For reflection (mirrors)
- For thermal insulation
- For solar control
- For antireflection
- For self-cleaning
- For photovoltaic

…

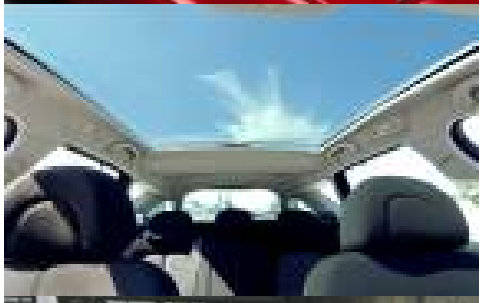




SAINT-GOBAIN
GLASS

Saint-Gobain Sekurit

- **Leading automotive glass supplier:**
  - **40** plants
  - Industrial and commercial operations in **22** countries
- **13,300 employees**
- **Organized by market:**
  - OEM
  - Automotive glass replacement
  - Transport
- **One out of two cars in Europe is equipped with Saint-Gobain glazing**



SAINT-GOBAIN GLASS

Saint-Gobain Solar

- **One business unit, three entities:**
  - Saint-Gobain Solar Glass: special glass substrates for photovoltaic modules and high performance mirrors
  - Avancis: photovoltaic modules
  - Saint-Gobain Solar Systems: distribution, integration and mounting of full photovoltaic systems
- **A major positioning, covering the whole supply chain**
- **300 employees**
- **Over 30% of the Flat Glass Sector's R&D efforts in 2009**

SAINT-GOBAIN GLASS

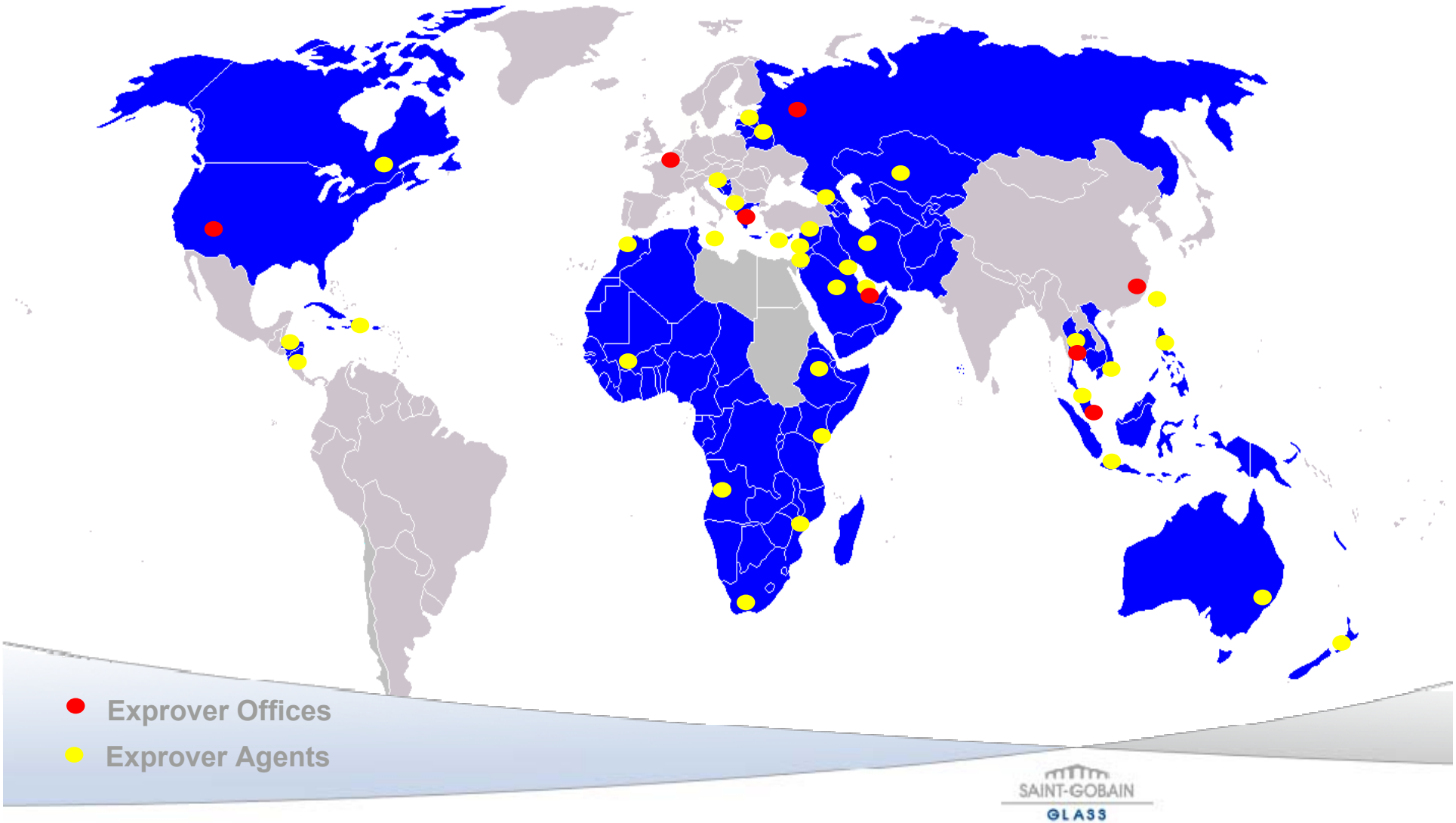
SGG Exprover

- **The export organization of Saint-Gobain Glass acting in more than 100 countries**
- **2 main activities :**
  - **Trading of raw glass to distributors and processors**
  - **Specification job and commercialization of glass and glazings for architectural projects**
- go to : http://exprover.saint-gobain-glass.com

SAINT-GOBAIN
GLASS

SGG Exprover sales network

- Over 100 countries, 8 Offices, 30 agents worldwide
- A network of 100 sales people



Saint-Gobain Glass

Our strengths and ambitions

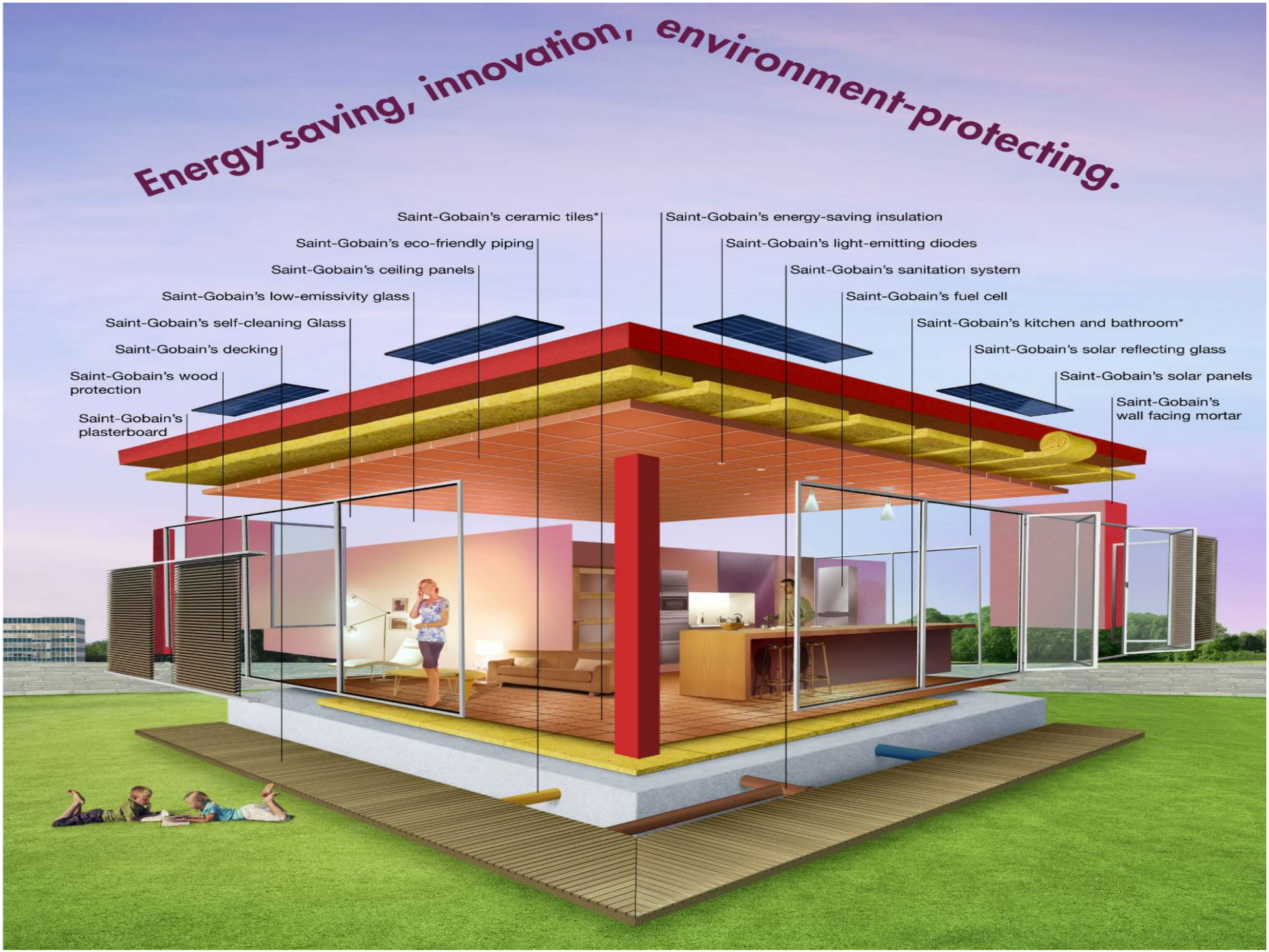
- ✓ One of the worldwide flat glass leaders, the only one European
- ✓ An industrial history of more than 3 centuries

- ✓ International coverage on the 5 continents, with an expansion in fast growing countries : Eastern Europe & Russia, Asia, Africa / Middle-East, Latin America

- ✓ N°1 on coated glass for window market and architectural applications
- ✓ A unique product range
- ✓ A dedicated Marketing approach by segment
- ✓ A well experienced technical certification program for fabricators

- ✓ Innovation is our key for success
  - ✓ Strong investments in R&D
  - ✓ Massive program of new products launches
  - ✓ Exploration of new segments and new applications

SAINT-GOBAIN
GLASS


Energy-saving, innovation, environment-protecting.
Saint-Gobain's ceramic tiles*
Saint-Gobain's eco-friendly piping
Saint-Gobain's ceiling panels
Saint-Gobain's low-emissivity glass
Saint-Gobain's self-cleaning Glass
Saint-Gobain's decking
Saint-Gobain's wood protection
Saint-Gobain's plasterboard
Saint-Gobain's energy-saving insulation
Saint-Gobain's light-emitting diodes
Saint-Gobain's sanitation system
Saint-Gobain's fuel cell
Saint-Gobain's kitchen and bathroom*
Saint-Gobain's solar reflecting glass
Saint-Gobain's solar panels
Saint-Gobain's wall facing mortar

SAINT-GOBAIN GLASS

References in architectural projects

SAINT-GOBAIN
GLASS

InteractiveCorp. – New York, USA

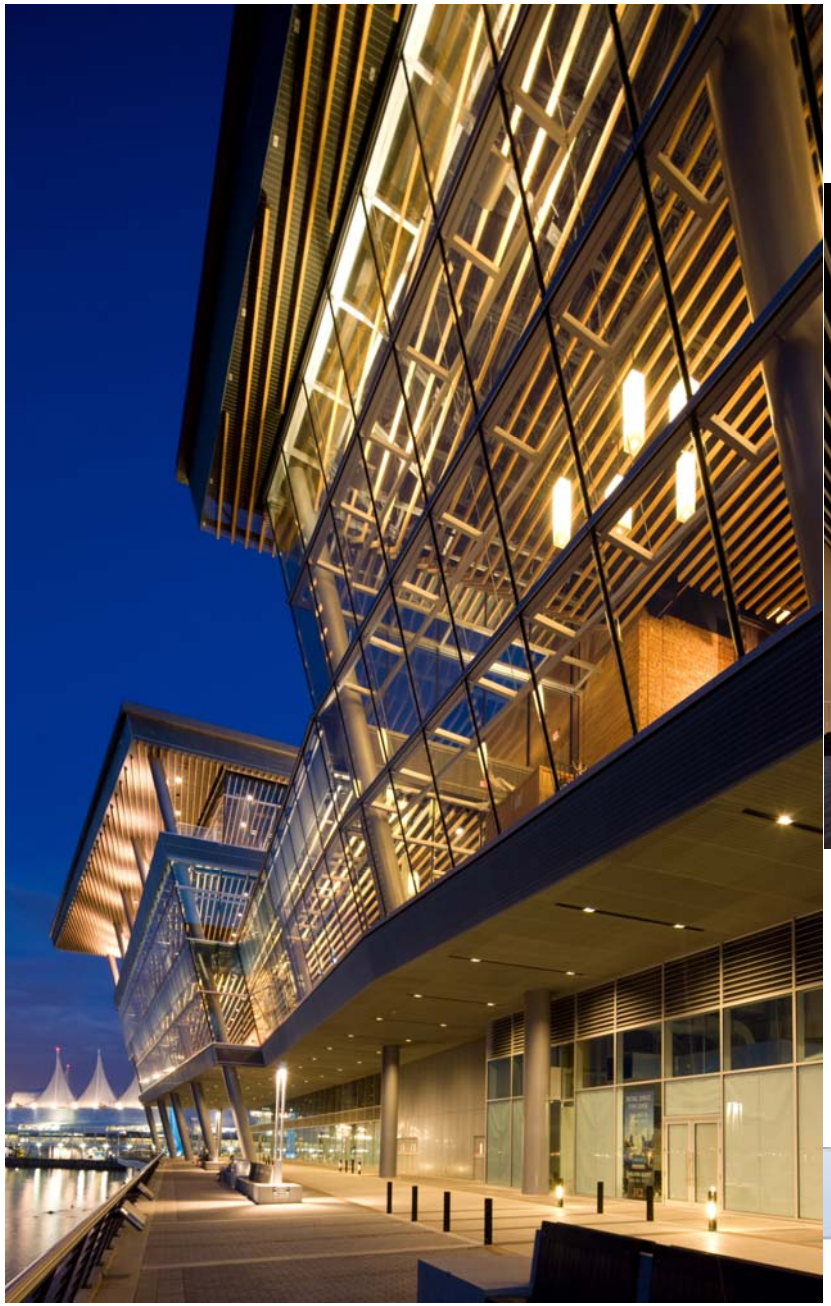
SGG COOL-LITE SERALIT KN 055

Ticket Booth, Times Square, NYC

SGG STADIP PROTECT DIAMANT
SGG STADIP COLOR
SGG LITE FLOOR

Vancouver Convention Center, Canada

Media Center for the 2010 Winter Olympics



Supplier : SGGS - Eckelt Glas

Products : SGG CLIMAPLUS SILENCE

SGG DIAMANT

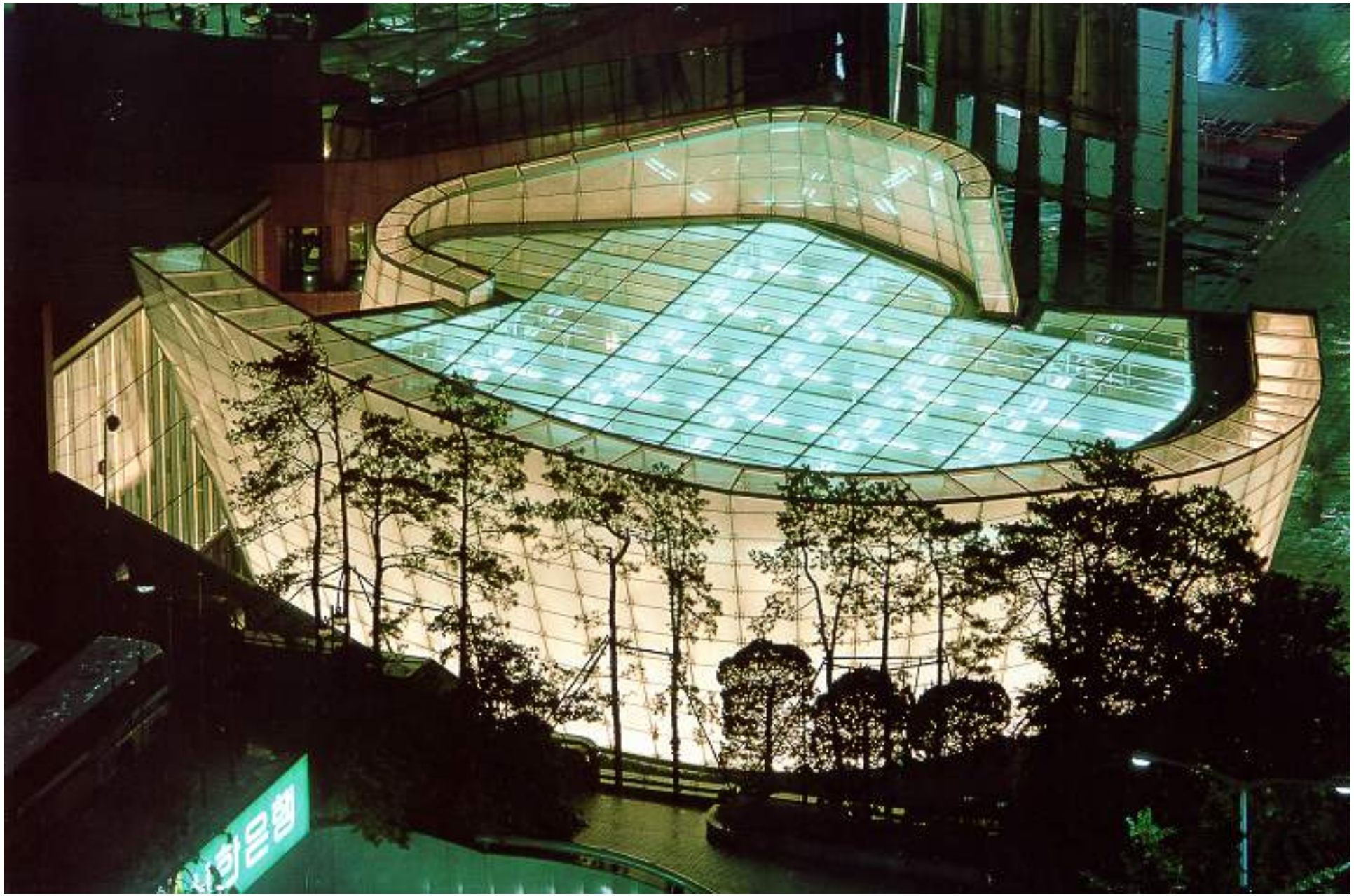
SAINT-GOBAIN GLASS

Dentsu tower - Tokyo

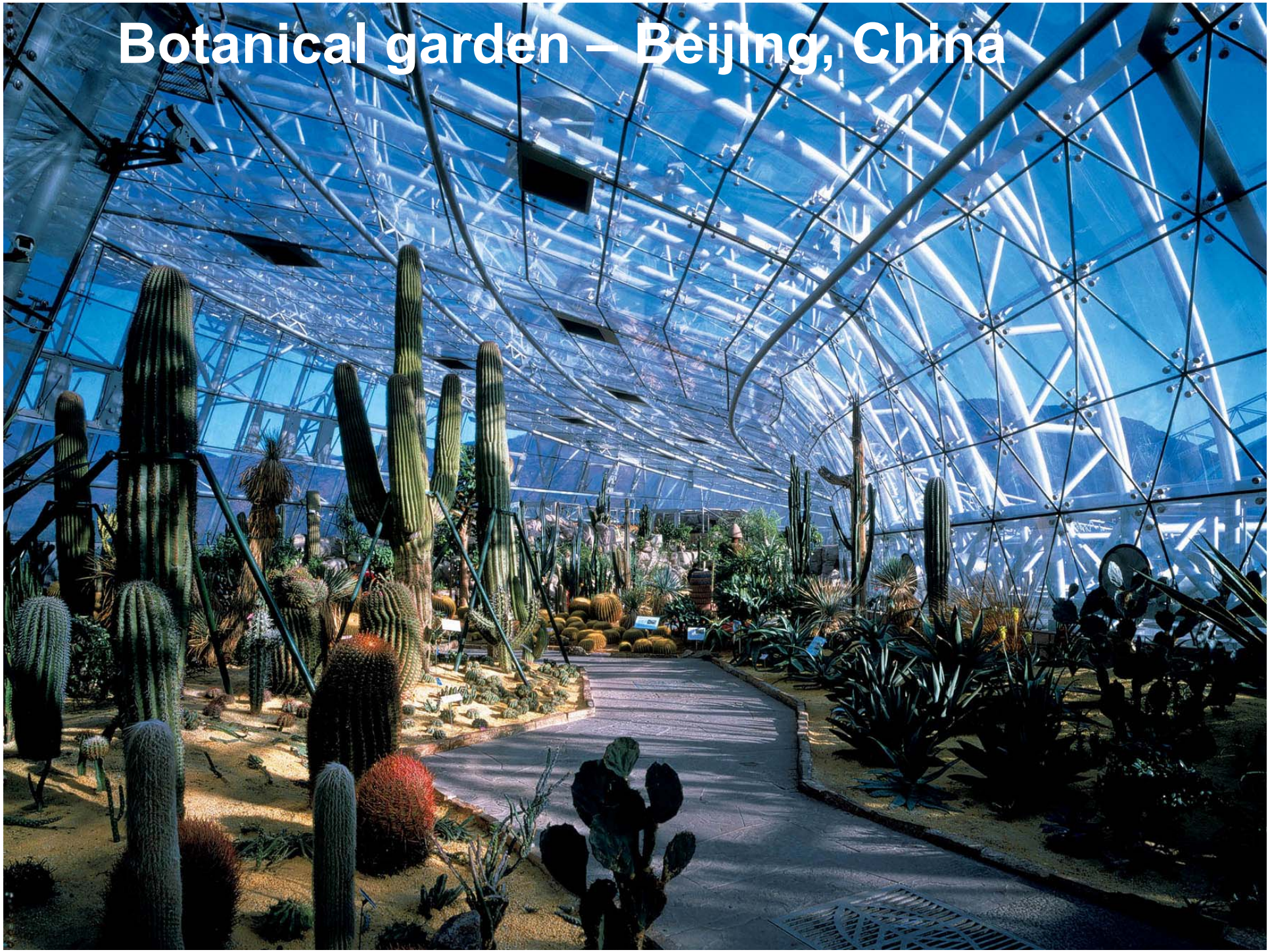
Architect:
Ateliers Jean Nouvel

SGG **DIAMANT**

Rodin Museum – Seoul, Korea



Botanical garden – Beijing, China



The National Grand Theatre – Beijing, China

Architect: Andreu

SGG **DIAMANT**
SGG **PLANITHERM**

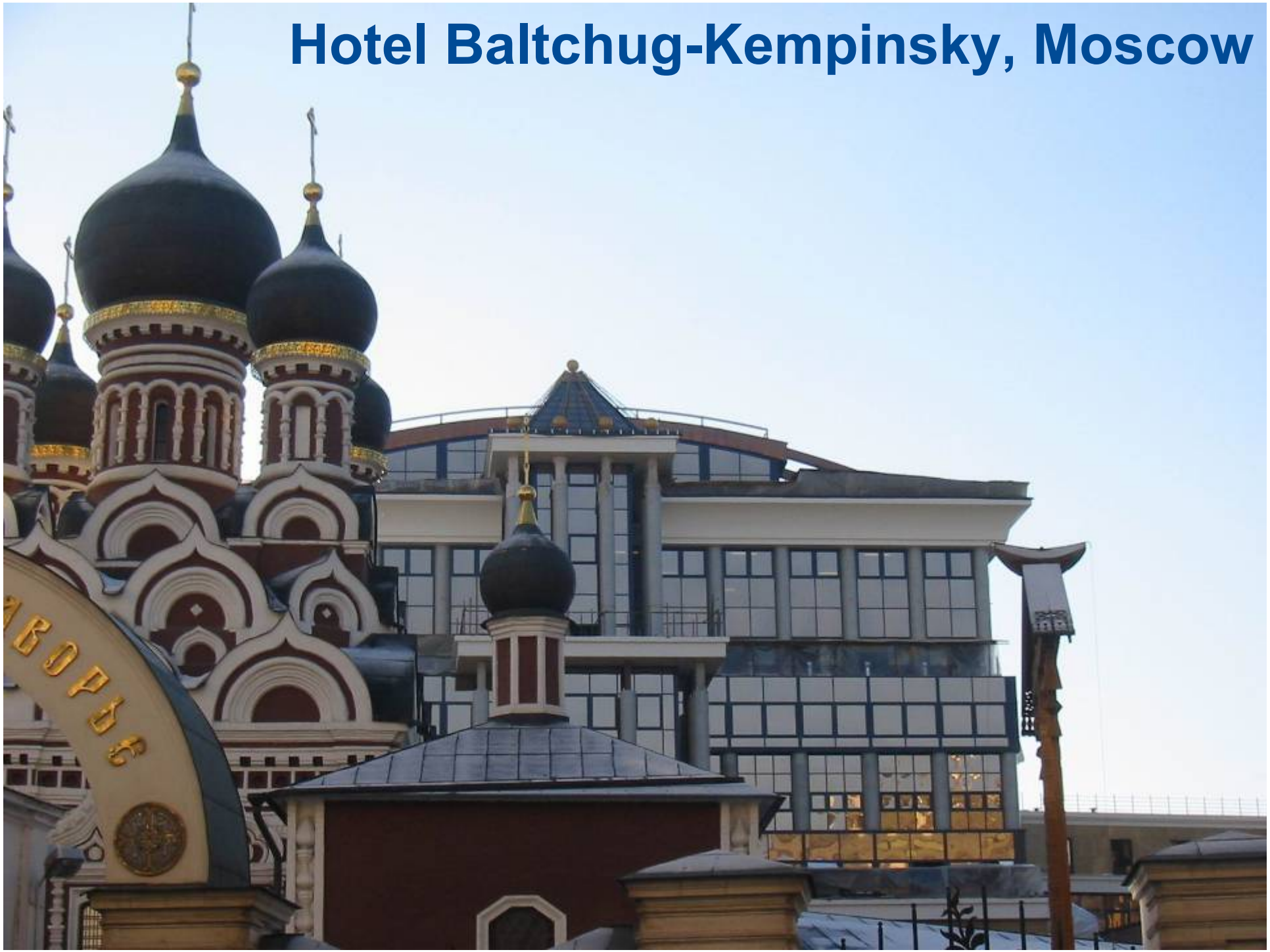
SAINT-GOBAIN
GLASS

THE SAIL @ Marina Bay, Singapore

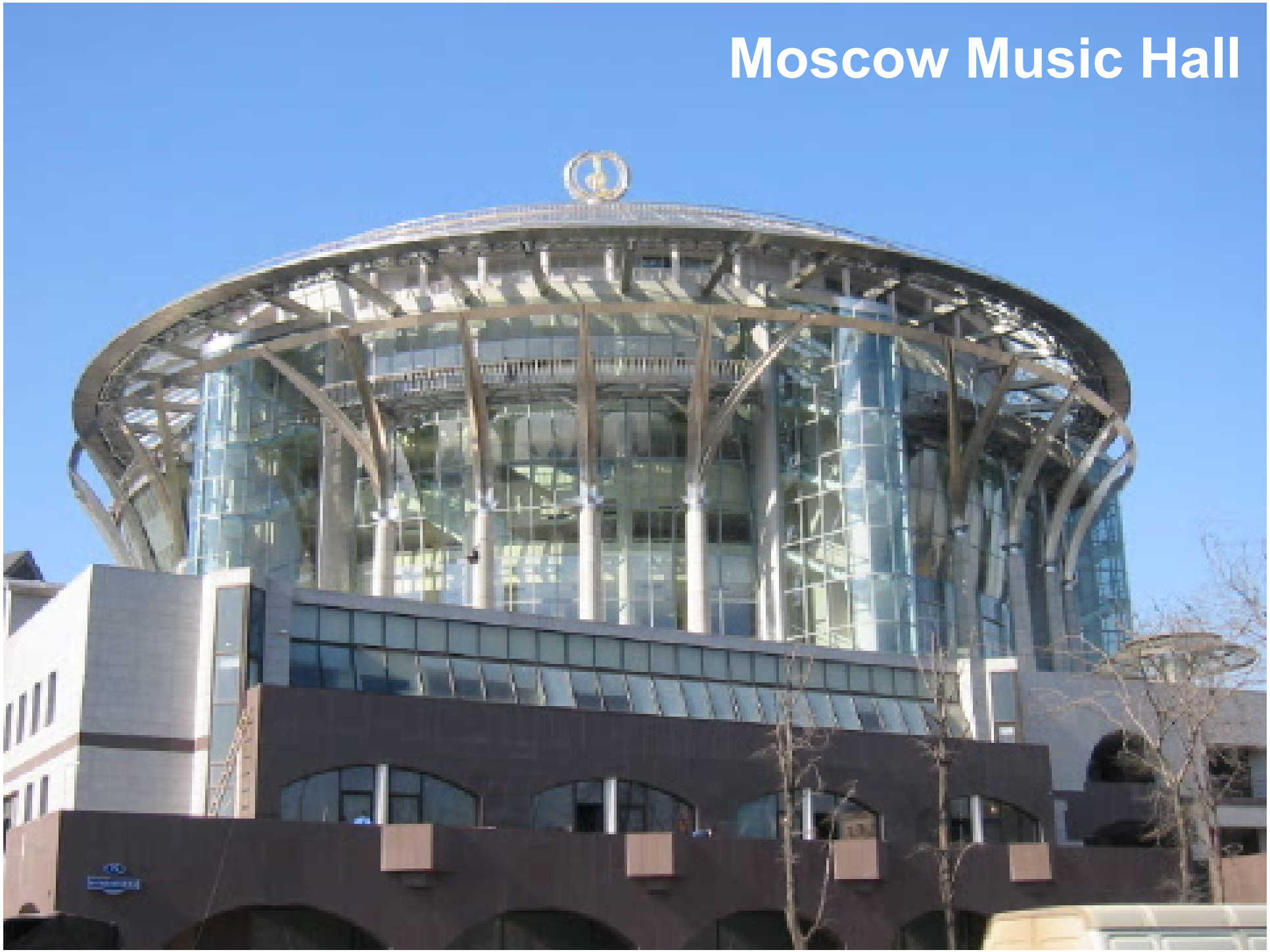
Infosys, Mysore, India

SGG COOL-LITE® STB 120

Hotel Baltchug-Kempinsky, Moscow



World Trade Center 2, Moscow

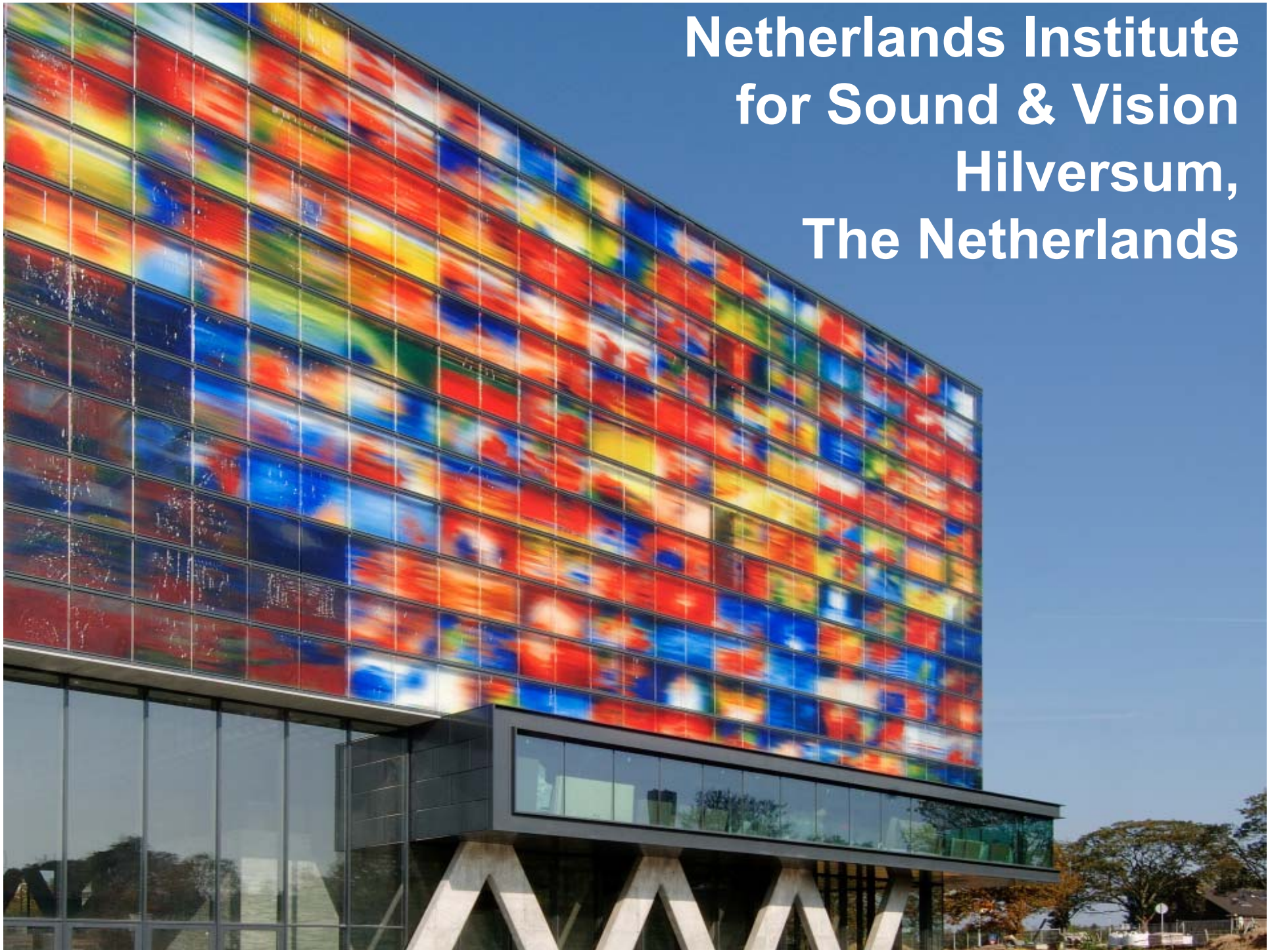

Moscow Music Hall

1000lt – Kaunas, Lithuania

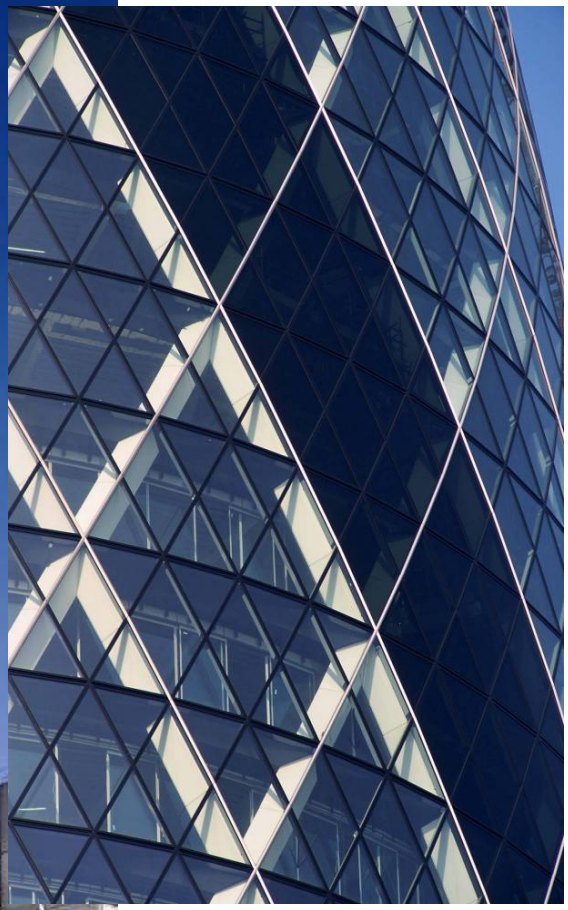
Lehrter Banhof – Berlin, Germany

DG Bank, Berlin

Architect:
Frank O. Gehry


Netherlands Institute
for Sound & Vision
Hilversum,
The Netherlands

Swiss Re – London, UK



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Le Monde HQ
Paris, France

Architect:
Christian de Portzamparc

SGG BIOCLEAN®
SGG DIAMANT®

SAINT-GOBAIN
GLASS

Torre Agbar Barcelona, Spain

SAINT-GOBAIN
GLASS

Torre Cristal
Madrid, Spain

- **Architect :**
  - Pelli Clarke Pelli

- **Product :**
  - SGG COOL-LITE® SKN 054

SAINT-GOBAIN
GLASS

New Acropolis Museum, Athens, Greece

HHHR Tower
Dubai, UAE


Sports City Center – Doha, Qatar
SGG COOL-LITE® SKN 165

New National Library, Riga, Latvia

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GLASS

Modern glass solutions for energy efficient buildings

Pascal Chartier
Gertrud Dederichs-Wimmer

SGG Exprover

Vilnius, April 17th, 2012

SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- Low-E glasses & Solar control glasses
- Energy balance / regulations trends

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

5 | A look at the future

6 | Interior - Design

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GLASS

Agenda

1 | Energy efficient glass

Background

Energy balance / regulations trends / window labelling

Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

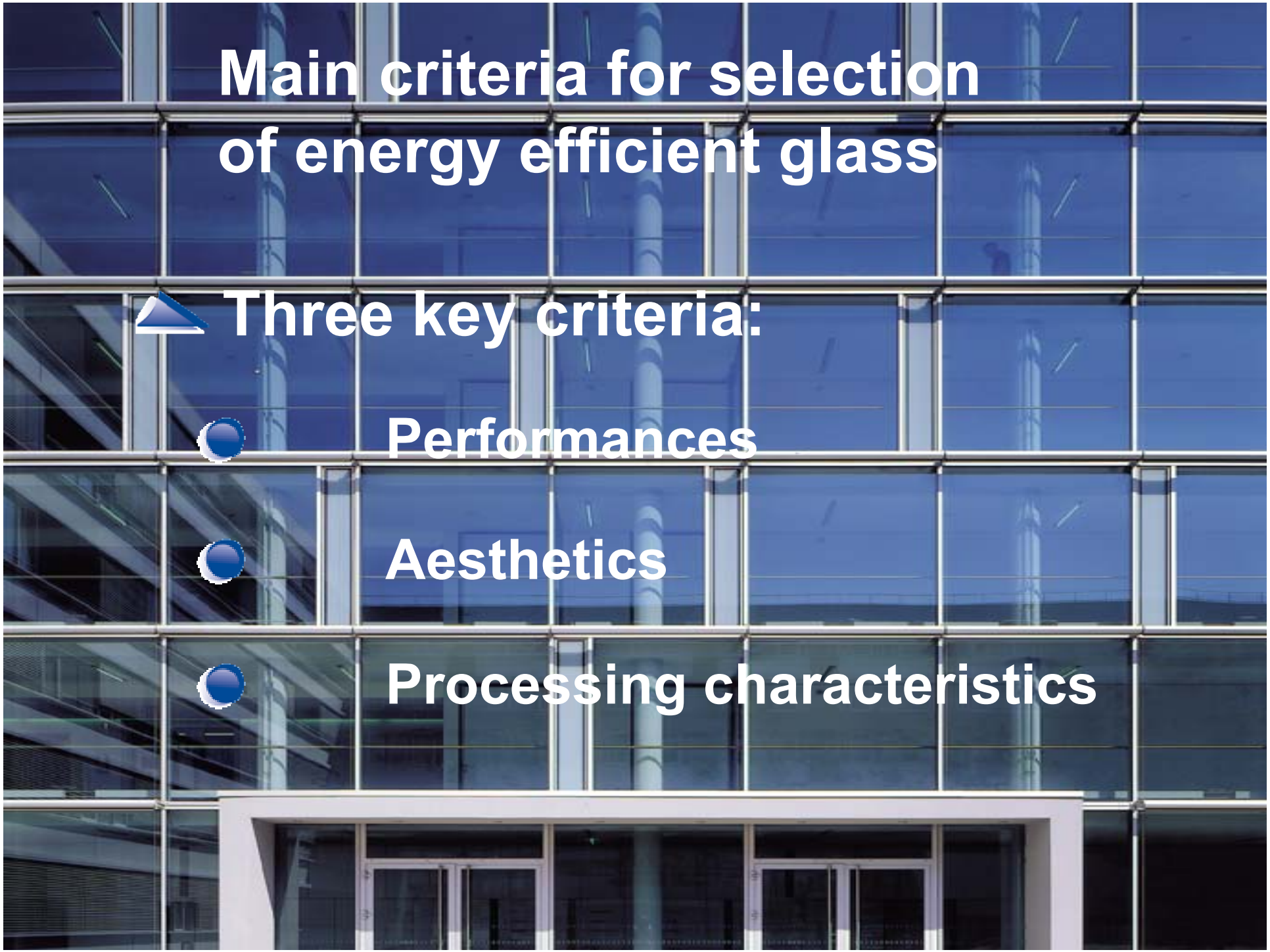
5 | A look at the future

6 | Questions - Answers

SAINT-GOBAIN GLASS

Role of glass in energy efficient buildings

- Controls heat gain / loss : minimize cooling / heating costs
- Daylight control : minimize artificial lighting
- Controls glare : visual comfort
- Controls the aesthetics : colour / reflection
- Controls noise : acoustic comfort
- Controls cleaningness : minimize maintenance costs



Main criteria for selection of energy efficient glass

- Three key criteria:
  - Performances
  - Aesthetics
  - Processing characteristics

Energy efficient glass - Definitions

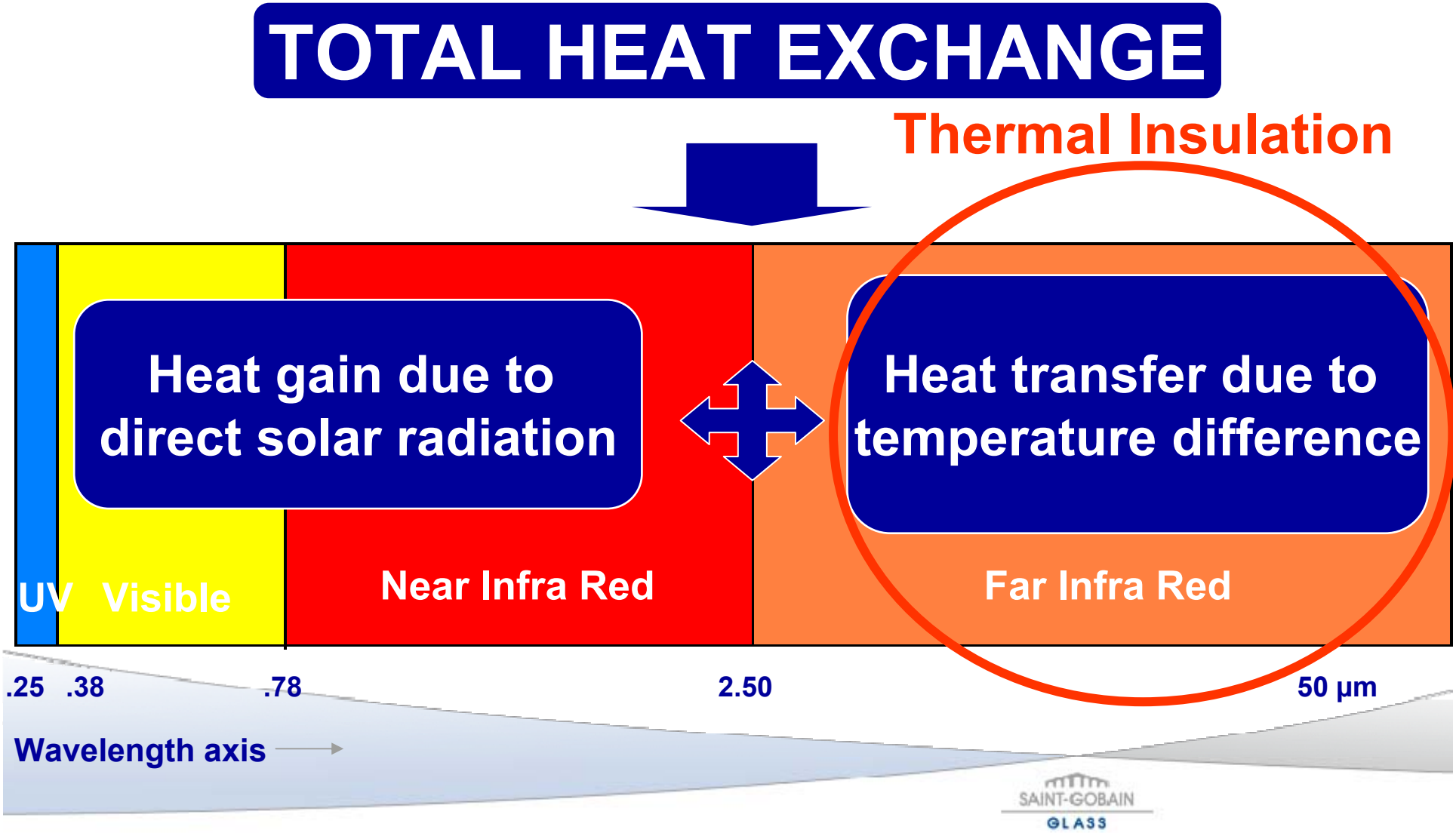
Key Performance Indicators

- **LIGHT FACTORS**
- **Visible light transmittance** — **LT %**
- **Visible light reflectance** — **LR %**
  - **External light reflectance** — **LRe**
  - **Internal light reflectance** — **LRi**

Glass type 6mm	Clear glass	Extra clear glass SGG DIAMANT	Reflective glass SGG ANTELIO	Low-reflective glass SGG VISION-LITE
LT %	89%	91%	45%	97%
LRe %	8%	8%	32%	1%

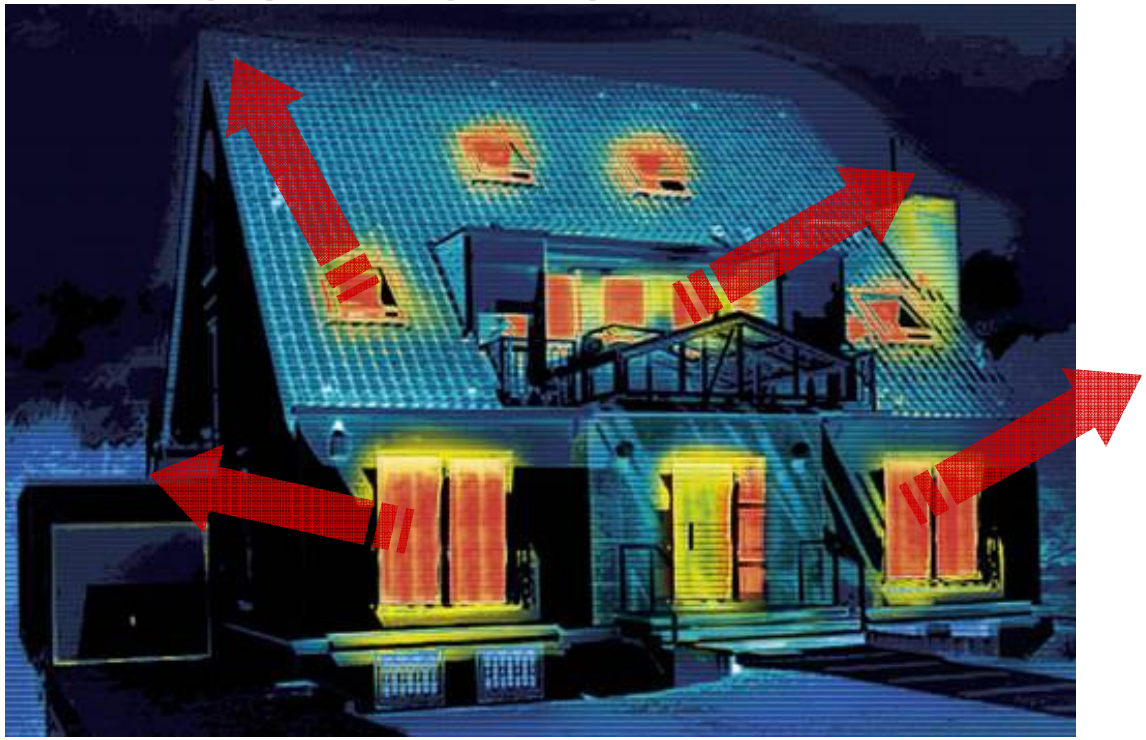
Total Heat Exchange

Electromagnetic Spectrum at Terrestrial Level



Thermal insulation : a strong challenge for buildings

A thermographic image of a private house



- In Europe, 80% of the energy consumed by private homes is used for heating
- 15-20% of heating energy is lost through old glazings

- In Germany, 60% of the glazings are out-of-date DGU or single glazing
- In the UK, 37% of all homes are fitted with single glazing & 60% with basic DGU

SAINT-GOBAIN GLASS

Energy efficient glass - Definitions

Key Performance Indicators

THERMAL INSULATION

- **U-value = Thermal heat transfer coefficient**

Amount of heat transferred through the glass pane due to the difference of temperature between inside and outside

The lower the U-value, the better the thermal insulation

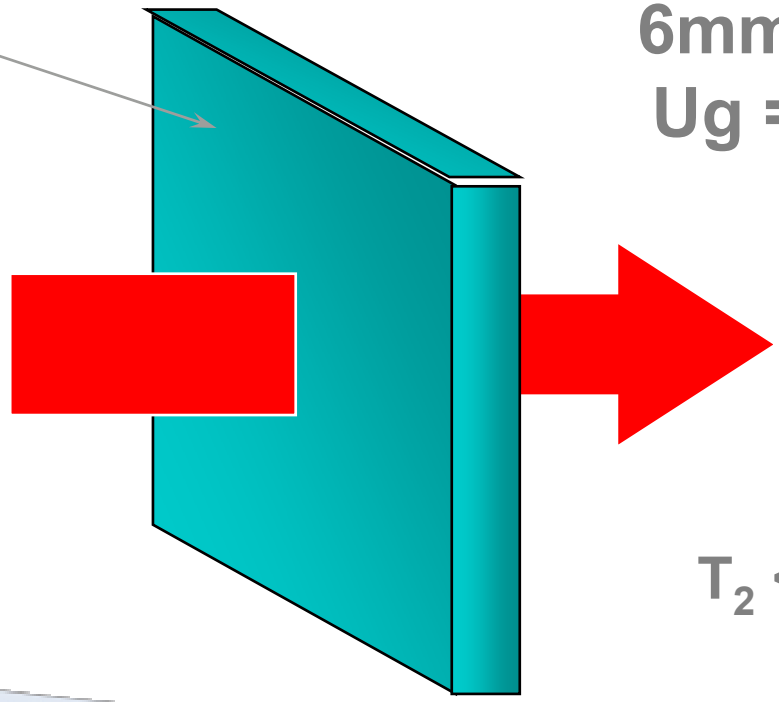
- **Unit**
  - **Metric : W/sqm.°K**
  - **Imperial : btu/ft².hr.°F**
- **Norms : EN 673, ASHRAE (US)**

Heat transfer : the U-value

Amount of heat transferred due to temperature difference

U-Value

Area = 1 m^2



6mm thick glass :
Ug = 5.7 $W/m^2.°K$

T_1

$T_2 < T_1$

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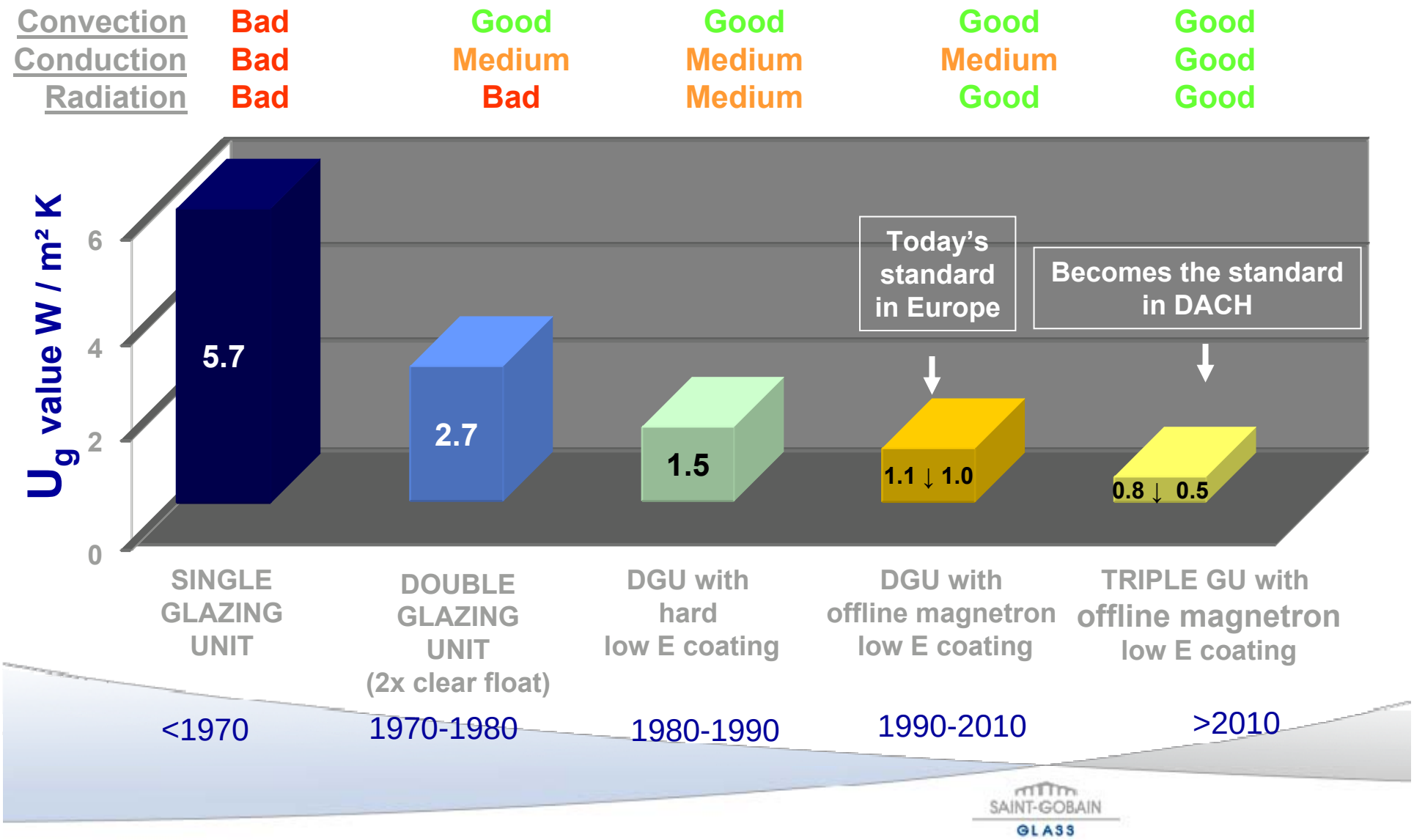
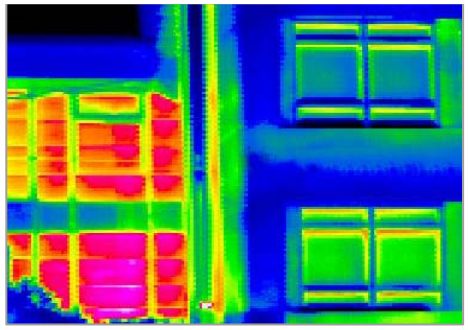
GLASS

Thermal insulation

Influence of the glazing design on the U-value



U_g & U_W



- Glazing is only one part of the window.
  - The Glazing thermal insulation is characterized using: Ug
- Global thermal insulation of the window is linked to:
  - Thermal insulation of the frame
  - Thermal insulation of the glazing
  - Edge effect
  - AND is characterized using: U_W

	Single Glazing	Double Glazing	Low E DGU
U_g W/m²K	5.7	2.9	1.1
U_W W/m²K	4.7	2.7	1.4 (PVC)

U_W 1,6 – 2,2 W/m²K

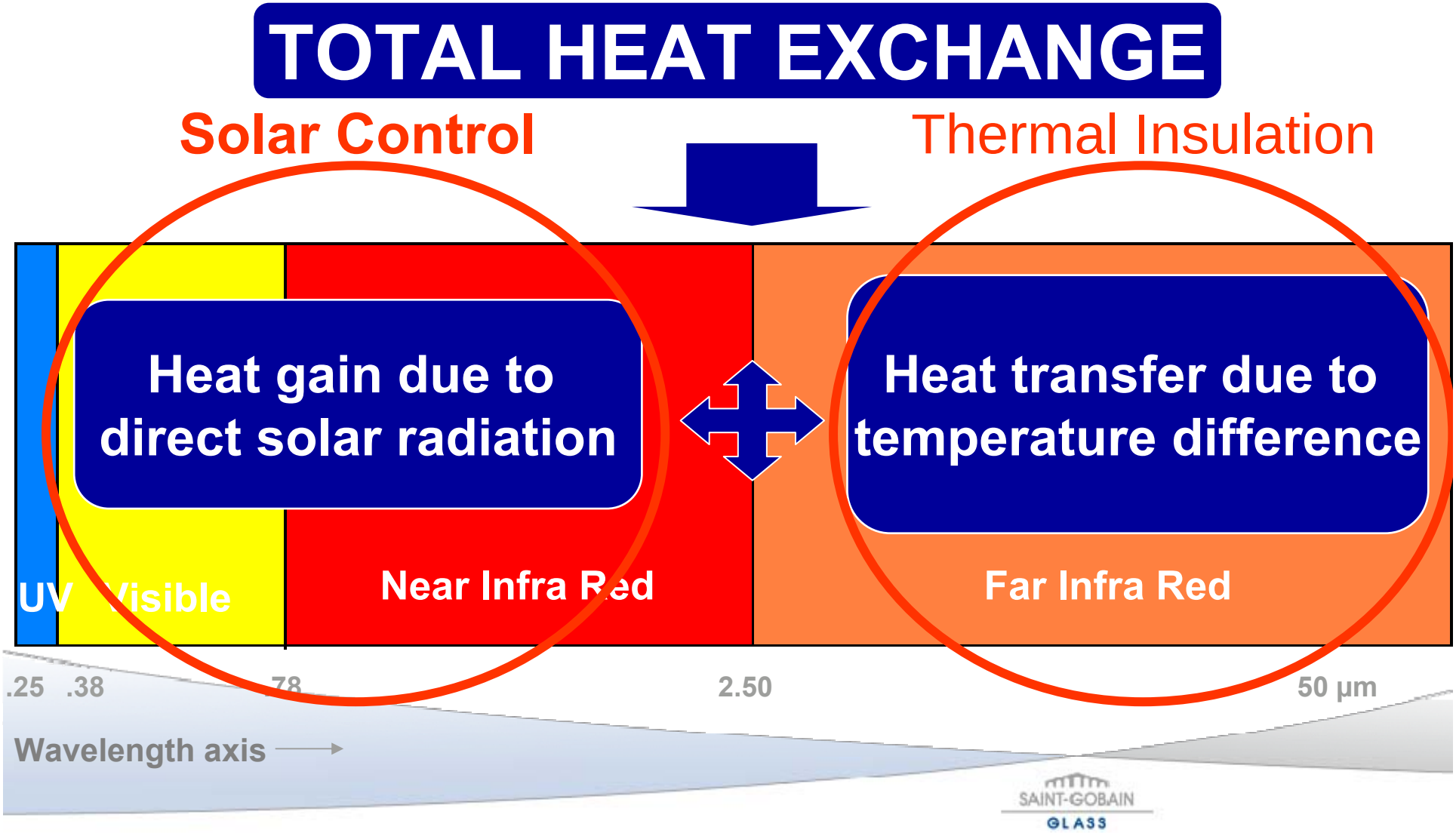
U_W 1,4 – 1,7 W/m²K

U_W 1,4 – 1,8 W/m²K

U_W 0,8 – 1,2 W/m²K

Total Heat Exchange

Electromagnetic Spectrum at Terrestrial Level



Energy efficient glass - Definitions

Key Performance Indicators

SOLAR ENERGETIC FACTORS

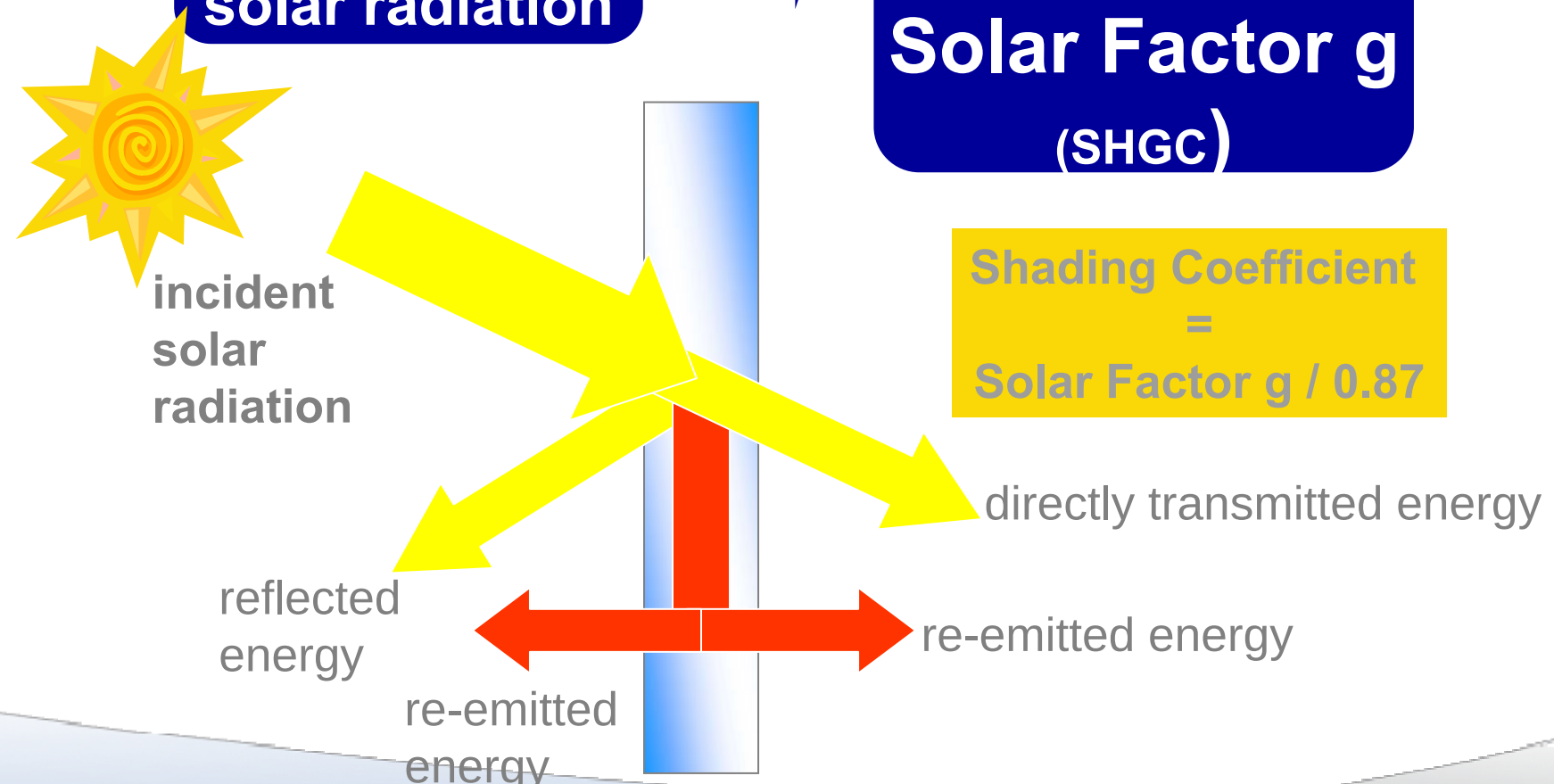
- **Solar Factor** — **g-value**
- **Solar Heat Gain Coefficient** — **SHGC**
- **Shading Coefficient SC** — **= g / $g_{3mm\ clear\ float\ (0.87)}$**

The lower the g-value (or SHGC or SC), the better the glass in cutting solar energy

Solar Factor / Shading coefficient

Heat gain due to direct solar radiation

directly +
re-emitted energy
=
Solar Factor g
(SHGC)



Shading Coefficient
=
Solar Factor g / 0.87

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Energy efficient glass - Definitions

Key Performance Indicators

ENERGETIC FACTORS

- **Solar Factor** — **g-value** (0 < < 1)
- **Solar Heat Gain Coefficient** — **SHGC**
- **Shading Coefficient SC** — **= g / $g_{3mm\ clear\ float\ (0.87)}$**

The lower the g-value (or SHGC or SC), the better the glass in cutting solar energy

Glass type 6mm	Clear glass	Tinted glass SGG PARSOL grey	Solar control glass SGG COOL-LITE KNT 155	High selective glass SGG COOL-LITE SKN 154
LT %	89%	43%	47%	50%
LRe %	8%	5%	17%	18%
g-value	0.82	0.58	0.36	0.26
SC	0.94	0.67	0.41	0.30

SAINT-GOBAIN GLASS

Energy efficient glass - Definitions

Key Performance Indicators

SELECTIVITY

- **Selectivity *** **= LT / g**

The higher the selectivity, the more performing is the glass in cutting more solar heat than visible light

Selectivity < 1	**Non selective glass**
Selectivity ~1.3 – 1.5	**Medium selective glass**
Selectivity > 1.8	**High selective glass**
Selectivity > 2	**Extremely High selective glass**

** Also called Light to Solar Gain (LSG)*

SAINT-GOBAIN GLASS

Energy efficient glass - Definitions

Solar control or low-E ?

Solar Control glass (reflective)

Plays on the solar factor g-value (or SHGC or SC)

Low-E glass

Plays on the U-value

Last generation of coatings – high performance coatings – combine both functions in one product

How to deposit a coating on glass ?

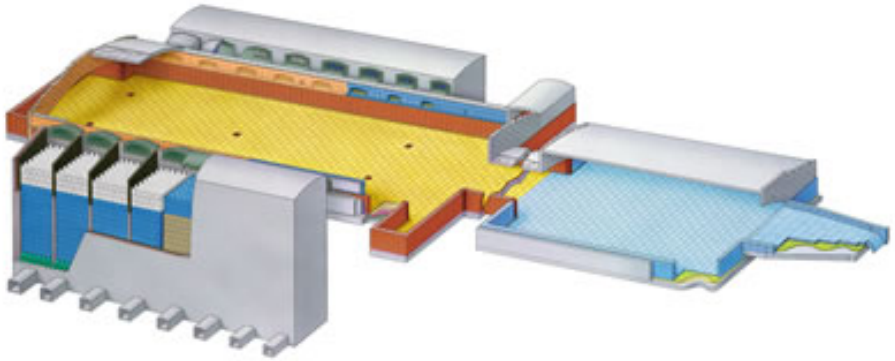
Online process

= pyrolitic technology

Offline process

= magnetron sputtering technology

On the float line



« coater »

SAINT-GOBAIN GLASS

Off Line coating line

- Coating applied under vacuum by a Magnetron sputtering process
- Offline process only can produce High Performance Coatings

Energy efficient glass
Major benefits of coated glass

- **Air-conditioned buildings**
  - *Energy savings all along the year, less money spent for AC*
  - *Smaller sized air conditioning, less investment*
  - *Less CO_2 output*
- **Buildings without air-conditioning**
  - *Energy & money savings during wintertime*
  - *Less CO_2 output*
  - *Improved comfort in hot period*
- **All buildings**
  - *Optimised daylight autonomy*
  - *Energy & money savings on artificial lighting*

Performances vs. climate

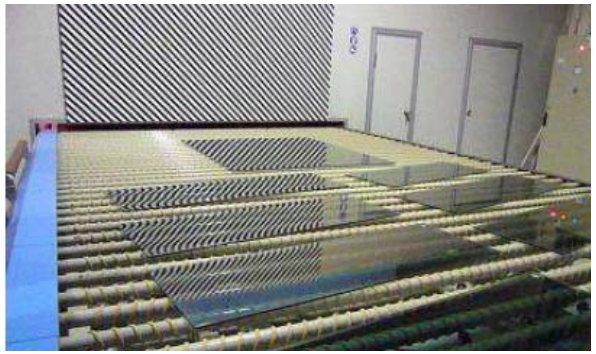
- **Heating-dominated climates**
  - Low U-value – High LT – High / medium g-value
  - IGU (double or triple)
- **Mixed climates**
  - Low U-value – Medium / high LT – Medium / low g-value
  - IGU (double)
- **Cooling-dominated climates**
  - Low g-value – Medium LT – Low U-value if $\Delta T > 10°C$ in average
  - Single, laminated or preferably DGU

Aesthetics

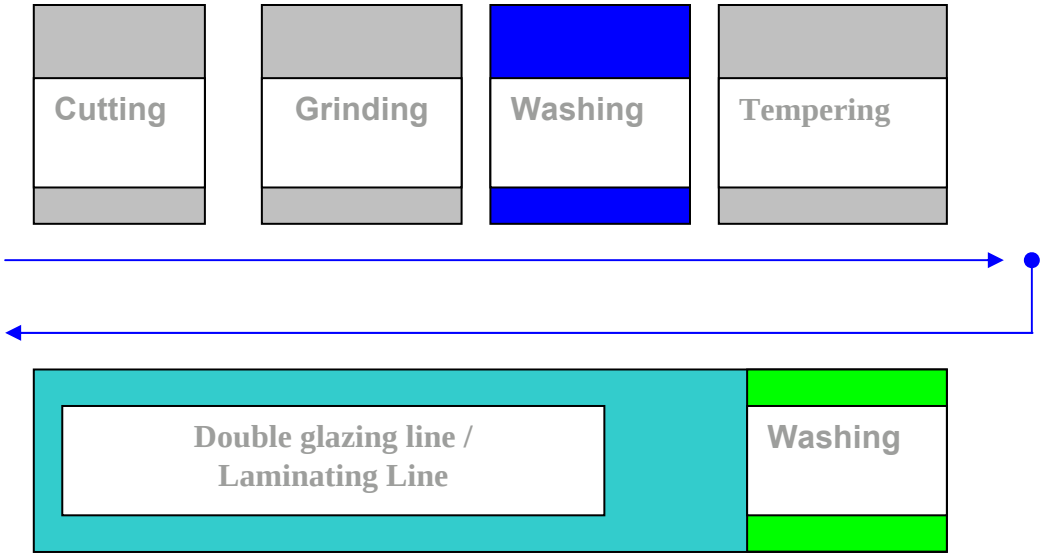
- Transparency
- Tint / Neutrality
  - in reflection
  - in transmission
- Reflectivity
- Design elements

Processing characteristics of coated glass

- **Major questions regarding processing:**
- Can the coating be
  - tempered ?
  - laminated ?
  - curved ?
  - enameled ?
  - used as single glazing ?
  - easily processed ?
  - …



Main recommendations for processing coated glass



- Cutting : use volatile cutting oil
- Grinding: prefer wet process to dry one
- Washing : use soft brushes & demineralised water
- Tempering : settings to adjust as per product type
- Lamination: keep nip-rolls clean

Compared to clear float glass processing, what's different ?

	Cutting	Washing	Tempering	Laminating	IGU Assembling
Cool-lite ST	F	F	5% more heating time	F	F
Cool-lite E II	F	Demineralised water / Soft brushes	Use little air injection	F	F
Cool-lite KNT	F	Demineralised water / Soft brushes	Use little convection	F	F
Cool-lite SKN II	F	Demineralised water / Soft brushes	Use full convection	F	F
Cool-lite XTREME II	F	Demineralised water / Soft brushes	Use full convection	F	F
Planitherm UN II ONE II, LUX II…	F	Demineralised water / Soft brushes	Use full convection	F	F

F : same as clear Float

SAINT-GOBAIN GLASS

Technical certification of glass processors

Saint-Gobain Glass
is pleased to confirm that the company

has successfully passed a Saint-Gobain Glass inspection on the mechanical treatment, heat treatment and insulating glass process qualifying it for the processing of:

The processor's site has been visited on
This certificate is valid until so long as your manufacturing process remains as it is on the date of inspection.
After such date, its renewal is subject to a new inspection.

In performing this certification, Saint-Gobain Glass does not assume or undertake to discharge any responsibility of the inspected company, which is the sole party responsible for the processing of its products in conformity with applicable laws, regulations, norms and the Guidelines for Use of Coated Glass of Saint-Gobain Glass.

CERTIFICATE

N°.

DATE

for Saint-Gobain Glass

CERTIFIED PROCESSOR

SAINT-GOBAIN
GLASS

SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- **Energy balance / regulations trends / window labelling**
- Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

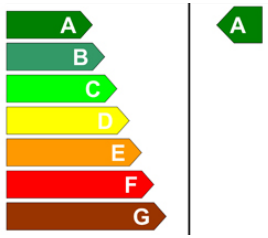
5 | A look at the future

6 | Interior - Design

SAINT-GOBAIN
GLASS

Residential buildings
Thermal Insulation trends

- From a ‘U-value’ tradition to the ‘energy balance’ concept
  - Mixing U-value and g-value (or SC)
  - Hot, mixed and cold climates



- From double glazing units to triple glazing units
  - Both very low U-value (<< 1.0) and high g-value
  - Cold climates in priority

SAINT-GOBAIN
GLASS

Windows Labelling schemes

SAINT-GOBAIN GLASS APPROACH

SAINT-GOBAIN
GLASS

Indication of the energy consumption of a window by a labelling will become compulsory (Directive 2010/30/EU)

18.6.2010 EN Official Journal of the European Union L 153/1

I

(Legislative acts)

DIRECTIVES

DIRECTIVE 2010/30/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 19 May 2010

on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products

(recast)

(Text with EEA relevance)

POSITION (UE) N o 9/2010 OF THE COUNCIL AT FIRST READING:

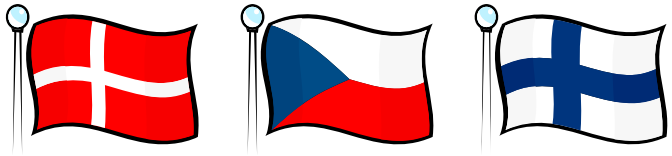
II. OBJECTIVE OF THE PROPOSAL

Together with two other proposals (4) this proposal is part of the Energy Efficiency Package tabled by the Commission in November 2008.

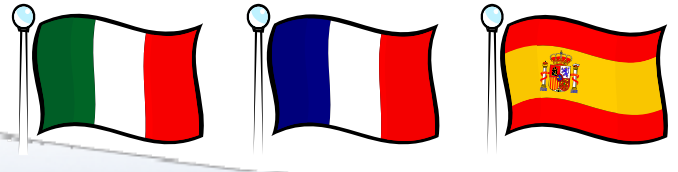
The main aim of the recast proposal is the extension of the scope of the current Directive 92/75/EEC, restricted to household appliances, to allow for the labelling of all energy-related products including the household, commercial and industrial sectors and some non-energy using products such as windows which have a significant potential for energy savings once in use or installed. It follows in particular the overall objective to improve the energy efficiency performance of those products, thereby contributing to the Community objectives of protecting the environment and combating climate change, in line with the EU's climate/energy policy goals for 2020 as regards greenhouse gas emissions.

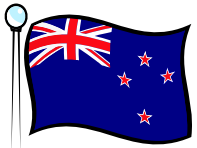
SAINT-GOBAIN GLASS

How are shaped labelling window systems?



Coming soon





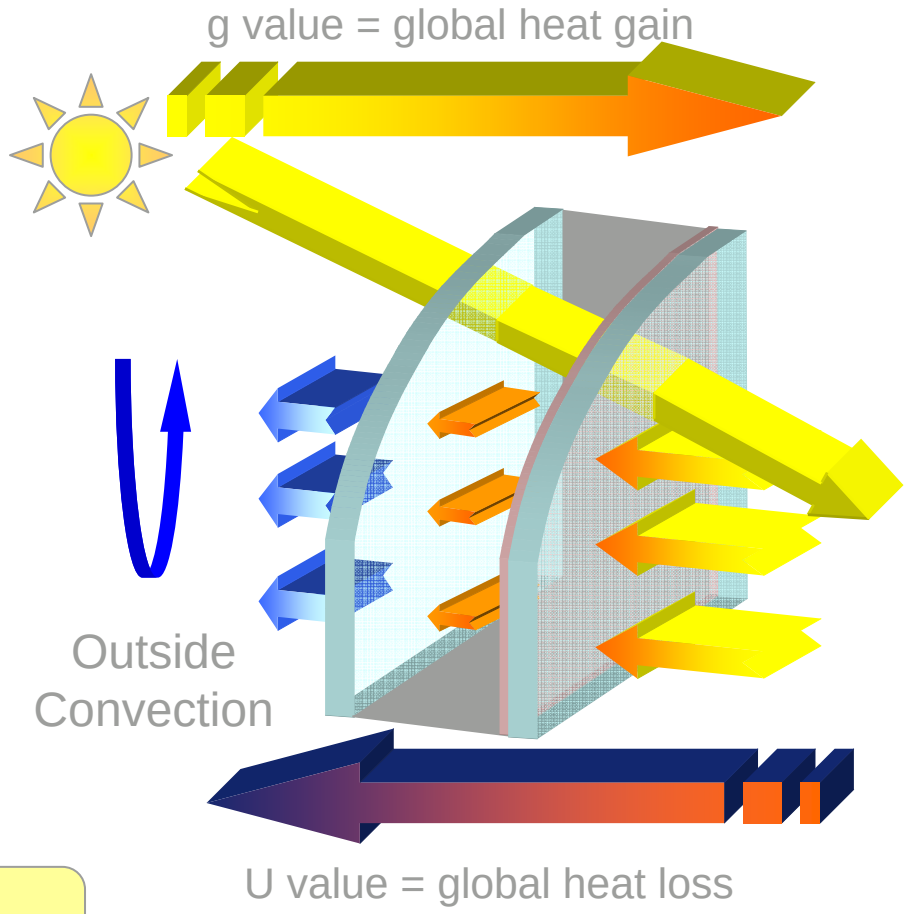
Energy balance: Heat loss and Heat gain

- Low-E coatings stop exchange by radiation in far infrared wavelengths:

  ➔ ***Reduction of Heat Loss***

- Low-E coatings are transparent to solar radiation from UV & visible until near Infrared:

  ➔ ***Increase of solar Heat Gain***



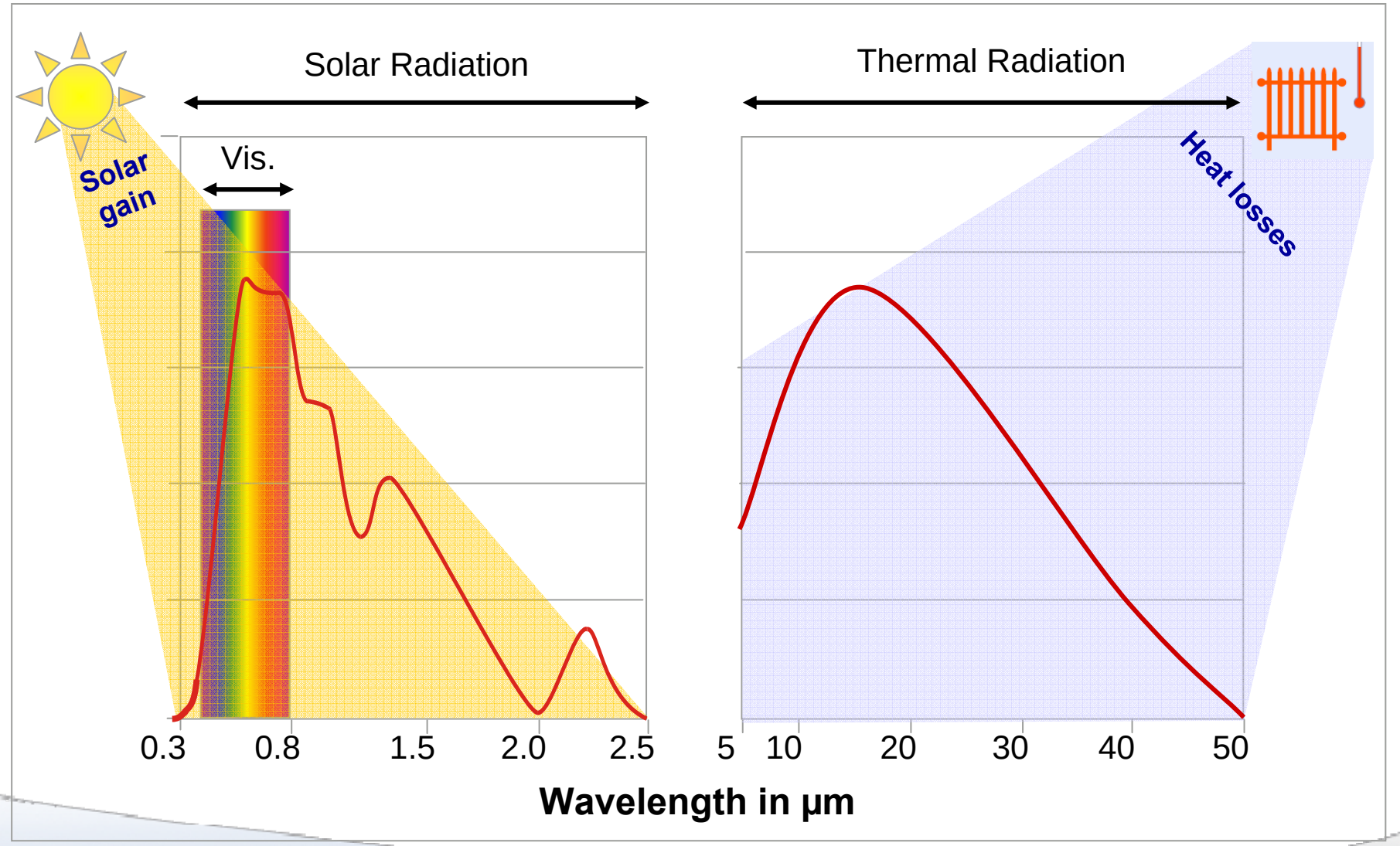
- Energy balance of a glazing is the balance between Heat Loss and Heat Gain:

Energy Balance = α x Ug – β x g

Loss **Gain**

SAINT-GOBAIN GLASS

Solar and Thermal Energy Spectrum



SAINT-GOBAIN GLASS

Examples of Window Ratings

From 01.2010

A	>0
B	-10 do <0
C	-20 do < -10
D	-30 do < -20
E	-50 do < -30
F	-70 do < -50
G	< -70

Great Britain

- 7 classes A to G
- E_{ref} = 218.6*g_w-68.5(U_w+L_{50})

A	> 0
B	-20 > 0
C	-40 > -20
D	-60 > -40
E	-80 > -60
F	-100 > -80
G	< -100

Slovaquia

- 7 classes A to G
- E_{ref} = 266,6*g_w-96,6(U_w+L_w)

A	> 0
B	-20 > 0
C	-40 > -20
D	-60 > -40
E	-80 > -60
F	-100 > -80
G	> -100

Czech Rep.

- 7 classes A to G
- E_{ref} = 282,4*g_w-98,7(U_w+L_w)

A	≥ 0
B	-17 > 0
C	-34 > -17

Denmark

- 3 classes A to C
- E_{ref}= 196,4*g_w-90,36*U_w

A	< 85
B	85-105
C	105-125
D	125-145
E	145-165
F	165-185
G	> 185

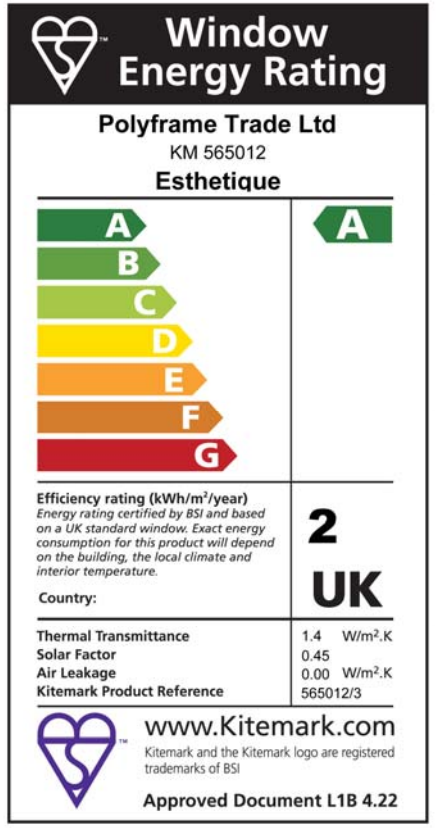
Finland

- 7 classes A to G
- E_{ref} = 140*U_w-160*g_w+50*L

Level	E index
A	>35
B	25 to <35
C	10 to < 25
D	-10 to < 10
E	-50 to < -10
F	-100 to < -50
G	< -100

Poland

UK – Window Energy Rating system



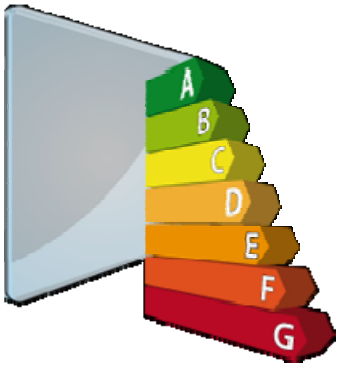
- Label content:
  - Consumer-friendly traffic-light style A-E ratings guide similar to that used on ‘white’ goods (such as fridges, freezers, washing machines etc…).
- Principles:
  - Comparison of window performance under identical conditions
    - Standard window size
    - General orientations of windows in UK homes
    - ONE zone in UK
  - Does not provide an absolute measure of the energy performance

SAINT-GOBAIN GLASS

UK - Rating Method:

Energy Index = 218.6 gw – 68.5 (Uw + L50)

- Energy index: shows how much energy the window will save or loose
- gw: solar factor of the window (glass fraction * glass solar factor) corrected by 0.9 factor (simplified method in EN 832)
- Uw: U value of the window calculated by BFRC Certified Simulators (EN 10077-2)
- L50: effective heat loss due to air penetration. Measured at 50 Pa, it is not suitable for energy calculations so it is divided by 20 to be converted to heat loss rate.



Level	E index
A	>0
B	-10 TO <0
C	-20 to < -10
D	-30 to < -20
E	-50 to < -30
F	-70 to < -50
G	< -70

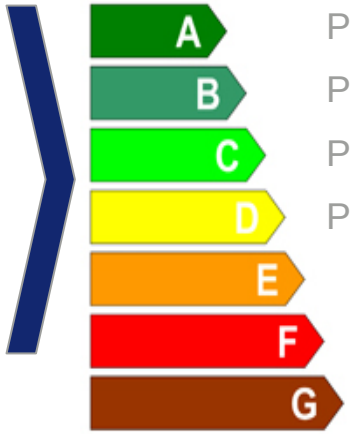
UK - WERs simplify product offer to the end user and change common ranking…

From Insulation focus

Ug	
0.7	PLT UN (TGU)
0.8	PLT LUX (TGU)
1.0	PLT ONE (DGU)
1.1	PLT UN (DGU)
1.2	PLT TOTAL+ (DGU)

to

Labels valuing Energy efficiency



PLT LUX (TGU)
PLT TOTAL+ (DGU)
PLT UN (DGU or TGU)
PLT ONE (DGU)

WERs in UK:

Ug	g	WERs
0.8	0.62	A
1.2	0.71	B
0.7 1.1	0.50 0.63	C
1.0	0.50	D

…by shifting strongly focus from insulation to energy balance

- Introduction of a minimum « band C » in UK thermal regulation from Oct. 2010
- Band B expected in 2014

SAINT-GOBAIN GLASS

Procedure for rating fenestration products in UK is based on voluntary certification

- Independent Agency approved by BFRC is responsible for auditing simulation, manufacturing systems and submit details to BFRC for label registration. Quality management system (ISO 9001 or similar) must be in place

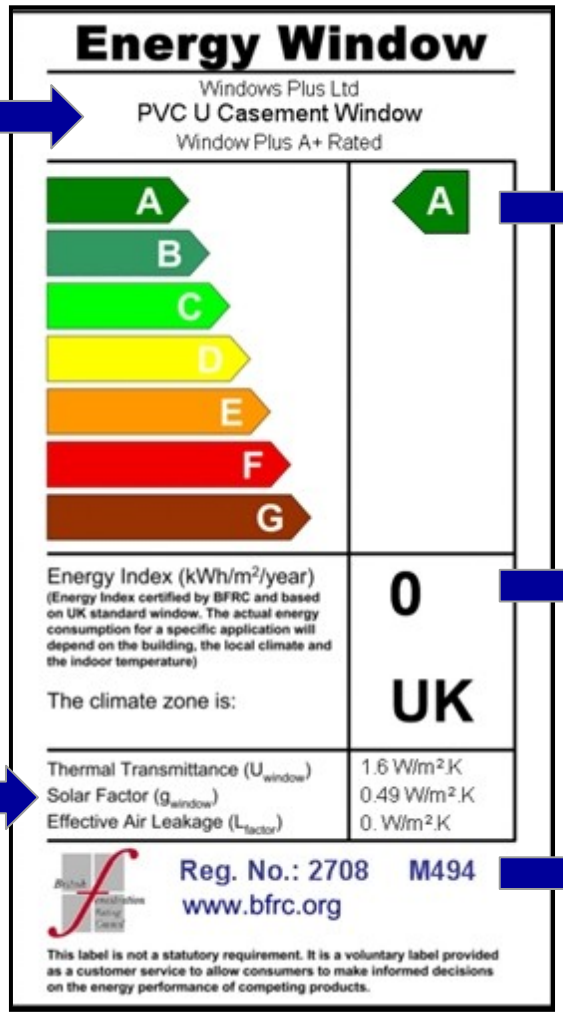
OR

- KITEMARK (BSI) certification for individual Fabricator scheme / System supplier scheme

- Companies achieving a ‘B’ rating under the WER scheme will be eligible to apply for the Energy Saving Trust Recommended scheme (one of the most highly recognised certification mark in UK)

Labelling information:

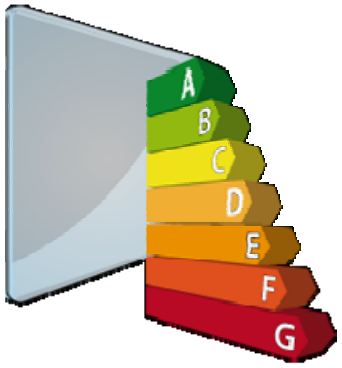
- WFM & window references
- Energy Band
- Energy index value
- Climate zone (UK only)
- Uw
- gw
- L50
- BFRC label registration number or Kitemark logo



Poland - Rating Method:

Energy Index = 309.6 gw – 91.59 Uw – 10.13a

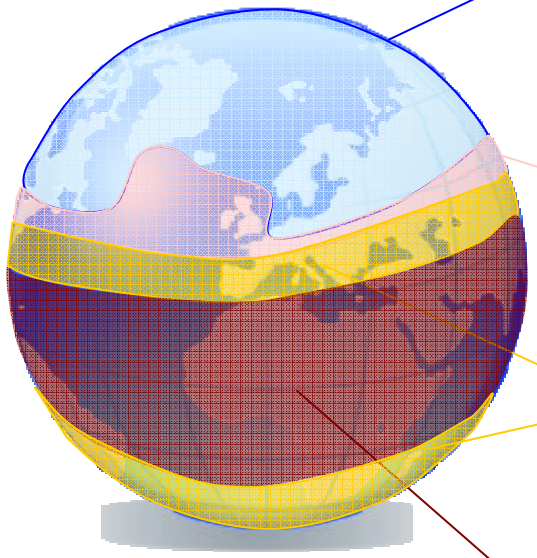
- Energy index: shows how much energy the window will save or loose
- gw: solar factor of the window (glass area * glass solar factor)
- Uw: U-value of the window
- a: air infiltration - effective heat loss due to air penetration.



Level	E index
A	>35
B	25 to <35
C	10 to < 25
D	-10 to < 10
E	-50 to < -10
F	-100 to < -50
G	< -100

SAINT-GOBAIN GLASS APPROACH:
Labelling system based on TRNSYS calculations

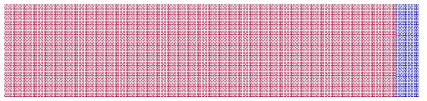
Residential Windows : Expected performance directly depends on climate : cold, intermediate, warm and hot



HEATING
COOLING

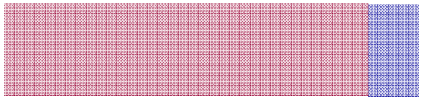
COLD CLIMATE

- Focused on thermal insulation



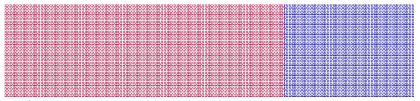
INTERMEDIATE CLIMATE

- Driven by energy balance



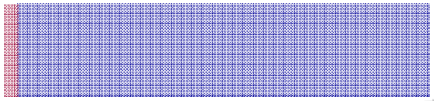
WARM CLIMATE

- Balancing between insulation and summer comfort



HOT CLIMATE

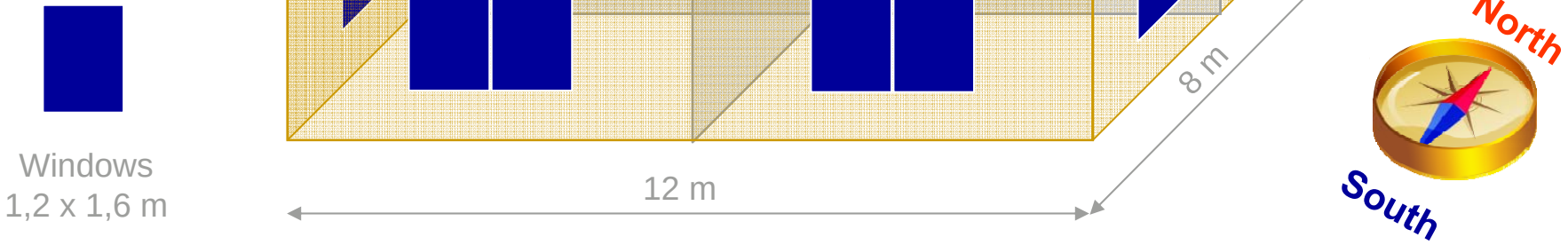
- Focused on low solar heat gain



SAINT-GOBAIN
GLASS

Labelling Method is based on a classical basic shaped single house

- 12 * 8m House
- 20% of floor surface is glazed:
  - 4% N, E, W and 8% South



96 combinations of windows are studied per climatic zone

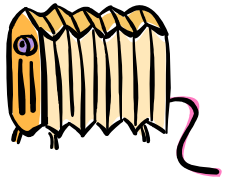
	Ug (W/m2K)	g-value
6 Types of glazing :		
Clear DGU 4(16)4	2.6	0.78
Climaplus Ultra N 4(16)4	1.1	0.63
Climaplus ONE 4(16)4	1.0	0.50
Climaplus 4S 4(16)4	1.1	0.42
Climatop Ultra N 4(14)4(14)4	0.7	0.50
Climatop LUX 4(14)4(14)4	0.7	0.62
2 ratio Glass to Frame Sg / (Sf+Sg) :		
Typical PVC	64%	
Typical Aluminium	76%	
2 Types of spacer	**psi**	
Warmedge:	0.035 W/mK	
Aluminium	0.074 W/mK	
7 Types of frame	**Uf**	
Typical Alu, PVC and mix	2.9 / 2 / 1.6 / 1.4 /1.2 /1 / 0.8 W/m²/K	

For each climate zone and window, the House Energy consumption is calculated using TRNSYS

Different Climates

Different Windows:
Uf, Ug, ψ, glazed ratio…

Thermal simulation using TRNSYS:
TRaNsient SYstem Simulation

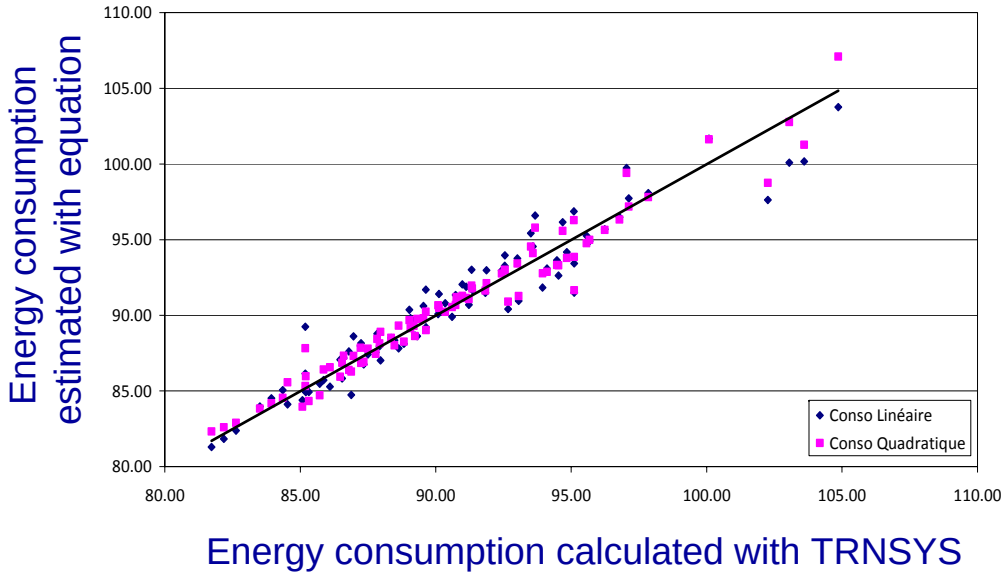


House Energy needs for cooling and heating

SAINT-GOBAIN GLASS

It’s possible to determine a simple energy consumption equation based on Uw and gw

- All parameters except windows are fixed
- For each climate zone and each window type:
  - Energy consumption has been calculated with TRNSYS
  - Multi Linear models gives simple equation based on Uw and gw

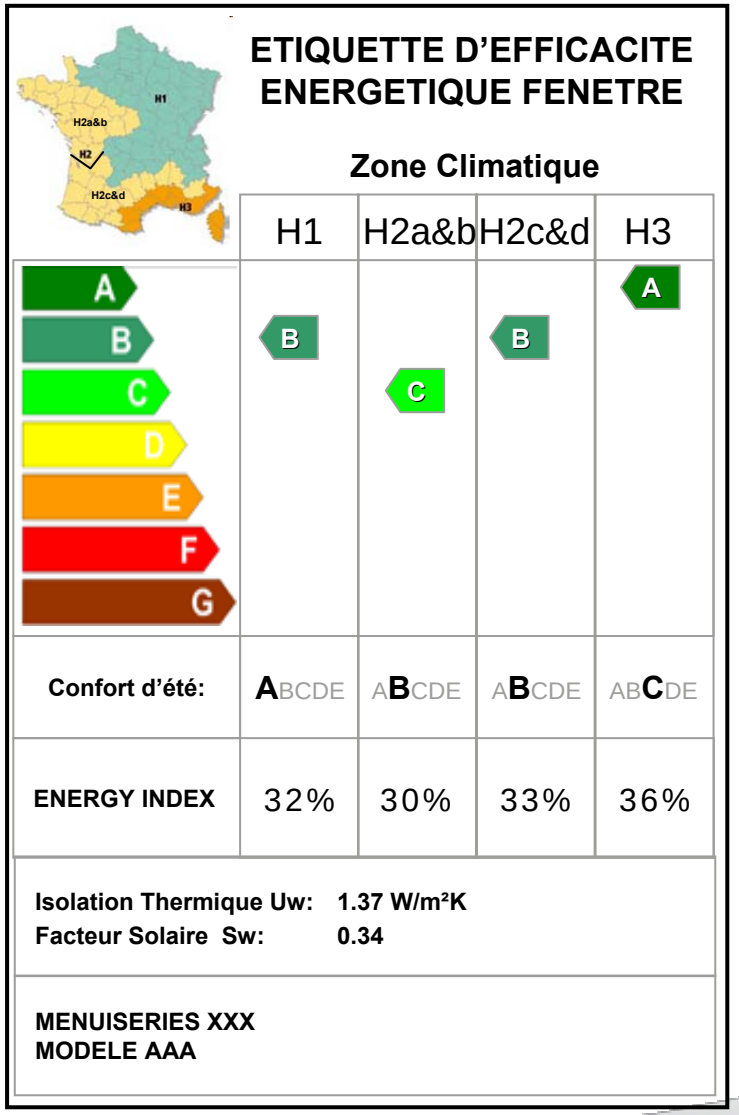


- ‘simple’ energy consumption equation :

$$E_{REF} = \alpha U_w - \beta g_w + \gamma$$

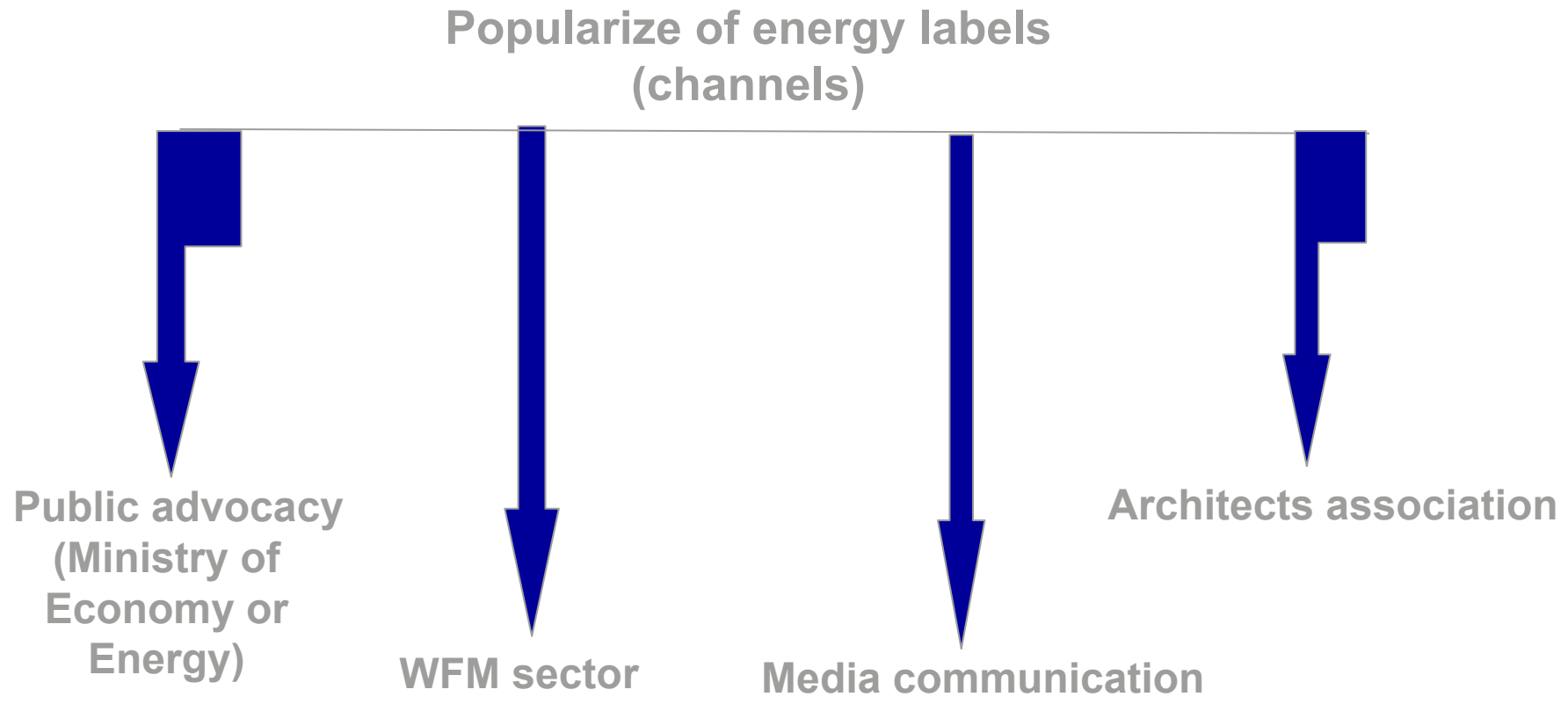
Window Labelling Scheme in France
SGG proposal

- Example FRANCE
  - 4 climates zones
    - H1-H2a&b-H2c&d-H3
  - Labelling for global Energy consumption
  - Labelling for Summer Comfort
  - Energy Index
  - Global performances
  - WFM coordinates



SAINT-GOBAIN GLASS

Promotion routes of energy labels in a given market



SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- **Low-E glasses & Solar control glasses**

2 | Noise protection glass

3 | Easy maintenance glass

4 | Fire Resisting Glass

5 | A look at the future

6 | Interior - Design

SAINT-GOBAIN
GLASS

SGG Low-E range for DGUs: performances

High light and energy transmitting low-E products

	LT	LRe	g	U	Tempering	Factory
PLANITHERM ULTRA N	80%	12%	0.63	1.1	No	Europe
PLANITHERM ULTRA N II	80%	12%	0.63	1.1	To be tempered	DE, PL, RO
PLANITHERM ONE	71%	22%	0.49	1.0	No	Europe
PLANITHERM ONE II	71%	22%	0.51	1.0	To be tempered	DE
PLANITHERM T	77%	11%	0.66	1.3	Temperable	IN, CH, KR
PLANITHERM TOTAL +	79%	12%	0.66	1.2	Temperable	UK

DGU: 4mm clear float / 16mm 90% Argon / coating on side 3 on clear float 4mm

« 4 seasons comfort » low-E products

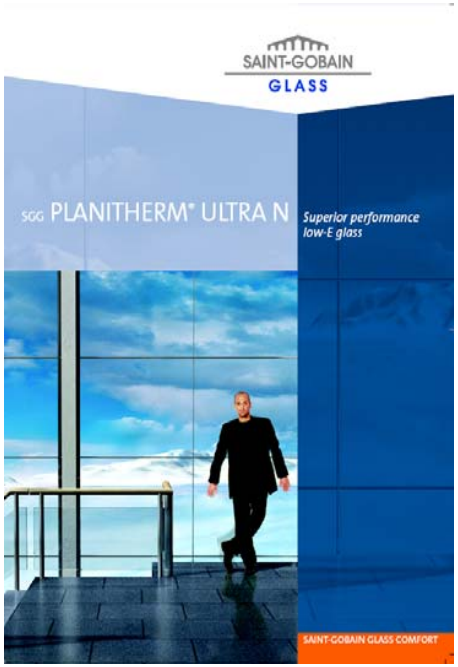
	LT	LRe	g	U	Tempering	Factory
PLANISTAR SUN	71%	12%	0.38	1.0	No	FR
PLANITHERM RELAX	70%	10%	0.42	1.1	No	DE
PLANITHERM 4S	65%	26%	0.43	1.1	No	RO, UK
PLANITHERM 4S II	65%	26%	0.43	1.0	To be tempered	RO, UK

DGU: coating on side 2 on clear float 4mm / 16mm 90% Argon / 4mm clear float

SAINT-GOBAIN GLASS

SGG PLANITHERM ULTRA N and ULTRA N II

- **SGG PLANITHERM ULTRA N:**
  - ε_N = 0.03
  - U_G= 1.1 W/m².K (DGU 4/16/4 90% Argon)
- **SGG PLANITHERM ULTRA N II:**
  - To be tempered version
    - When a safety glass is necessary
    - To avoid the risk of thermal breakage
  - Characteristics, after tempering, are similar to those of SGG PLANITHERM ULTRA N.
- **Advantages of those products:**
  - Optimum energy balance:
    - Minimum U value
    - Maximum g value
  - Excellent neutrality in transmission and reflection



SGG PLANITHERM ULTRA N

DGU type:
4mm / 16mm 85% Argon / 4mm

U-value:
1.1 W/m²K

Light Transmission
T_L: 80%

Reflected Light
R_L: 12%

Solar Factor
g : 0.63

SGG PLANITHERM ONE and ONE II

SGG PLANITHERM ONE:

- The lowest emissivity ever reached!
- ε_N = 0.01
- U_G= 1.0 W/m².K (DGU 4/16/4 85% Argon)
- To be tempered version : **ONE II**
  - Same performance and appearance both before and after tempering

SGG PLANITHERM ONE

DGU type:
4mm / 16mm 85% Argon / 4mm

U-value:
1.0 W/m²K

Light Transmission
T_L: 71%

Reflected Light
R_L: 22%

Solar Factor
g : 0.49

Benefits of SGG PLANITHERM ONE:

- Maximized heat insulation
- Excellent neutrality in transmission and reflection

SGG PLANITHERM® LUX

Low-E glass for Triple Glazings Units

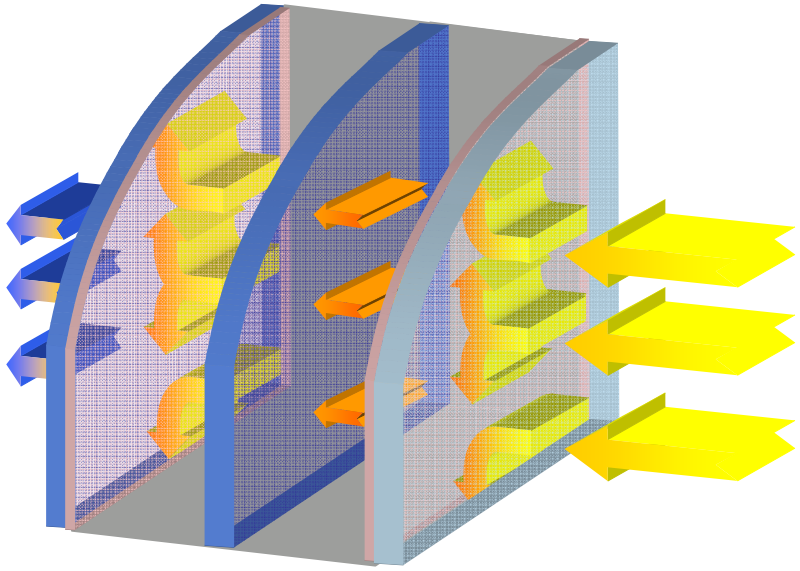
SAINT-GOBAIN
GLASS

Applying the principle :
FROM THERMAL INSULATION TO ENERGY BALANCE OF GLAZING

Triple glazed units with high energy balance

➔ **REDUCTION OF HEAT LOSSES**
➔ **INCREASE OF SOLAR GAINS**

Reduction of Heat Losses can only be achieved using Triple Glazed Units



Low E DGU:

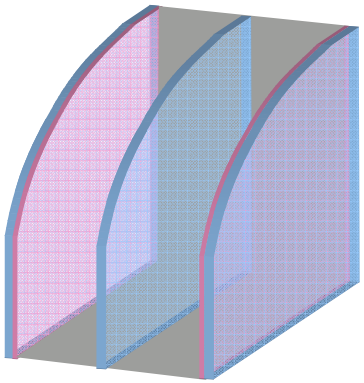
- If air or gas spacer becomes too wide (>16mm), then increase of volume creates natural convection inside the cavity.
- Ug value is no more improved for spacer wider than 16mm

Low E TGU:

- A glass put in between the gas space will block natural convection: **TRIPLE GLAZING UNIT!**
- Ug value can be improved up to 2 times compared to Low E DGU.

Solar Heat Gains drastically downgraded by using ‘Standard’ Low-E coatings in a TGU

- To avoid thermal breakage of the middle pane Low E coatings are usually on both sides # 2 and #5 in a TGU
- Most ‘common’ Low E coating are not optimized for TGU
  - Decrease of the Solar Factor (and LT)
  - Energy balance is not optimised



	DGU with PLT ULTRA N	TGU with PLT ULTRA N
Glazing composition	4mm PLX / 16mm 90% Argon / PLT ULTRA N 4mm (3)	PLT ULTRA N 4mm (2) / 12mm 90% Argon / 4mm PLX / 12mm 90% Argon / PLT ULTRA N 4mm (5)
U_g	1.1 W/m²K	0.7 W/m²K
TL	80%	70%
g – value	0.63	0.50

SAINT-GOBAIN GLASS

SGG PLANITHERM® LUX / MAX / ULTRA N

Performance data comparison

	TGU with PLT ULTRA N		TGU with PLT LUX		TGU with PLT MAX	
External Pane	SGG PLANITHERM ULTRA N		SGG PLANITHERM LUX		SGG PLANITHERM MAX	
Middle Pane	SGG PLANILUX		SGG PLANILUX		SGG DIAMANT	
Internal Pane	SGG PLANITHERM ULTRA N		SGG PLANITHERM LUX		SGG PLANITHERM MAX	
Composition in mm	36mm = 4 / 12 / 4 / 12 / 4 or 40mm = 4 / 14 / 4 / 14 / 4					
spacers	2 x 12mm 90% Argon	2 x 14mm 90% Argon	2 x 12mm 90% Argon	2 x 14mm 90% Argon	2 x 12mm 90% Argon	2 x 14mm 90% Argon
Coating positions	Face 2 and 5		Face 2 and 5		Face 2 and 5	
TL*	70%		73%		74%	
RLe*	15%		17%		15%	
g-value*	0.50		0.62		0.60	
Ug-value in W/m2K**	0.7	0.6	0.8	0.7	0.7	0.7

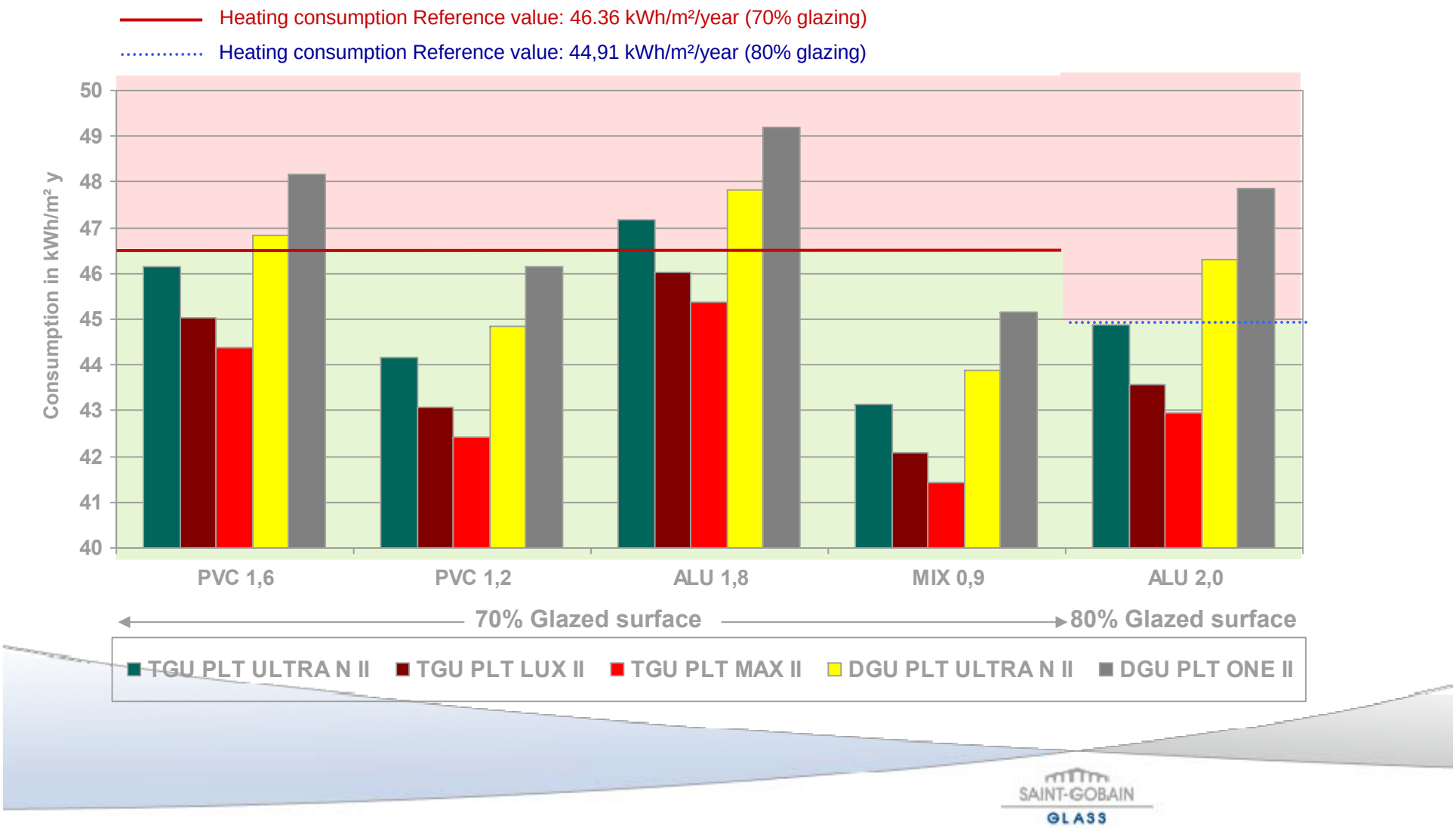
* Light and solar performance according to EN 410
** Centre pane Ug-values in accordance with EN 673

SAINT-GOBAIN GLASS

SGG PLANITHERM® LUX / MAX / ULTRA N / ONE

Performance and cost savings referring to EnEV

TGU: 4mm Glass coating on side 2 / 12mm 90%Ar / 4mm Glass / 12mm 90%Ar / coating side 5 on 4 mm Glass



SAINT-GOBAIN GLASS

SGG PLANITHERM® LUX / MAX / ULTRA N

Performance and cost savings referring to EnEV

	Type	TGU with PLT ULTRA N	TGU with PLT LUX	TGU with PLT MAX	DGU with PLT ULTRA N
	U_g	0.7	0,8	0,7	1.1
	Solar factor	0.50	0,62	0,60	0.63
PVC frame u_f = 1.2 +warm-edge 70% glazed	Consumption in kWh/m².y	44.15	43,06	42.41	44.86
	Cost vs TGU with PLT LUX	+886 €	REF	-530 €	+1466 €

Dollarization: Reference 'Familien Haus' of 214.1m²

Electricity = 0.19€/kWh

SGG PLANITHERM® LUX and SGG PLANITHERM® LUX II: ‘next generation’ of Low-E coatings on clear float glass

- Launched in 2010 **SGG PLANITHERM® LUX is the *BEST Low-E*** for Triple Glazed Units using clear float glass
- Now, the **“to be tempered” version SGG PLANITHERM® LUX II** is available with the same exceptional energy balance :
  - **Ug down to 0.7 W/m²K**
  - **g = 0.62**
  - **LT = 73%**
- **SGG PLANITHERM® LUX II** provides the **safety function** and can be used in side 3 of triple glazing **without risk of thermal breakage**

SGG PLANITHERM® LUX / LUX II

Performance data in triple glazing units

	TGU with PLT LUX		TGU with PLT LUX II		TGU with PLT LUX II	
External Pane	SGG PLANITHERM LUX		SGG PLANITHERM LUX II		SGG PLANITHERM LUX II	
Middle Pane	SGG PLANILUX		SGG PLANILUX		SGG PLANILUX	
Internal Pane	SGG PLANITHERM LUX		SGG PLANITHERM LUX II		SGG PLANITHERM LUX II	
Composition in mm	36mm = 4 / 12 / 4 / 12 / 4 or 40mm = 4 / 14 / 4 / 14 / 4					
spacers	2 x 12mm 90% Argon	2 x 14mm 90% Argon	2 x 12mm 90% Argon	2 x 14mm 90% Argon	2 x 12mm 90% Argon	2 x 14mm 90% Argon
Coating positions	Face 2 and 5		Face 2 and 5		**Face 3** and 5	

TL*	73%		73%		73%	
RLe*	17%		17%		16%	
g-value*	0.62		0.62		**0.64**	
Ug-value in W/m2K**	0.8	0.7	0.8	0.7	0.8	0.7

* Light and solar performance according to EN 410
** Centre pane Ug-values in accordance with EN 673

Ug = 0.6 W/m²K with 12mm of Kr 90%

Passiv Haus compliance !!

SAINT-GOBAIN GLASS

Be inspired by superior performances of new Triple Glazed Units using SGG PLANITHERM® LUX

Enlarge windows size and bring more space inside with SGG PLANITHERM® LUX / LUX II

SGG rolling-out the SGG GLASS COMPASS across EU through 2012, with more user-friendly applications

Now available:
- Benelux
- France

Planned in 2012:
- Germany/Austria/CH
- Spain/Portugal
- Poland
- Italy
- Nordic
- UK/Ireland
- Romania
- Central EU
- Greece
- …

SGG and its window frame partners starting with an “end-user oriented offer”, based on customer needs…

	COMFORT	FAMILY	PLATINIUM
ENERGY SAVINGS	★★★	★★☆	★★★
WINTER COMFORT	★★★	★★☆	★★★
EASY MAINTENANCE	★☆☆	★☆☆	★★★
ACOUSTIC	★☆☆	★★☆	★★★
SAFETY	★☆☆	★★★	★★★
	SGG PLANITHERM LUX	SGG PLANITHERM ONE SGG STADIP 44.2	SGG PLANITHERM LUX SGG BIOCLEAN VISION SGG STADIP SILENCE 44.2

SAINT-GOBAIN GLASS

IMPROVING ENERGY SAVINGS AND SUMMER COMFORT USING ‘FOUR SEASONS’ COATINGS

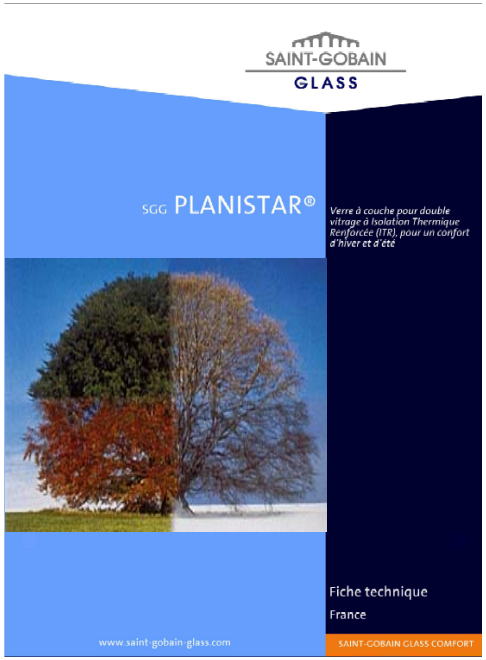
SAINT-GOBAIN
GLASS

SGG Residential ‘Four Seasons’ product range:

- Four seasons
  - SGG PLANISTAR **SUN**
  - SGG PLANITHERM RELAX
  - SGG PLANITHERM 4S

SGG PLANISTAR SUN

- Low E glass
  - with low solar factor
  - with low reflection
- In Winter:
  - DGU incorporating SGG Planistar brings same comfort as SGG PLANITHERM ULTRA N
- In Summer:
  - SGG PLANISTAR stops two times more solar energy than a clear glazing.
  - The interior of the room is cooler with level of light transmittance.
- Range:
  - 4, 6, 8mm
  - PLF, DLF
  - Laminated



NEW !
SGG PLANISTAR SUN
U 1.0 !
g-value 0.38 !
LT always 71% !

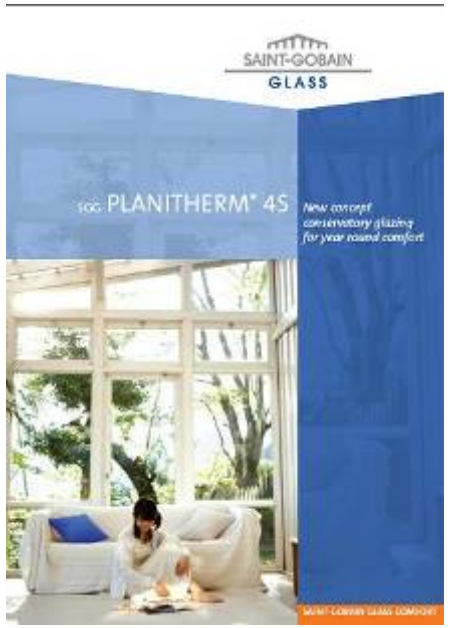
SAINT-GOBAIN
GLASS

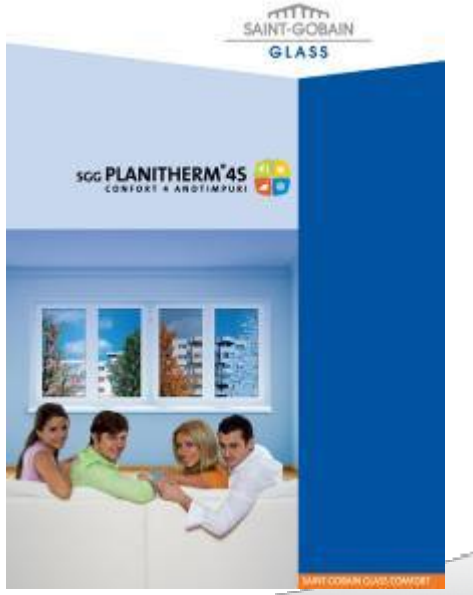
SGG PLANITHERM 4S / 4S II

Low E glass with low solar factor

- Multicomfort glazing for cold winter AND warm summer

SGG PLANITHERM 4SII	SGG PLANITHERM 4S
DOUBLE GLAZING UNIT: 4mm / 16mm 90% Argon / 4mm	DOUBLE GLAZING UNIT: 4mm / 16mm 90% Argon / 4mm
U Value: **1.0 W/m²K**	U Value: **1.0 W/m²K**
Light Transmittance **T_L: 65%**	Light Transmittance **T_L: 65%**
Light Reflectance **R_L: 26%**	Light Reflectance **R_L: 26%**
Solar Factor **g : 0.43**	Solar Factor **g : 0.43**



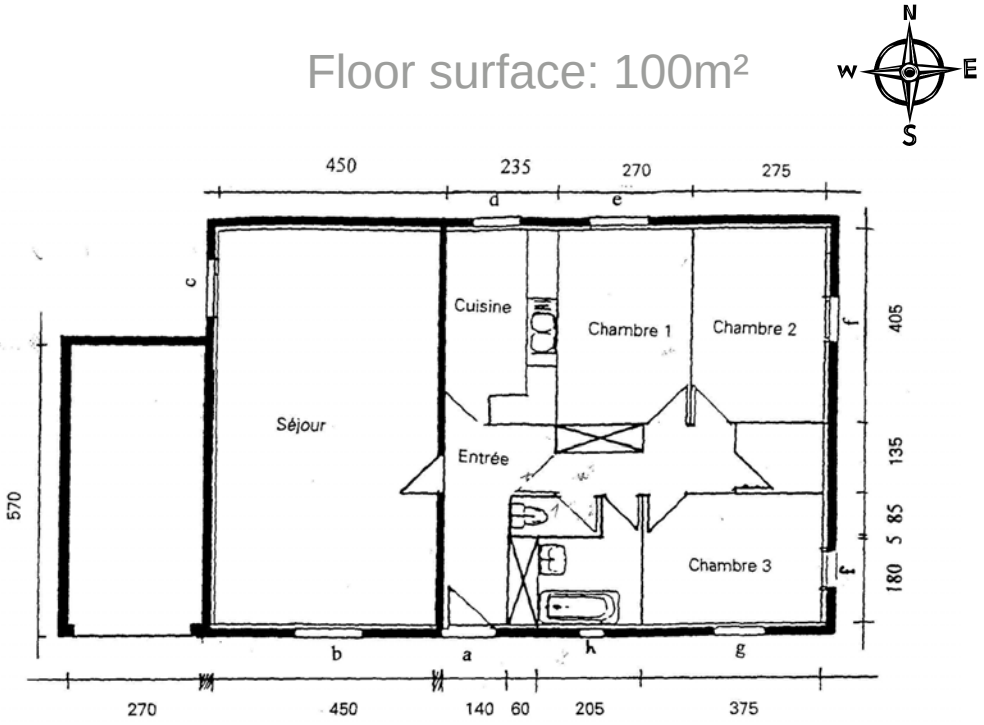


SAINT-GOBAIN GLASS

Impact of ‘Four Seasons’ coating on comfort in standard French House:

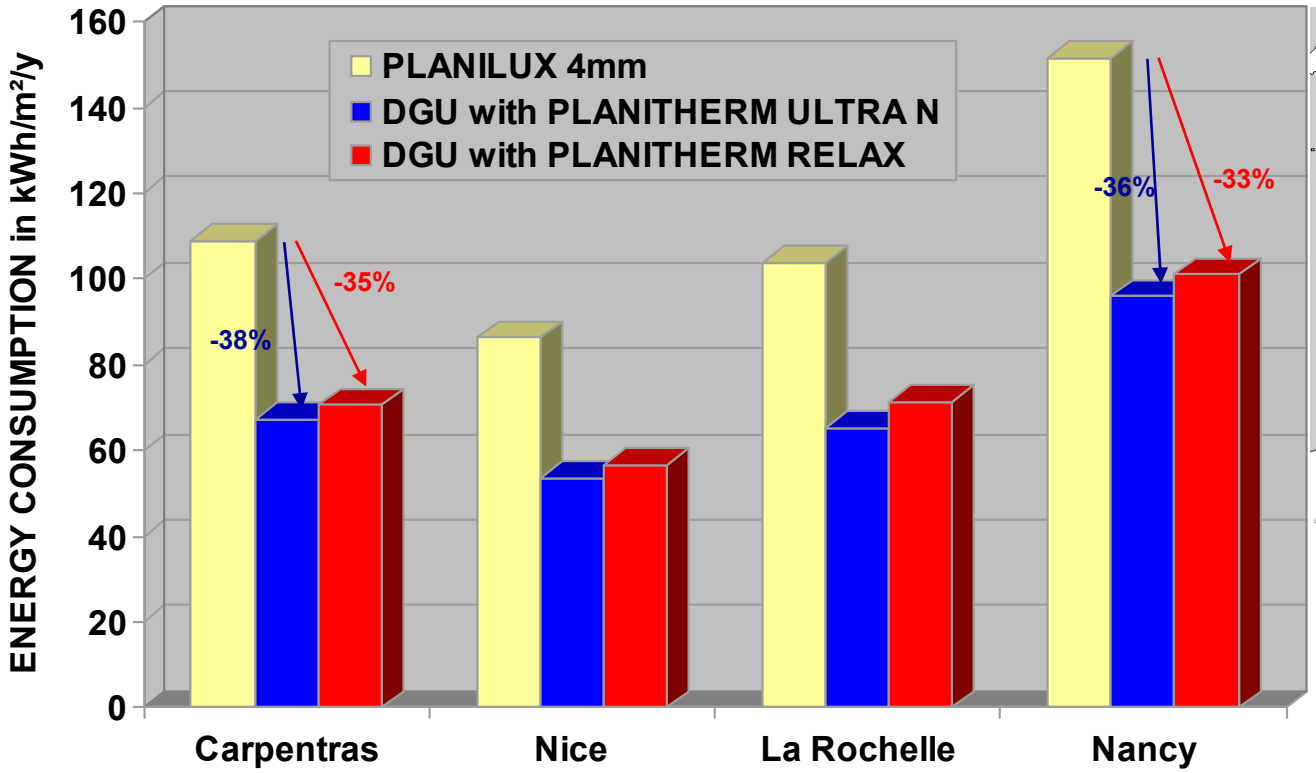
- ‘Maison Mozart’ reference house according to RT2005

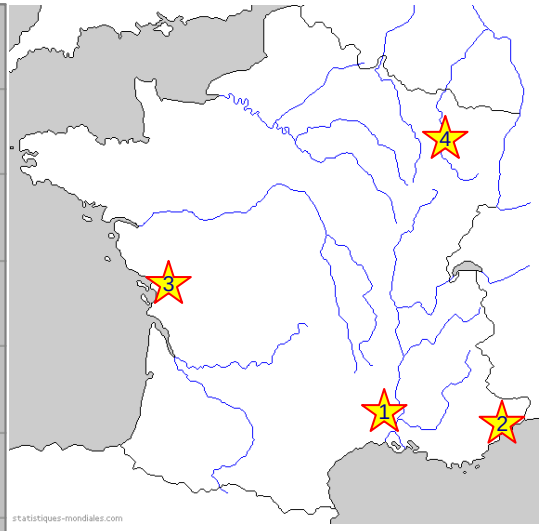
Floor surface: 100m²



SAINT-GOBAIN GLASS

Four Seasons glazing: a strong improvement of energy consumption for heating and cooling.



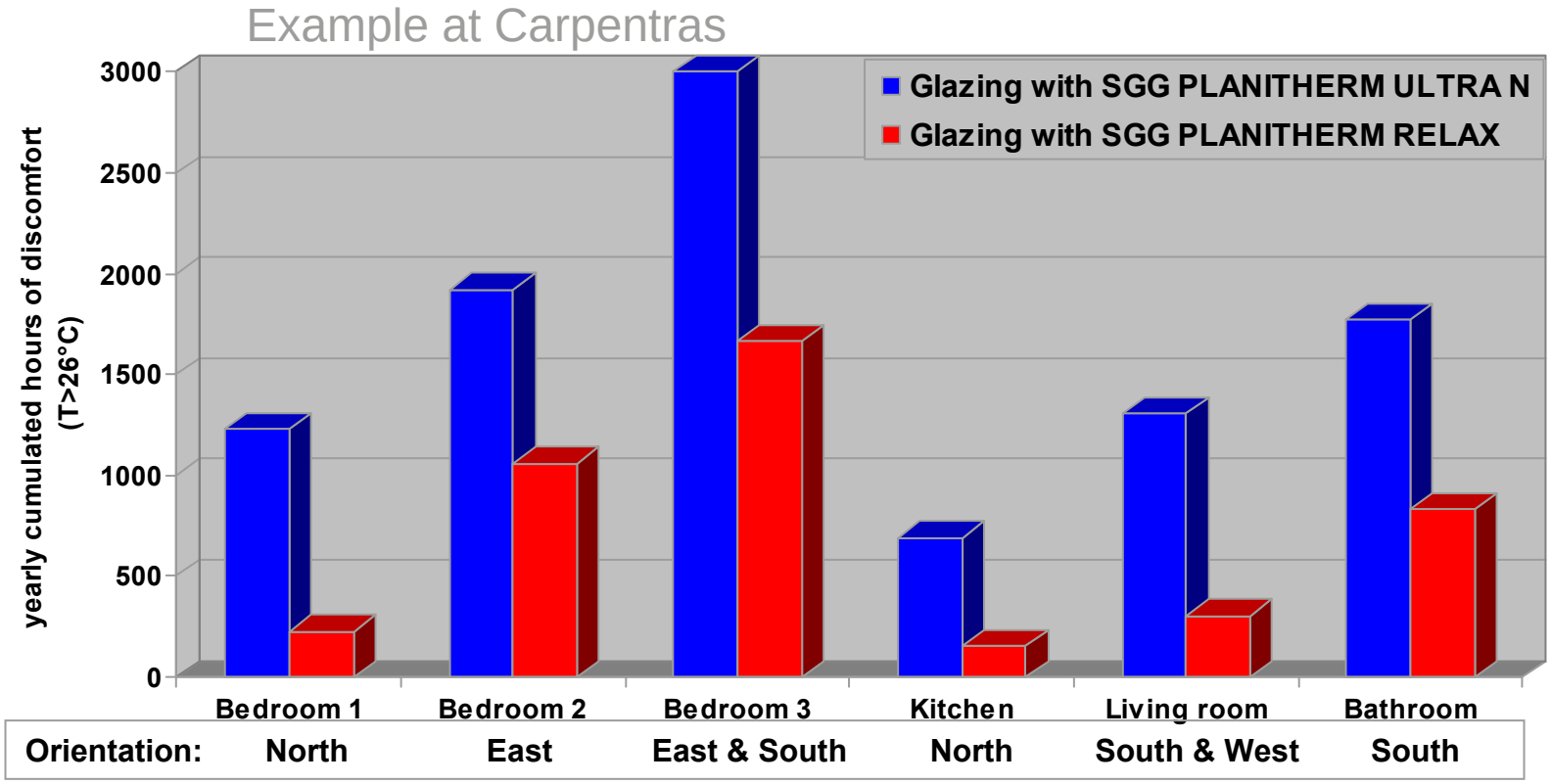


1- Carpentras
2- Nice
3- La Rochelle
4- Nancy

- Four seasons glazing reduces global energy consumption from **33% to 35%** compared to clear float glass.
- Global energy consumption quite close (but slightly higher) with Four seasons glazing compare to 'normal Low E' glazing.

SAINT-GOBAIN GLASS

Four Seasons glazing: a strong impact on comfort without air-conditioning

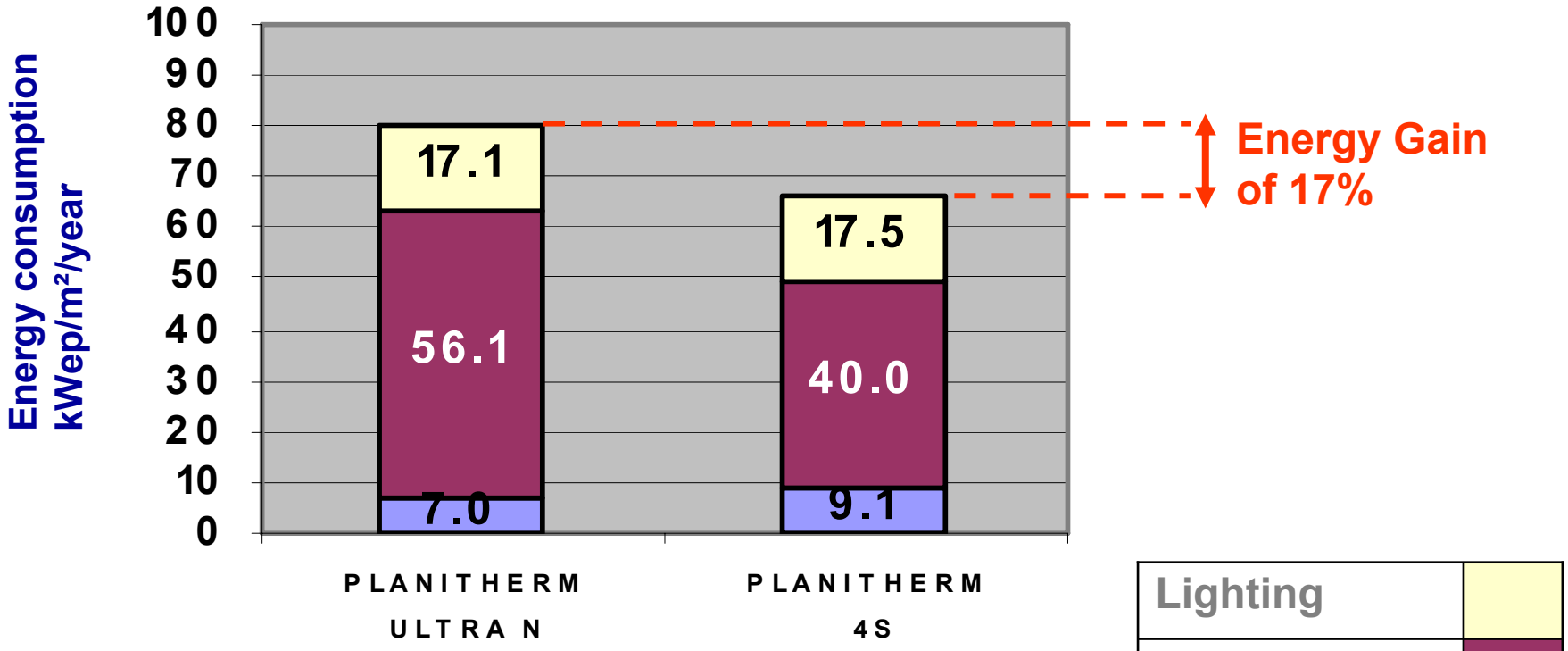


- At Carpentras: Number of hours of discomfort is divided by 2 using Four Seasons glazing instead of Low E glazing.
- At Nancy & La Rochelle: no need of air-conditioning

SAINT-GOBAIN GLASS

Case study : Main Olympic Village at Sochi

Results

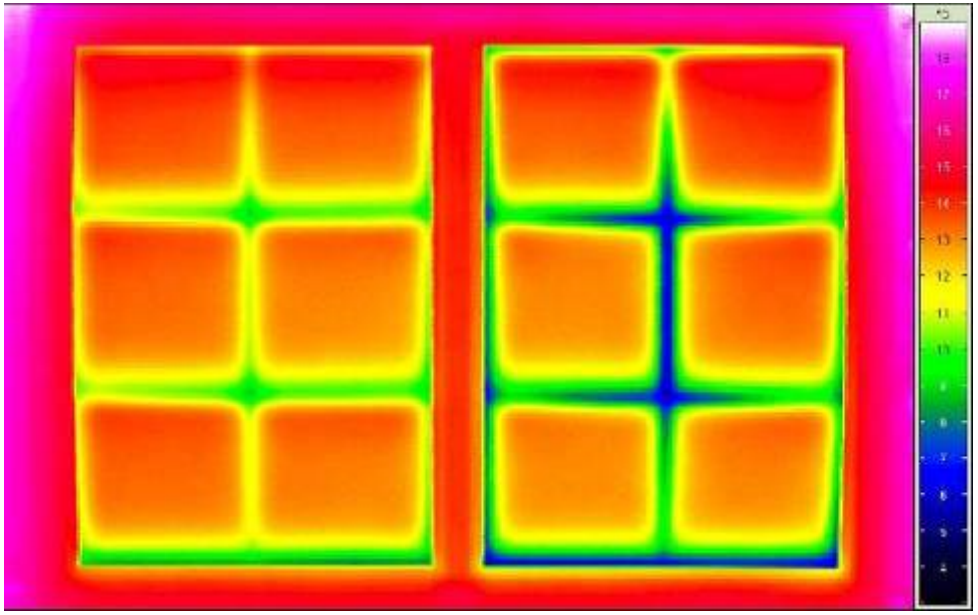


UK / IE October 2011

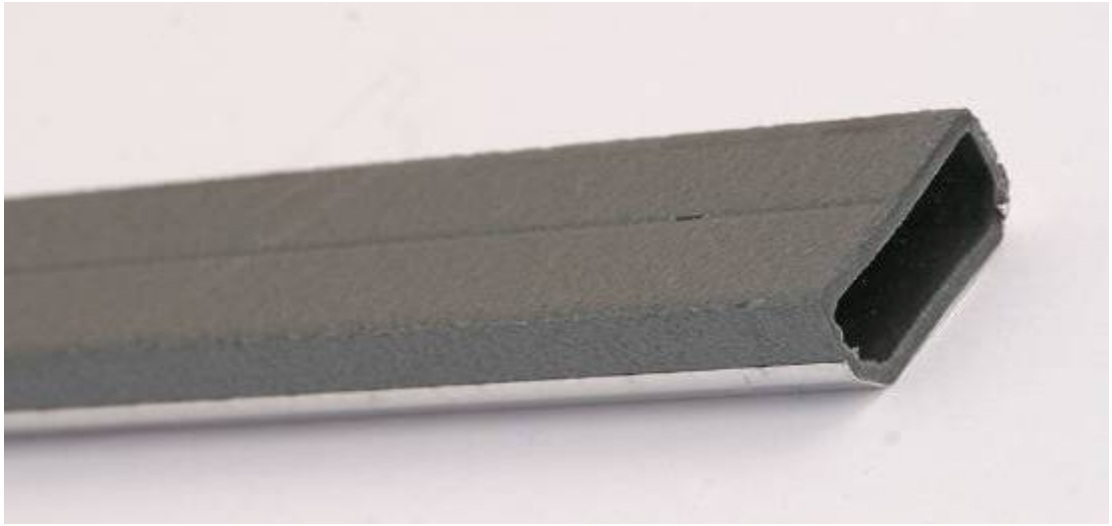
SWISSPACER
SAINT-GOBAIN

SWISSPACER – Why “Warm Edge”?

- Energy efficiency
- Cost reduction for heating and cooling
- CO_2 reduction
- Reduction of condensation
- Aesthetics
- More comfort



The product



Perfect aesthetic surface

Same geometry as standard spacer bars

The product

2 Types:

- SWS: Glass-fibre (35%) rein-forced synthetic material and aluminium foil (0.03mm)
- SWS-V: Glass-fibre rein- forced synthetic material and stainless steel foil (0.01mm)

The product

A « real » warm-edge system
with the lowest heat transmission values, available on the market(ψ),

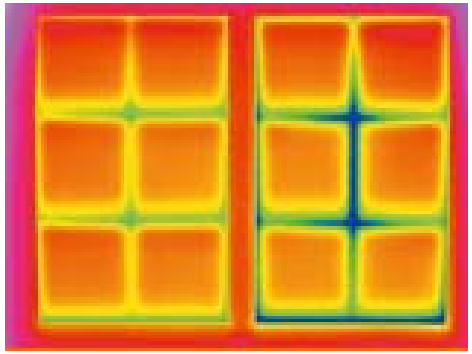
DGU, Ug 1.1 W/qmK
Psi – value

Spacer: Uf:	Wood 1,4	Alu 1,6	PVC 1,2	Wood / Alu 1,4
ALU	0.081	0.111	0.077	0.092
Stainless Steal	0.053	0.068	0.051	0.058
SWISSPACER	0.047	0.060	0.045	0.052
SWISSPACER V	0.032	0.039	0.034	0.035

The technical values were determined in accordance with ift guideline WA-08/1 „Thermally Optimised Spacers-Part 1: Determining the Representative PSI Value for Window Frame Profiles“.

The product

- Full product range :
  - **All sizes : 8, 10, 11, 12, ½" 14, 15, 16, 18, 20, 22, 24, 27 mm**
- All accessories including warm-edge Georgian Bars out of SAN



Sizes:

7,5 x 20 mm
7,5 x 24 mm
7,5 x 30 mm

9,5 x 20 mm
9,5 x 24 mm
9,5 x 30 mm

11,5 x 20 mm
11,5 x 24 mm
11,5 x 30 mm

SWISSPACER
SAINT-GOBAIN

SWISSPACER - the advantages

Aesthetics

17 different colours

SWISSPACER: Advantages

Aesthetics

SWISSPACER: Advantages

Energy saving

SGG SWISSPACER – thermische Leistung in unterschiedlichen Fensterkonstruktionen

Abstandhalter-System		2-faches Isolierglas				3-faches Isolierglas			
		Aluminium	Edelstahl	SGG SWISSPACER	SGG SWISSPACER V	Aluminium	Edelstahl	SGG SWISSPACER	SGG SWISSPACER V
Holzfenster: Rahmen-Wert: U_f = 1,4 W/m²K; Glas-Wert: U_g = 1,1 W/m²K						1,4 W/m²K; 0,7 W/m²K			
Psi-Wert	[W/m²K]	0,081	0,053	0,047	0,032	0,086	0,052	0,046	0,031
Fenster, U_W	1-flügel. [W/m²K]	1,4	1,3	1,3	1,3	1,1	1,0	1,0	1,0
Fenster, U_W	2-flügel. [W/m²K]	1,5	1,4	1,4	1,3	1,3	1,2	1,1	1,1
Minimale Oberflächentemperatur* [°C]		6,5	9,2	10,0	11,2	8,2	11,2	11,7	13,2
Kunststofffenster: Rahmen-Wert: U_f = 1,2 W/m²K; Glas-Wert: U_g = 1,1 W/m²K						1,2 W/m²K; 0,7 W/m²K			
Psi-Wert	[W/m²K]	0,077	0,051	0,045	0,034	0,075	0,048	0,042	0,032
Fenster, U_W	1-flügel. [W/m²K]	1,3	1,3	1,2	1,2	1,0	1,0	1,0	0,9
Fenster, U_W	2-flügel. [W/m²K]	1,4	1,3	1,3	1,3	1,2	1,1	1,0	1,0
Minimale Oberflächentemperatur* [°C]		7,7	10,2	10,7	12,0	9,0	11,5	12,0	13,0
Holz-Aluminiumfenster: Rahmen-Wert: U_f = 1,4 W/m²K; Glas-Wert: U_g = 1,1 W/m²K						1,4 W/m²K; 0,7 W/m²K			
Psi-Wert	[W/m²K]	0,092	0,058	0,052	0,035	0,097	0,058	0,051	0,033
Fenster, U_W	1-flügel. [W/m²K]	1,4	1,3	1,3	1,3	1,2	1,1	1,0	1,0
Fenster, U_W	2-flügel. [W/m²K]	1,6	1,4	1,4	1,3	1,3	1,2	1,1	1,1
Minimale Oberflächentemperatur* [°C]		5,0	8,2	9,0	10,5	7,2	10,2	11,0	12,5
Aluminiumfenster: Rahmen-Wert: U_f = 1,6 W/m²K; Glas-Wert: U_g = 1,1 W/m²K						1,6 W/m²K; 0,7 W/m²K			
Psi-Wert	[W/m²K]	0,111	0,068	0,060	0,039	0,111	0,063	0,056	0,034
Fenster, U_W	1-flügel. [W/m²K]	1,5	1,4	1,4	1,3	1,5	1,1	1,1	1,1
Fenster, U_W	2-flügel. [W/m²K]	1,7	1,5	1,5	1,4	1,5	1,3	1,3	1,2
Minimale Oberflächentemperatur* [°C]		7,2	10,2	10,7	12,0	9,2	12,2	12,7	14,0

Die technischen Werte wurden gemäß ift-Richtlinie WA-08/1 „Wärmetechnisch verbesserte Abstandhalter – Teil 1: Ermittlung des repräsentativen Psi-Wertes für Fensterrahmenprofile" ermittelt.

Psi-Wert: linearer Wärmedurchgang am Glasrand [W/m²K] nach EN ISO 10077-2:2003
** Entspricht den Randbedingungen der EN 10077*
Außentemperatur Ta: -5 °C
Innentemperatur Ti: +20 °C

Geometrie
Gesamtfläche: (1,23 x 1,48 m)
Fläche d. Rahmens:
Länge Glasrand:

Fenster, 1 Flügel: A_W = 1,82 m² A_f = 0,55 m² l_g = 4,54 m
Fenster, 2 Flügel: A_W = 1,82 m² l_g = 6,84 m

Aluminiumfenster: Rahmen-Wert: U_f = 1,6 W/m²K; Glas-Wert: U_g = 1,1 W/m²K					
Psi-Wert	**[W/m²K]**	**0,111**	**0,068**	**0,060**	**0,039**
Fenster, U_W	1-flügel. [W/m²K]	1,5	1,4	1,4	1,3
Fenster, U_W	2-flügel. [W/m²K]	1,7	1,5	1,5	1,4
Minimale Oberflächentemperatur* [°C]		7,2	10,2	10,7	12,0

Reduction of Uw by
0,3 W/m²K
through SWISSPACER V

SWISSPACER
SAINT-GOBAIN

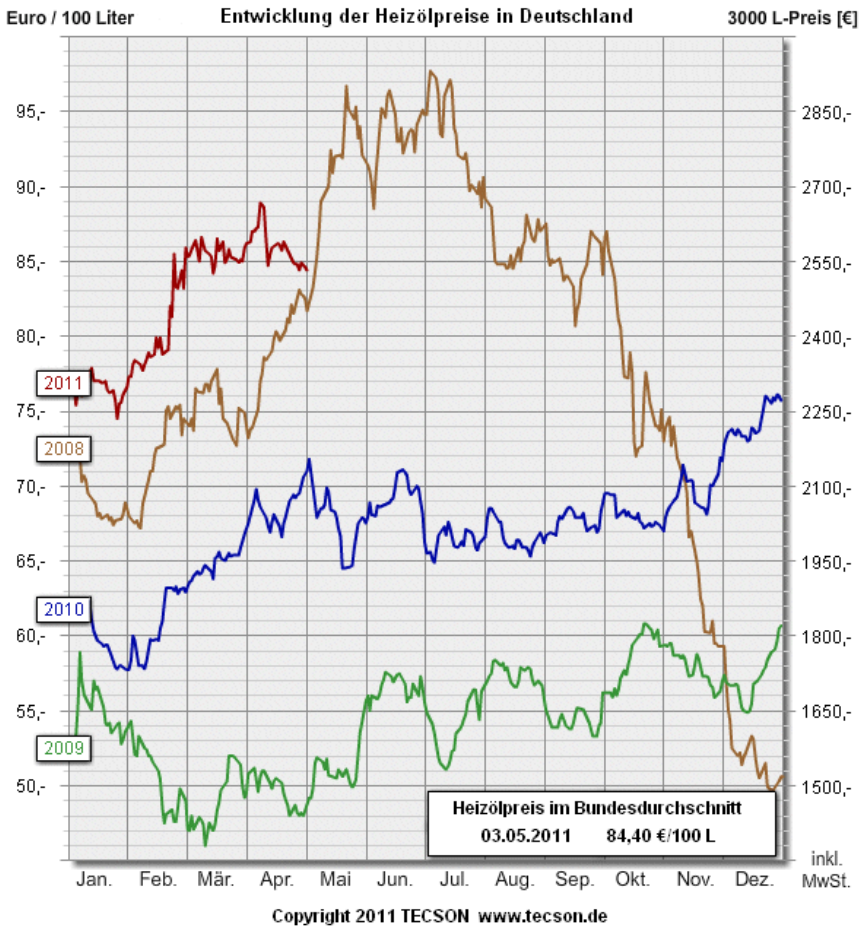
SWISSPACER: Advantages

Energy saving

<u>General calculation</u>

Savings: A reduction by 0,1 of the Uw – value means saving 1,2 ltr. heating oil / m² / year. 30 m² surface area in a single house means:

Savings / year
2006 = 68.05 €
2007 = 70.20 €
2008 = 97.20 €
2009 = 59.40 €
2010 = 71.30 €
2012 = ???



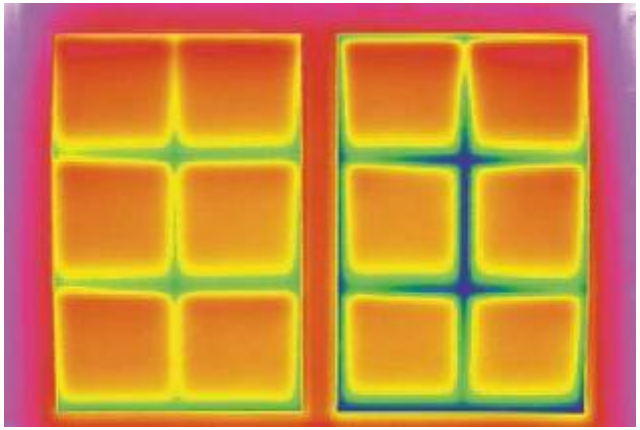
SWISSPACER
SAINT-GOBAIN

SWISSPACER: Advantages

Comfort

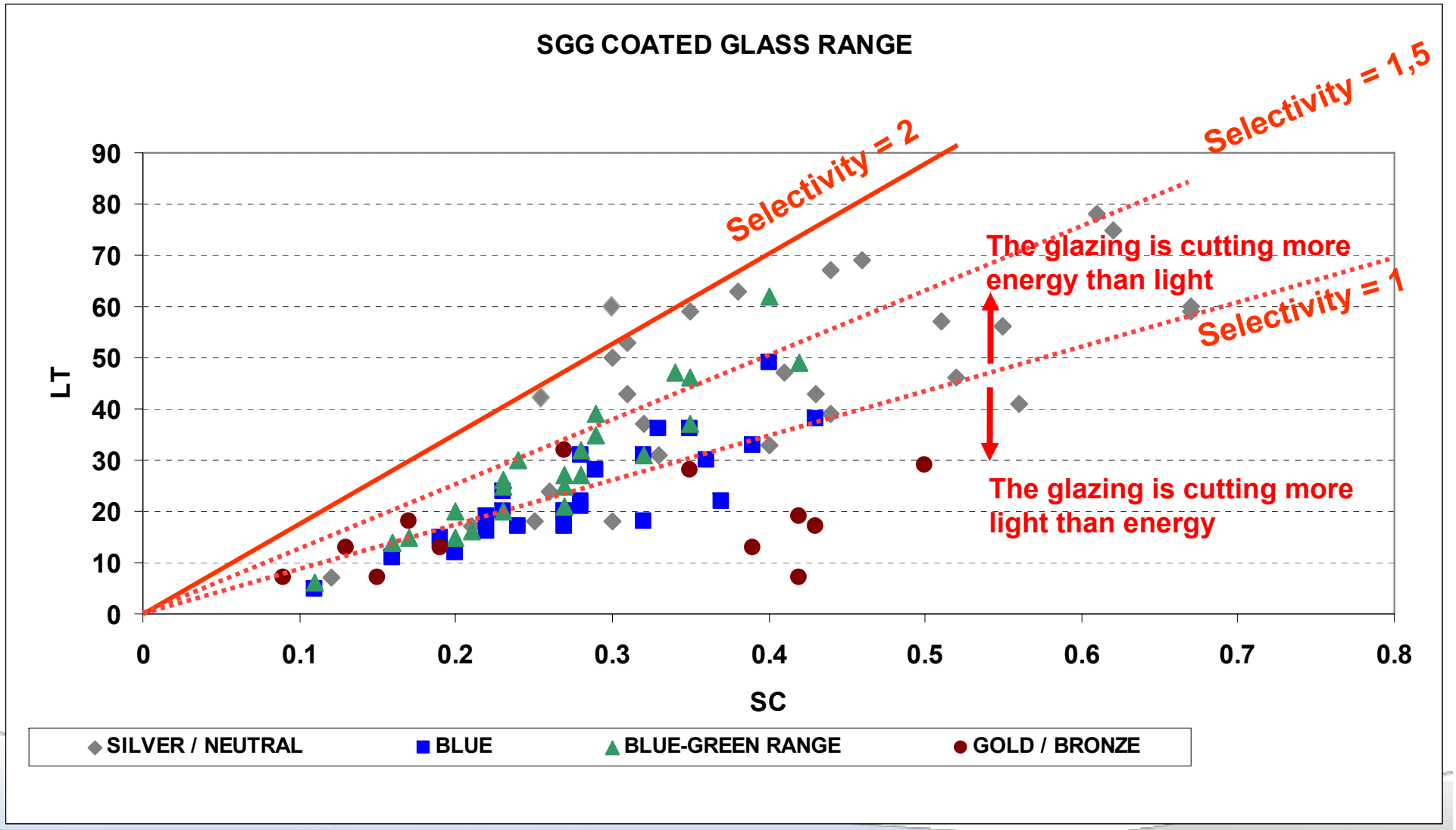
With SWISSPACER

Without SWISSPACER



SWISSPACER
SAINT-GOBAIN

SGG Solar Control coated glass range



g-value = SC x 0.87

SAINT-GOBAIN GLASS

Facade market
Solar control coated glass

Selectivity

Benefits

Markets

„Best“

SGG COOL-LITE XTREME (II)

SGG COOL-LITE SKN / SKN II

Cooling + heating + lighting energy savings

USA
Europe/Russia
Middle East
Singapore

„Better“

SGG COOL-LITE KT

SGG COOL-LITE E II

Cooling + heating energy savings

Middle East
Asia

„Good“

SGG COOL-LITE ST

SGG ANTELIO

SGG REFLECTASOL

Cooling energy savings

Middle East
Africa
Europe / Russia
Central Asia
South East Asia

SAINT-GOBAIN GLASS

SGG COOL-LITE

A complete range of solar control coatings

- SGG COOL-LITE ST series
- SGG COOL-LITE KT series
- SGG COOL-LITE SKN series
- SGG COOL-LITE XTREME

SAINT-GOBAIN
GLASS



SGG COOL-LITE ST series



SAINT-GOBAIN
GLASS

SGG COOL-LITE ST

- Major product advantage : **can be heat-treated** after the deposition of the coating (one single stock product)
- **Has no low-E properties** : must be combined with SGG PLANITHERM in case enhanced thermal insulation is required
- Manufactured in **jumbo sizes**, 3210 × 6000 mm (Europe), 3660 x 2440 or 2540 mm (India, China), and **stock sizes** (DLF)
- Main markets for **SGG COOL-LITE ST** : **India, China, Southern parts of Europe and Middle East**
- Coating always on **surface # 2**

SGG COOL-LITE ST on clear glass

- Performances of SGG COOL-LITE **ST** deposited on SGG PLANILUX

Product	LT	LR_E	g	U	Color	Selec-tivity
SGG COOL-LITE **ST 167**	59	22	0.58	2.8	Neutral	1.02
SGG COOL-LITE **ST 150**	46	20	0.46	2.8	Neutral grey	1.00
SGG COOL-LITE **ST 136**	33	23	0.34	2.8	Silver / grey	0.97
SGG COOL-LITE **ST 120**	18	32	0.22	2.8	Silver	0.82
SGG COOL-LITE **ST 108**	7	44	0.10	2.8	Silver	0.70
SGG COOL-LITE **STB 136**	33	18	0.34	2.8	Blue	0.97
SGG COOL-LITE **STB 120**	20	23	0.24	2.8	Blue	0.83

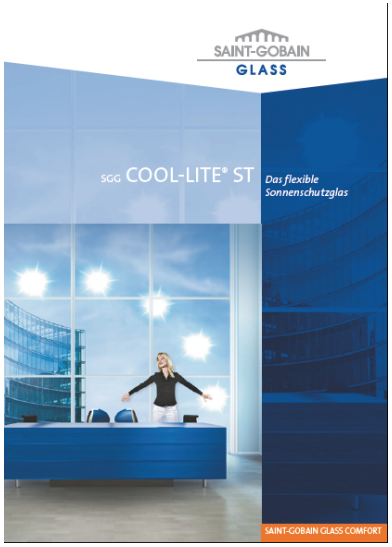
DGU : 6 ST 1xx + 12 air + 6 clear - Solar control coating #2

Remark : the value of LT decreases due to the presence of the second glass of the DGU

SAINT-GOBAIN GLASS

SGG COOL-LITE ST

A complete range of temperable Solar Control Coatings



Non selective

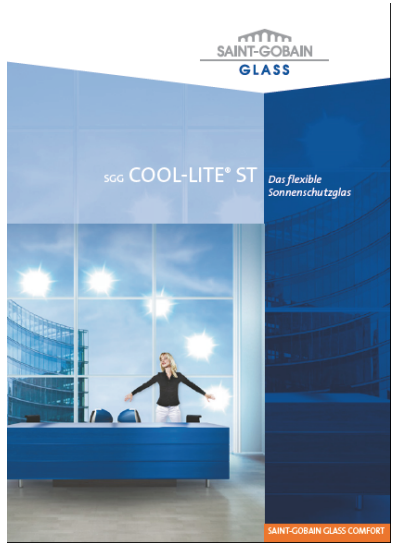
	T_L	R_L	g	U	Colour	Selectivity
SGG COOL-LITE ST 167	60	20	0,48	1,1	neutral	1,25
SGG COOL-LITE ST 150	46	19	0,37	1,1	neutral/blue	1,24
SGG COOL-LITE ST 136	33	23	0,28	1,1	neutral/blue	1,18
SGG COOL-LITE ST 120	18	32	0,17	1,1	silver	1,06
SGG COOL-LITE ST 108	7	44	0,08	1,1	silver	0,88
SGG COOL-LITE STB 136	33	17	0,27	1,1	blue	1,22
SGG COOL-LITE STB 120	20	22	0,18	1,1	blue	1,11

(6-16-4 - Argon 90 % - COOL-LITE ST coating #2 / Planitherm Ultra N coating #3)

Available as well on Parsol Green (Spain, India) and on Parsol Sapphire Blue (India)

SAINT-GOBAIN
GLASS

SGG COOL-LITE ST

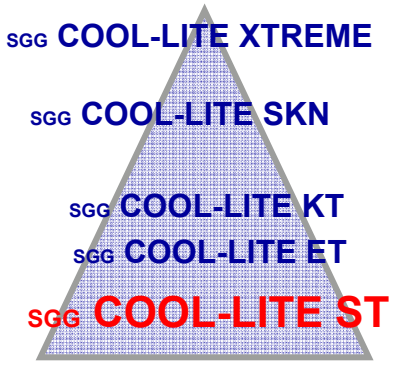


A wide range of processing possibilities

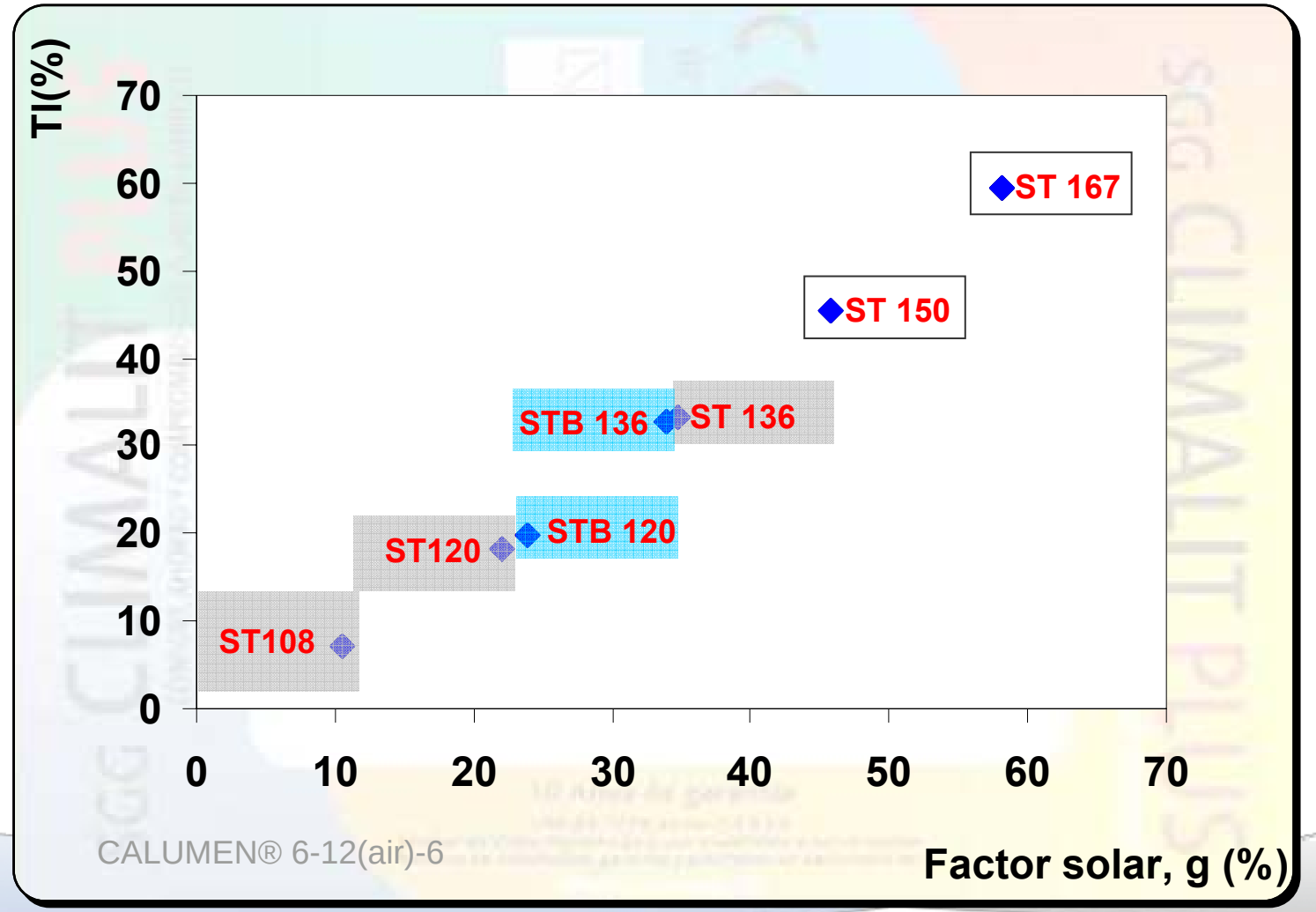
SGG COOL-LITE ST

- can only be used with coating on face #2
- can be used as single glazing
- can be tempered,
- can be curved (with the exception of STB)
- can be laminated
- can be laminated coating against the PVB
- can be enamelled
- does not require edge striping
- may be combined with Planitherm for improved U-value

SGG COOL-LITE ST on clear : Graph LT – g-value



SGG COOL-LITE ST



SAINT-GOBAIN GLASS

SGG COOL-LITE ST on green glass

- Performances of SGG COOL-LITE **ST** deposited on PARSOL **GREEN**

Product	LT	LR_E	g	U	Color	Selec-tivity
SGG COOL-LITE **ST 467**	49	16	0.36	2.8	Green	1.36
SGG COOL-LITE **ST 450**	37	15	0.30	2.8	Green	1.23
SGG COOL-LITE **ST 436**	27	17	0.25	2.8	Green	1.08
SGG COOL-LITE **ST 420**	15	23	0.18	2.8	Green	0.83
SGG COOL-LITE **ST 408**	6	32	0.10	2.8	Green	0.60
SGG COOL-LITE **STB 436**	27	14	0.24	2.8	Blue - green	1.13
SGG COOL-LITE **STB 420**	16	23	0.18	2.8	Blue - green	0.89

DGU : 6 ST 4xx + 12 air + 6 clear - Solar control coating #2

SGG COOL-LITE ST on blue glass

- Performances of SGG COOL-LITE **ST** deposited on PARSOL **BLUE**

Product DGU with SGG PLANILUX	LT	LR_E	g	U	Color	Selec-tivity
SGG COOL-LITE **ST** 767	38	12	0.37	2.8	Blue	1.03
SGG COOL-LITE **ST** 750	29	11	0.31	2.8	Blue	0.94
SGG COOL-LITE **ST** 736	22	12	0.25	2.8	Blue	0.88
SGG COOL-LITE **ST** 720	12	12	0.18	2.8	Blue	0.67
SGG COOL-LITE **ST** 708	5	21	0.10	2.8	Blue	0.50
SGG COOL-LITE **STB** 736	21	10	0.24	2.8	Blue	0.88
SGG COOL-LITE **STB** 720	13	12	0.19	2.8	Blue	0.68

DGU : 6 ST 7xx + 12 air + 6 clear - Solar control coating #2

SGG COOL-LITE KT

KNT 164 Non temp.	KNT 164 tempered	KBT 140 Non temp.	KBT 140 tempered	KNT 155 Non temp.	KNT 155 tempered

SAINT-GOBAIN GLASS

SGG COOL-LITE KT

Temperable coatings combining solar control and low-e performance

SGG COOL-LITE KT coatings…

- are selective (Light / Solar Gain)
- offer solar control performance & low-E performance in one coating
- neutral or blue in colour of reflection
- will be used with coating on face #2
- require assembling into a DGU
- can be tempered / heat treated / bent (single stock product)
- can be laminated
- can be laminated with coating against the PVB
  (> application as single glazing)
- do require edge stripping

SGG COOL-LITE KT

Temperable coatings combining solar control and low-e performance

Selective

	LT	LR	g	U	Colour	LT / g
SGG COOL-LITE KNT 164	58	14	0.45	1,5	Neutral	1,29
SGG COOL-LITE KNT 155	48	17	0.37	1,5	Neutral	1,30
SGG COOL-LITE KNT 140	37	23	0.28	1,3	Neutral/ Silver	1,32
SGG COOL-LITE KBT 140	36	24	0.30	1,4	Blue	1,20

(6-16-4 - Argon 90 % - KT coating surface #2)

Available as well on Parsol Green (Spain, India) and on Parsol Sapphire Blue (India)

SAINT-GOBAIN
GLASS

Solar Control range SGGCOOL-LITE

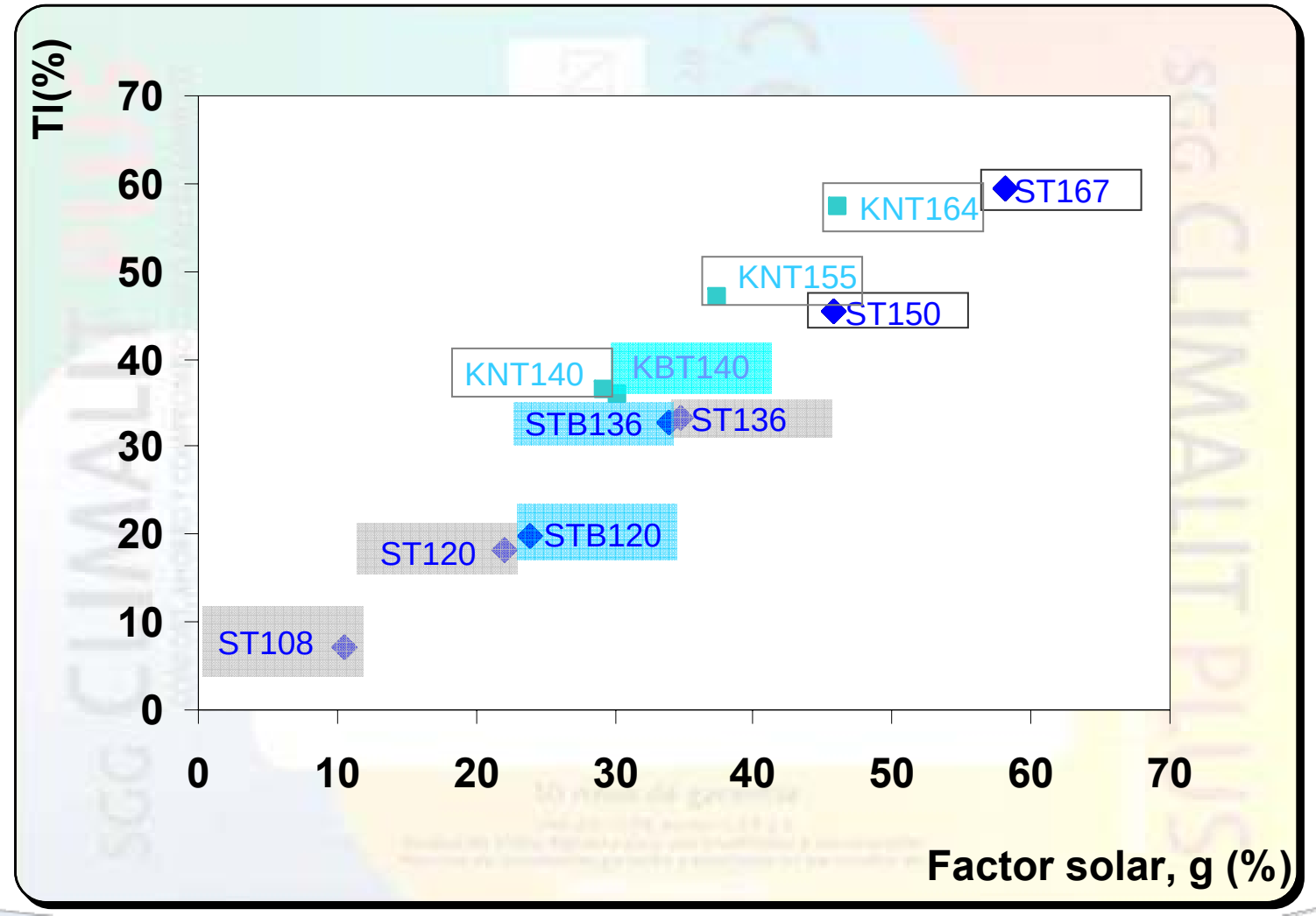
Selectivity: LT / g

SGG COOL-LITE SKN

SGG COOL-LITE KT

SGG COOL-LITE ST

SGG COOL-LITE KT



SAINT-GOBAIN GLASS

SGG COOL-LITE KT on green glass

- Performances of SGG COOL-LITE KT deposited on SGG PARSOL GREEN

	LT	LR_E	g	U	Color	Selec-tivity
SGG COOL-LITE KNT 464	47	11	0.30	1.4	Green	1.57
SGG COOL-LITE KNT 455	39	13	0.25	1.4	Green	1.56
SGG COOL-LITE KNT 440	30	17	0.21	1.3	Green	1.43

DGU : 6 KT 4xx + 16 argon + 6 clear - Solar control coating #2

SGG COOL-LITE KT on blue glass

- Performances of SGG COOL-LITE KT deposited on SGG PARSOL BLUE

	LT	LR_E	g	U	Color	Selec-tivity
SGG COOL-LITE KNT 764	37	8	0. 2 9	1.4	Blue	1.28
SGG COOL-LITE KNT 755	31	10	0.24	1.4	Blue	1.29
SGG COOL-LITE KNT 740	24	12	0.20	1.3	Blue	1.20

DGU : 6 KT 7xx + 16 argon + 6 clear - Solar control coating #2

SGG COOL-LITE SKN series

A unique range of high selective coatings !

SAINT-GOBAIN
GLASS

SGG COOL-LITE SKN
The best choice series…

Main Characteristics

- Best available selectivity (Light / Solar Gain)
- High transparency
- Uniform and stable in colour
- Excellent performance in controlling solar gains and heat-losses
- Attractive aesthetics
- **Four 'to be tempered' versions available ("SKN II")**
  - Easily available, high degree of flexibility, shorter lead-times when processing the glass
  - higher added value through in-house tempering

SGG COOL-LITE SKN

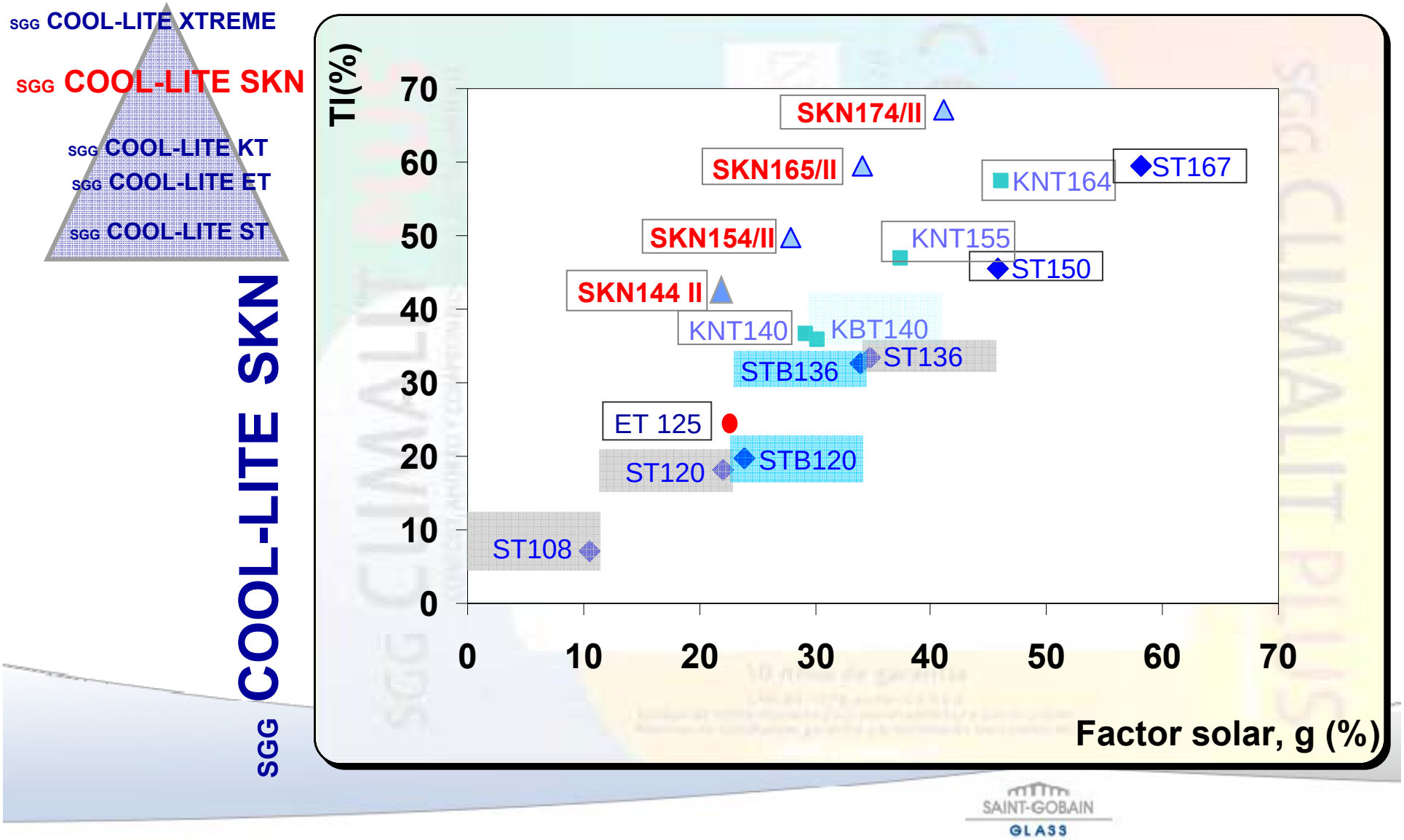
- The **high selective coatings** combining high performance solar control, **high neutrality** and **lowest** possible **emissivity**

DGU 6-16-6 - Argon 90 % - solar control coating #2) CEN standard	LT	LR_E	g	U	Selectivity	Temperable
SGG COOL-LITE SKN 174	68	11	0.41	1.1	1.66	NO
SGG COOL-LITE SKN 174 II	68	11	0.41	1.1	1.66	YES
SGG COOL-LITE SKN 165	60	15	0.32	1.1	1.68	NO
SGG COOL-LITE SKN 165 II *	60	15	0.32	1.1	1.68	YES
SGG COOL-LITE SKN 154	50	17	0.27	1.1	1.85	NO
SGG COOL-LITE SKN 154 II	50	17	0.27	1.0	1.85	YES
SGG COOL-LITE SKN 144 II	40	21	0.22	1.0	1.82	YES

*** It exists a variation produced in China, called SKN 163 II with LT 59% ; g 0.34 ; U 1.1**

SAINT-GOBAIN GLASS

SGG COOL-LITE SKN : Graph LT – g-value



SAINT-GOBAIN GLASS

SGG COOL-LITE SKN

- **SGG COOL-LITE SKN 174 II, SKN 165 II, SKN 154 II and SKN 144 II are** the most recent innovations in the SKN serie.

- Those SKN II variations are the first high selective solar control coatings on the markets which allow for a heat treatment after the deposition of the coating.

- Both so-called 'to be tempered' coatings achieve their performance and aesthetics only after tempering. So they must be heat-treated before use.

- After tempering, they match in colour and performance with the annealed versions COOL-LITE SKN 174, SKN 165 and SKN 154.

- SKN 144 exists only in ‘to be tempered’ version.

SAINT-GOBAIN
GLASS

SGG COOL-LITE SKN on tinted glass

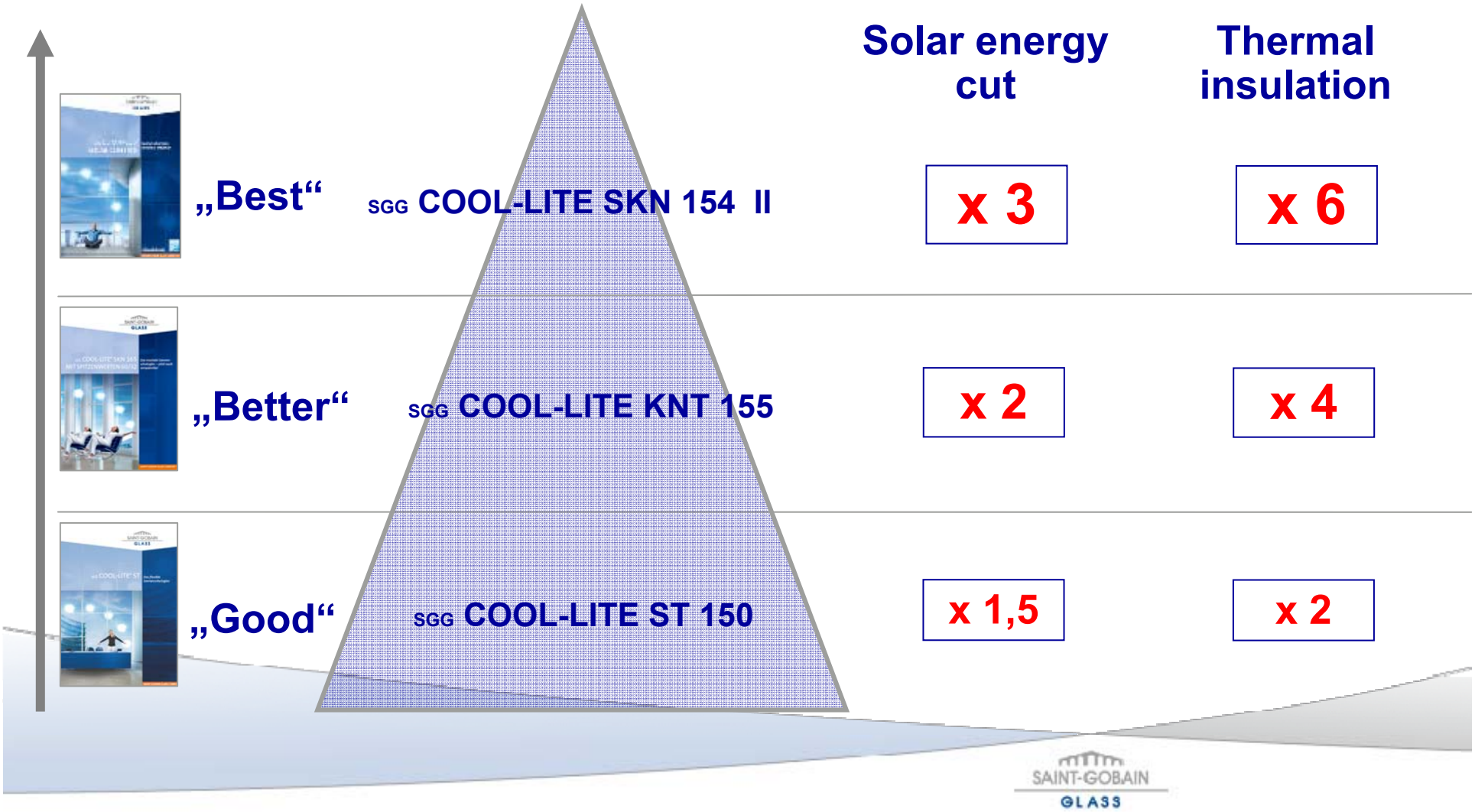
- The **SKN II serie** includes now some coatings on **green** and **blue** **tinted glass,** produced in **India.**

(6-16- 6 - Argon 90 % - solar control coating #2) CEN standard	LT	LR_E	g	SC ISO	U	Selec -tivity	Color	Temper -able
SGG COOL-LITE SKN 154 II	50	17	0.27	0.29	1.0	1.85	Neutral	YES
SGG COOL-LITE SKN 454 II	41	14	0.22	0.23	1.0	1.86	Green	YES
SGG COOL-LITE SKN 754 II	32	10	0.20	0.21	1.0	1.60	Blue	YES
SGG COOL-LITE SKN 144 II	40	21	0.22	0.24	1.0	1.82	Neutral	YES
SGG COOL-LITE SKN 444 II	33	15	0.18	0.19	1.0	1.83	Green	YES
SGG COOL-LITE SKN 754 II	26	11	0.16	0.18	1.0	1.63	Blue	YES

SAINT-GOBAIN GLASS

Solar Control Coated Glass
Examples of product benefits

For LT = 50%



Comparison with a 6mm clear glass

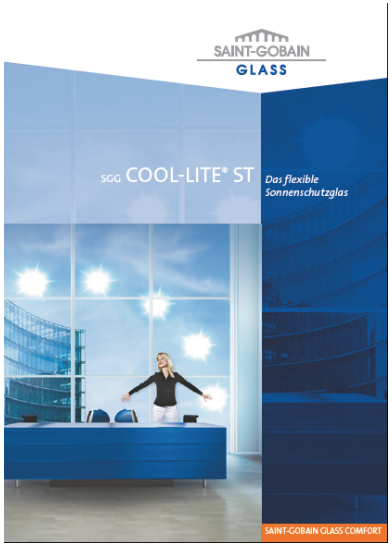
	Solar energy cut	Thermal insulation
„Best“ SGG COOL-LITE SKN 154 II	x 3	x 6
„Better“ SGG COOL-LITE KNT 155	x 2	x 4
„Good“ SGG COOL-LITE ST 150	x 1,5	x 2

SAINT-GOBAIN GLASS

…… and how do the three SGG COOL-LITE series compare ?

SAINT-GOBAIN
GLASS

SGG COOL-LITE
Light transmission LT = 60%

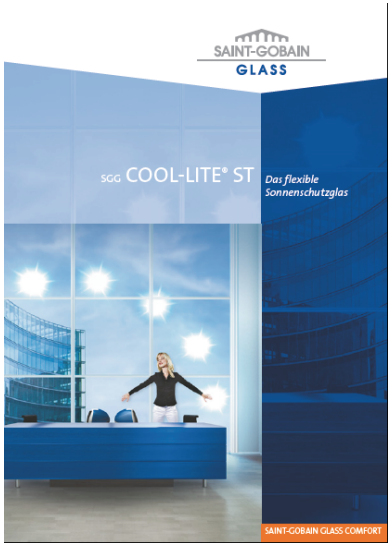


	T_L	R_L	g	U	Colour	Selectivity
SGG COOL-LITE ST 167	60	22	0,59	2,7	neutral	1,02
SGG COOL-LITE ST 167+ UN	60	20	0,48	1,1	neutral	1,25
SGG COOL-LITE KNT 164	58	14	0,45	1,5	neutral	1,29
SGG COOL-LITE SKN 165	**60**	**15**	**0,33**	**1,1**	**neutral**	**1,82**

(6-16-4 - Argon 90 % - solar control coating #2)

SGG COOL-LITE

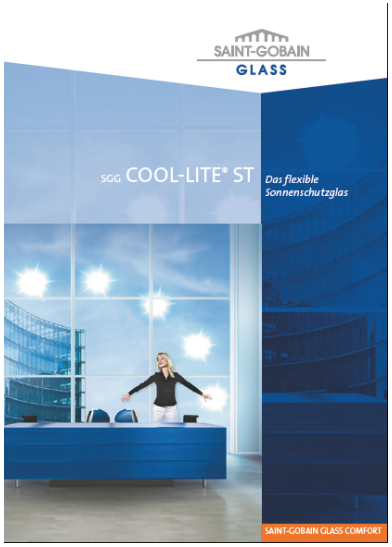
Light transmission LT = 50%



	T_L	R_L	g	U	Colour	Selectivity
SGG COOL-LITE ST 150	46	20	0,46	2,7	neutral	1
SGG COOL-LITE ST 150+UN	46	19	0,37	1,1	neutral	1,24
SGG COOL-LITE KNT 155	48	17	0,37	1,3	neutral	1,30
SGG COOL-LITE SKN 154	**50**	**17**	**0,27**	**1,1**	**neutral**	**1,85**

(6-16-4 - Argon 90 % - solar control coating #2)

SGG COOL-LITE
Light transmission LT = 40%



	T_L	R_L	g	U	Colour	Selectivity
SGG COOL-LITE ST 136	34	23	0,35	2,6	neutral	0,97
SGG COOL-LITE ST 136+UN	33	23	0,28	1,1	neutral	1,18
SGG COOL-LITE KNT 140	37	23	0,28	1,3	neutral	1,32
SGG COOL-LITE SKN 144 II	**41**	**24**	**0,23**	**1,1**	**neutral**	**1,78**

(6-16-4 - Argon 90 % - solar control coating #2)

SGG COOL-LITE XTREME

SAINT-GOBAIN
GLASS

SGG COOL-LITE XTREME 60 / 28

Triple silver coating

- The **extremely high selective coating** combining high performance solar control with lowest possible emissivity

(6-16-4 - Argon 90 % - solar control coating #2) CEN standard	LT	LR_E	g	U	Selectivity	Temperable
SGG COOL-LITE XTREME 60/28	60	14	0.28	1.0	2.14	NO
SGG COOL-LITE XTREME 60/28 II*	60	14	0.28	1.0	2.14	YES

* Full release 2012

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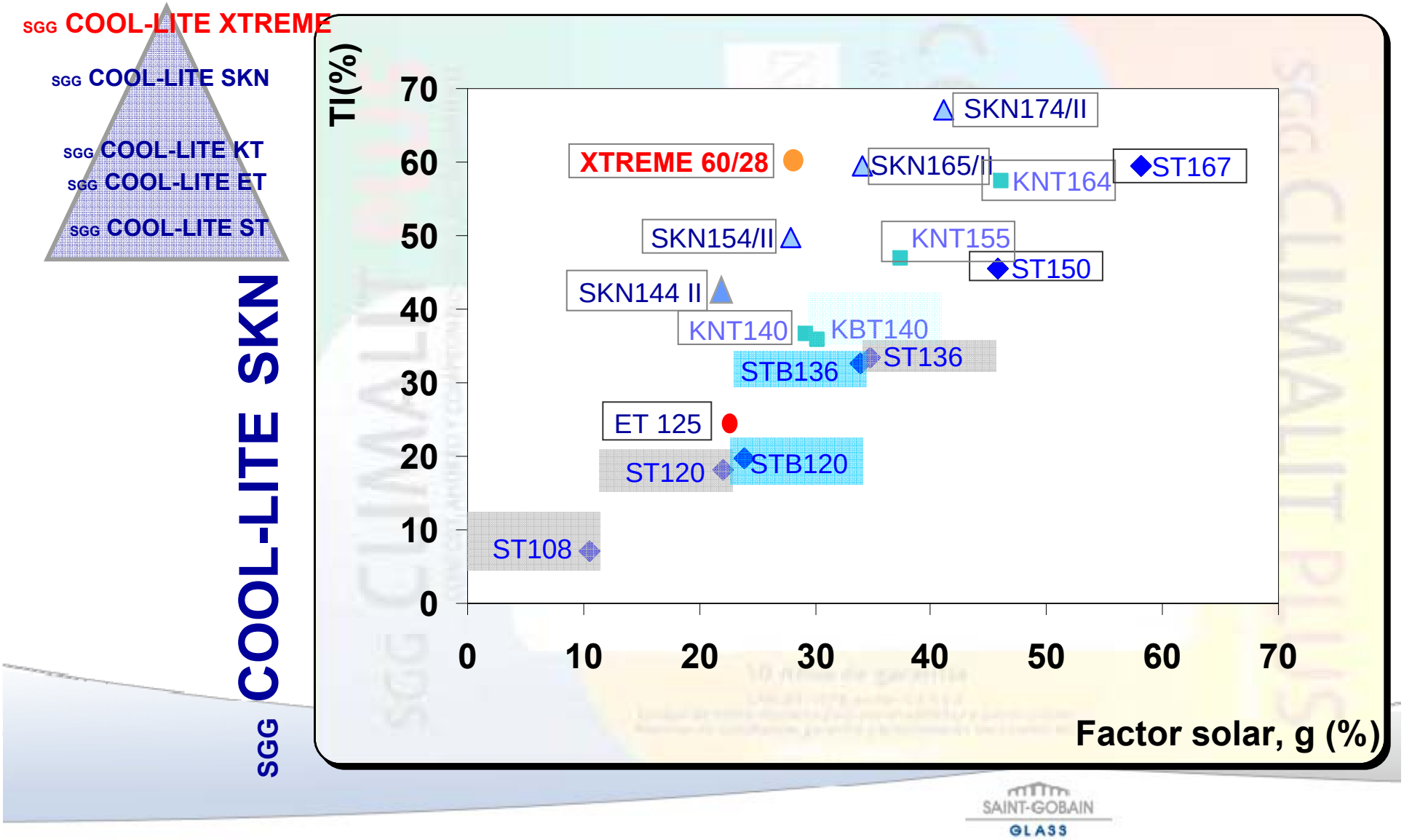
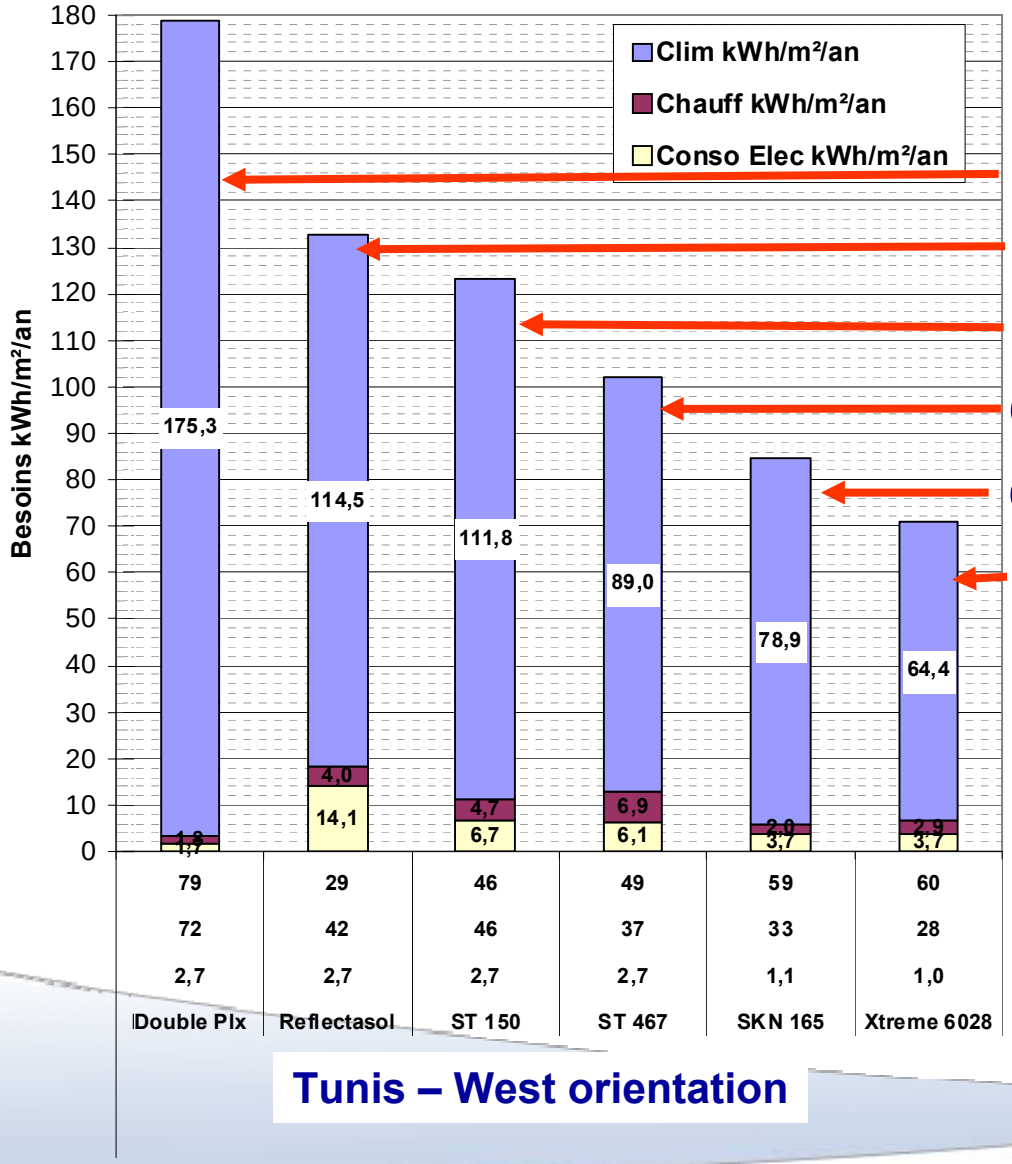
GLASS

SGG COOL-LITE XTREME : Graph LT – g-value



Impact of coated glass on energy consumption of buildings – Hot climate



Tunis – West orientation

Energy Saving

Clear Float

Reflectasol 'good')

Cool-Lite ST 150 ('good') **31%**

Cool-Lite ST 467 ('better')

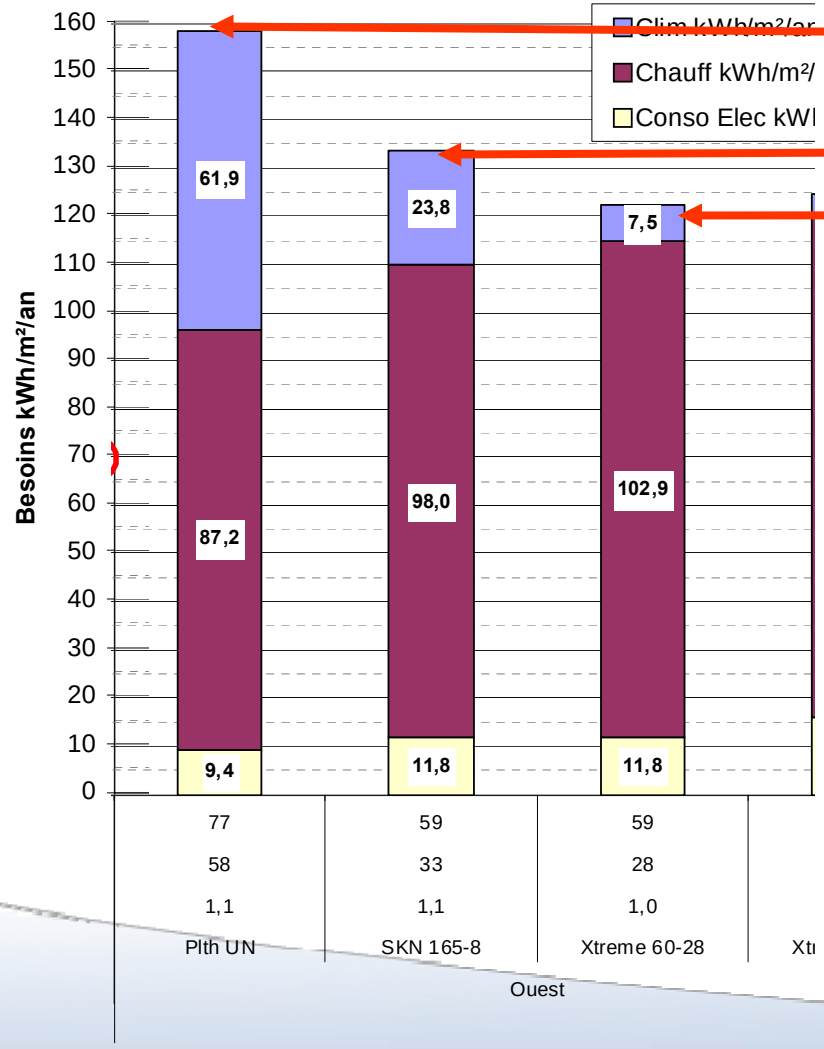
Cool-Lite SKN 165 ('best') **53%**

Cool-Lite XTREME 60-28 **66%**

Simulation done with TRNSYS
Office building
Insulation level : current building french regulation

SAINT-GOBAIN GLASS

Impact of coated glasses on the energy consumption - cold climate (Stockholm)



Planitherm Ultra N **REF**

Cool-Lite SKN 165 **16%**

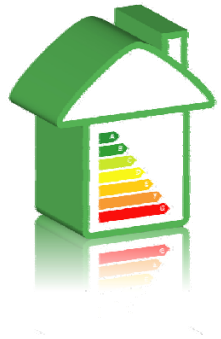
Cool-Lite XTREME 60-28 **23%**

Energy Saving

SAINT-GOBAIN GLASS

UK Building Regulations

2013 Amendments to Document L – 2A & B (non-dwellings)



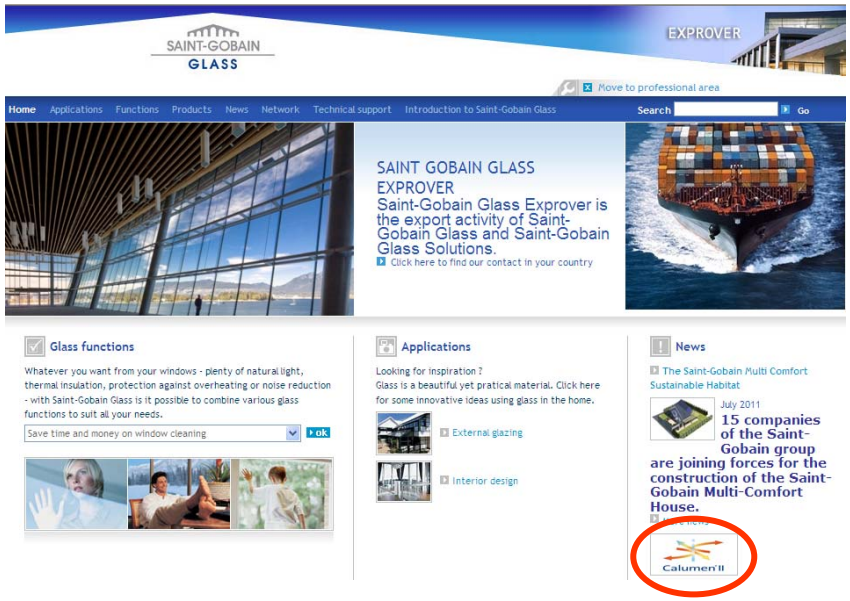
- Conservation of fuel and power in New non-Dwellings
  - The calculated rate of CO_2 emissions must not be greater than the TER
  - Proposed 11% or 20% uplift over 2010
  - Propose Uw from 2.2 to 1.4 (heated buildings) and 1.8 (a/c buildings)
  - Add max g-value of 0.4 and LT of 71%.
  - Response TBC as highly technical calculation

- Conservation of fuel and power in Existing non-Dwellings
  - Window standard tightened to WER band B, or Uw 1.4 for “domestic” buildings and Uw 1.8 for all others.
  - Centre Pane U value (1.2) still permitted, but is for glass only (not the whole IGU).
  - All agreed

Energy efficient coatings
Marketing tools

Calculation Software

Calumen online on www.exprover.saint-gobain-glass.com



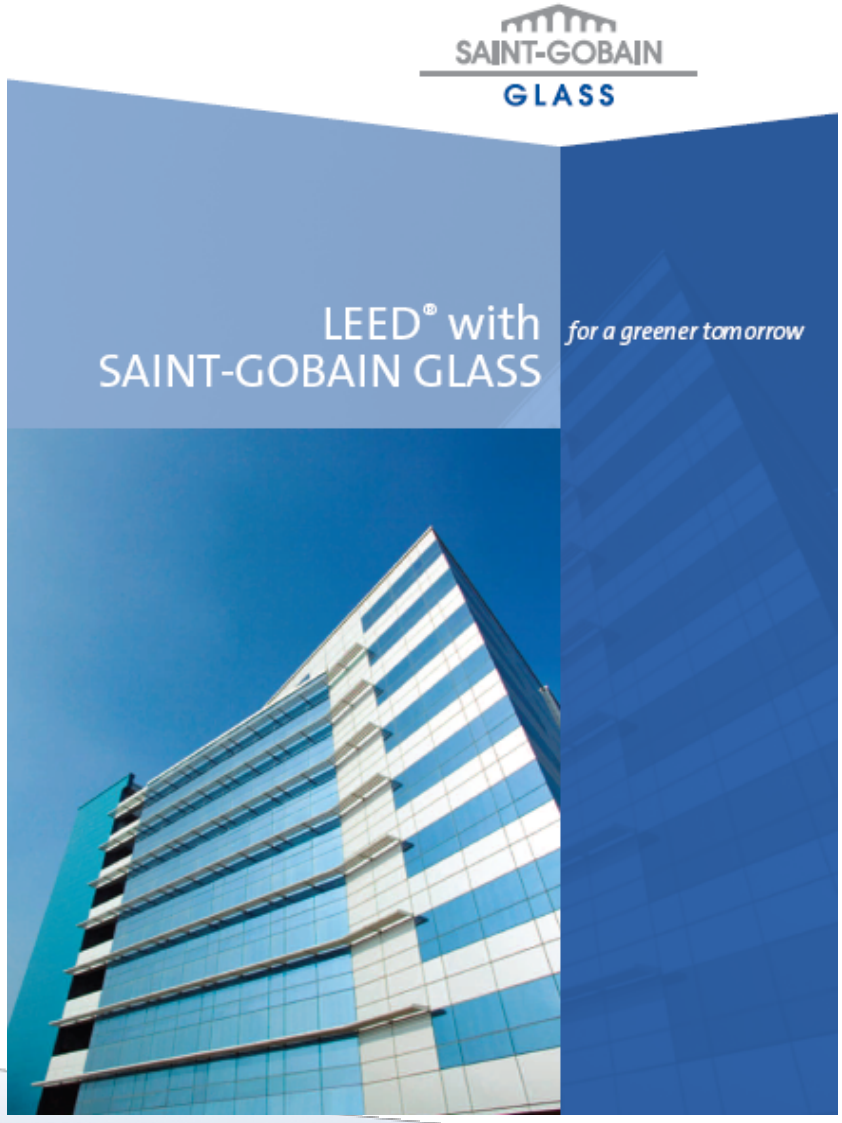
Product documentations

Covering:

- Applications
- Advantages
- Product Description
- Combinations
- Range
- Processing
- Specifications

SAINT-GOBAIN
GLASS

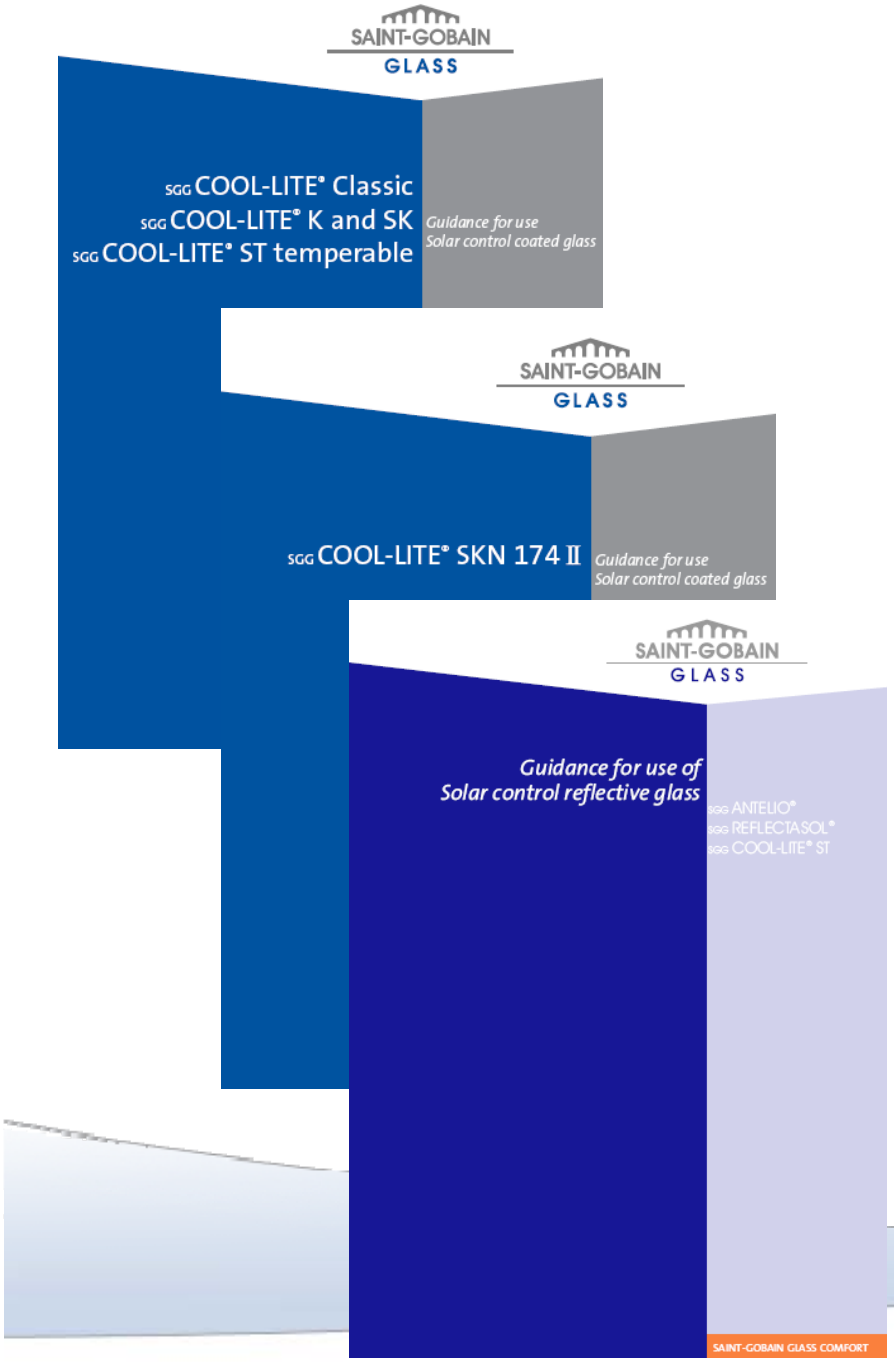
LEED 3.0 leaflet



Covering:

- Summary of chapters
- Requirements
- SGG contribution

Guidance for use



Covers:

- Receipt of glass
- Storage
- Cutting
- Edge Deletion
- Washing
- Toughening
- IGU Manufacture
- Shelf Life
- Quality

PLANITHERM handling DVD (UK version)

- Training DVD on handling PLANITHERM correctly
- Begins with promotional video
- Can be used for new starters or as a refresher
- Covers handling, toughening, washing, IGU manufacture

Coating detectors

Applicable for :

- Single glazing
- Double Glazing Unit
  - . Coating on surfaces # 1, #2, #3 or #4

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

5 | A look at the future

6 | Interior - Design

SAINT-GOBAIN GLASS

The human perception of sound level

50 dB

x 2

+ 3 dB

53 dB

50 dB

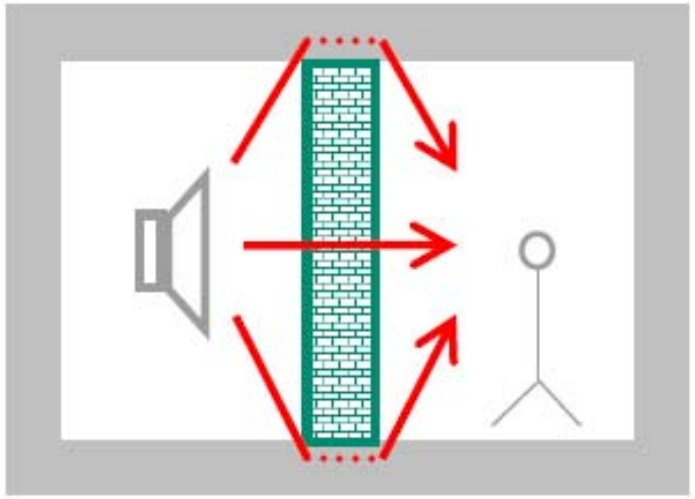
x 10

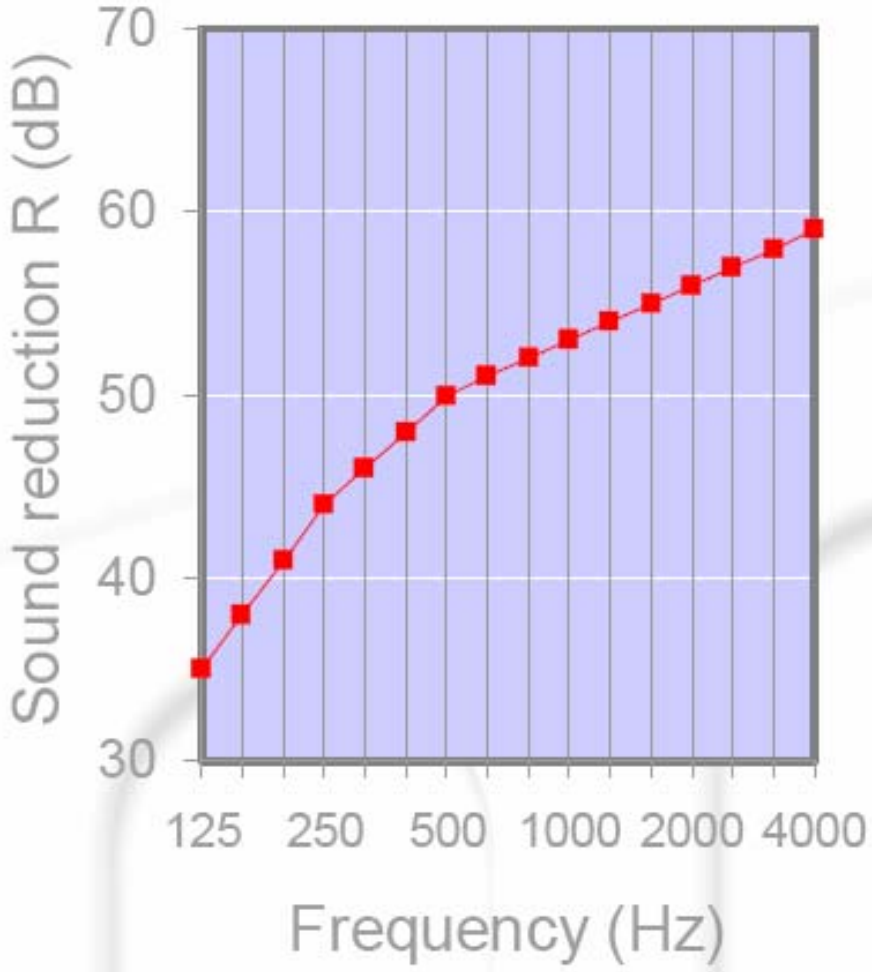
+ 10 dB

60 dB

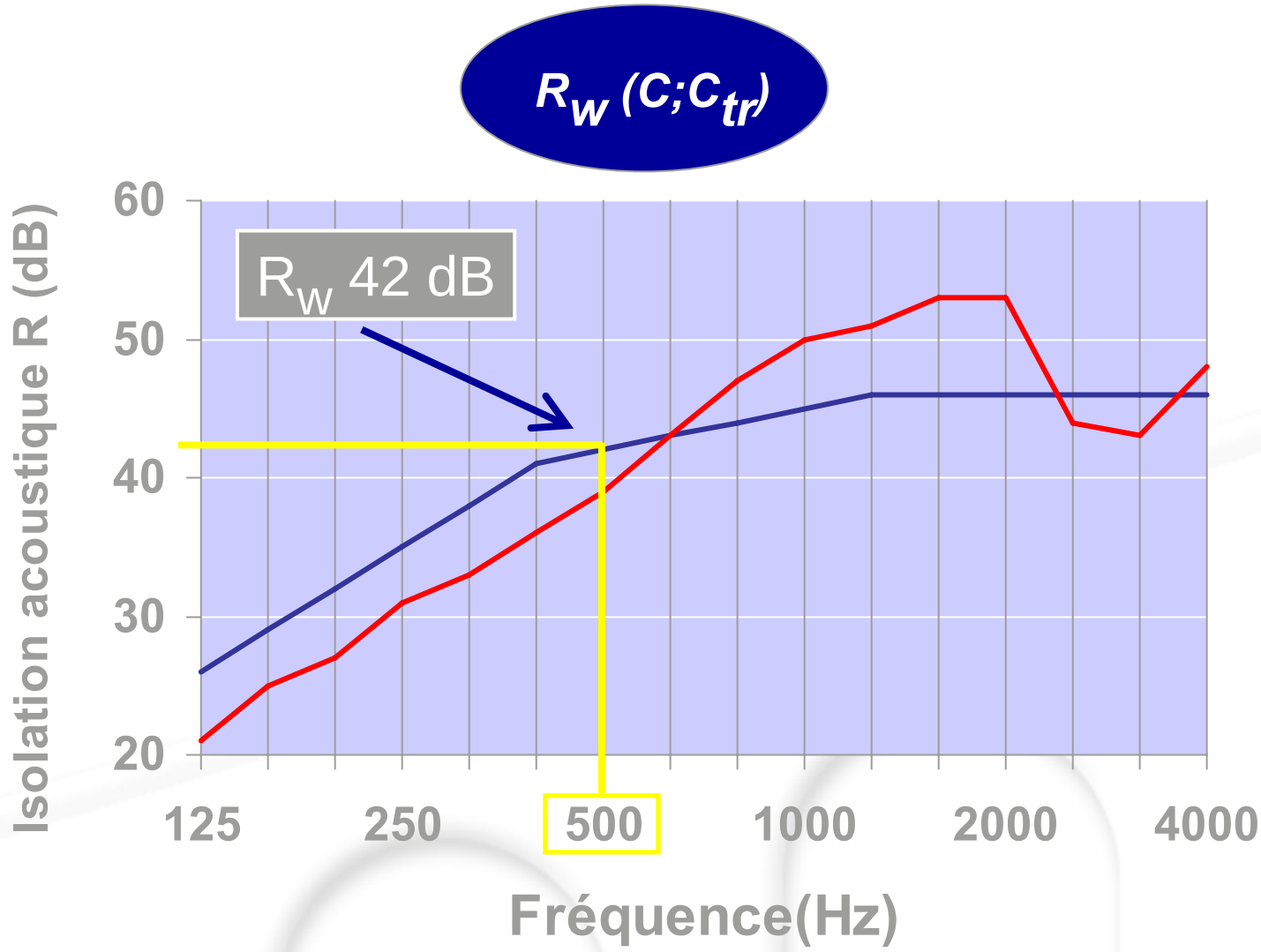
SAINT-GOBAIN GLASS

Sound reduction





EN ISO 717-1

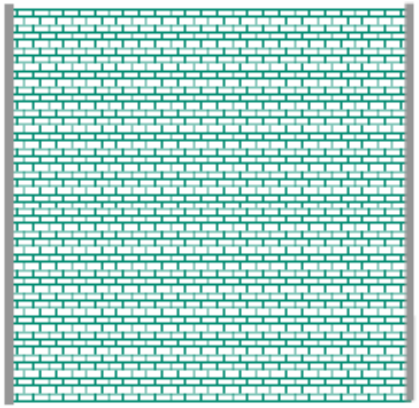


SAINT-GOBAIN
GLASS

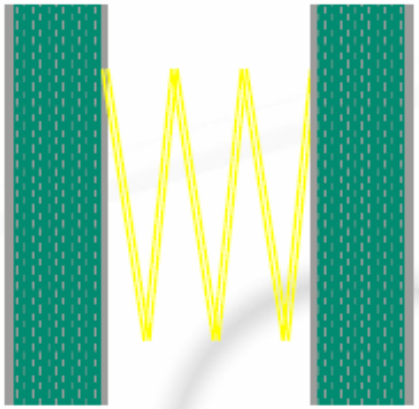
Rw (C ; Ctr) dB

Rw + **C**	fast traffic (highway), railroad, airplane nearby, human activities
Rw + **Ctr**	slow traffic, urban traffic, disco music, airplane

Sound reduction : 2 systems

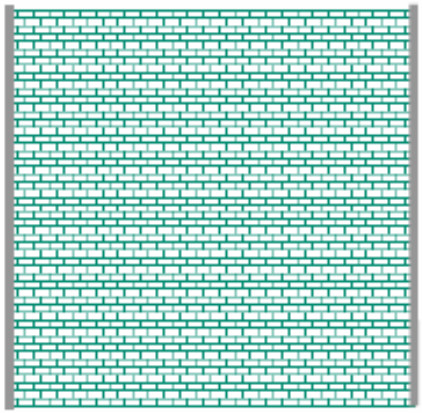


Mass



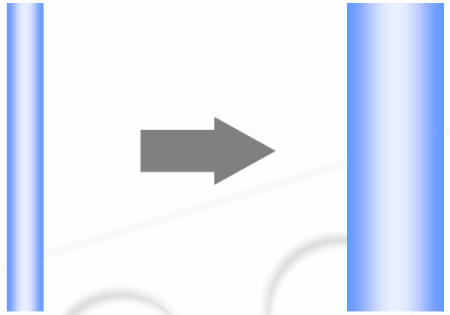
Mass-Spring

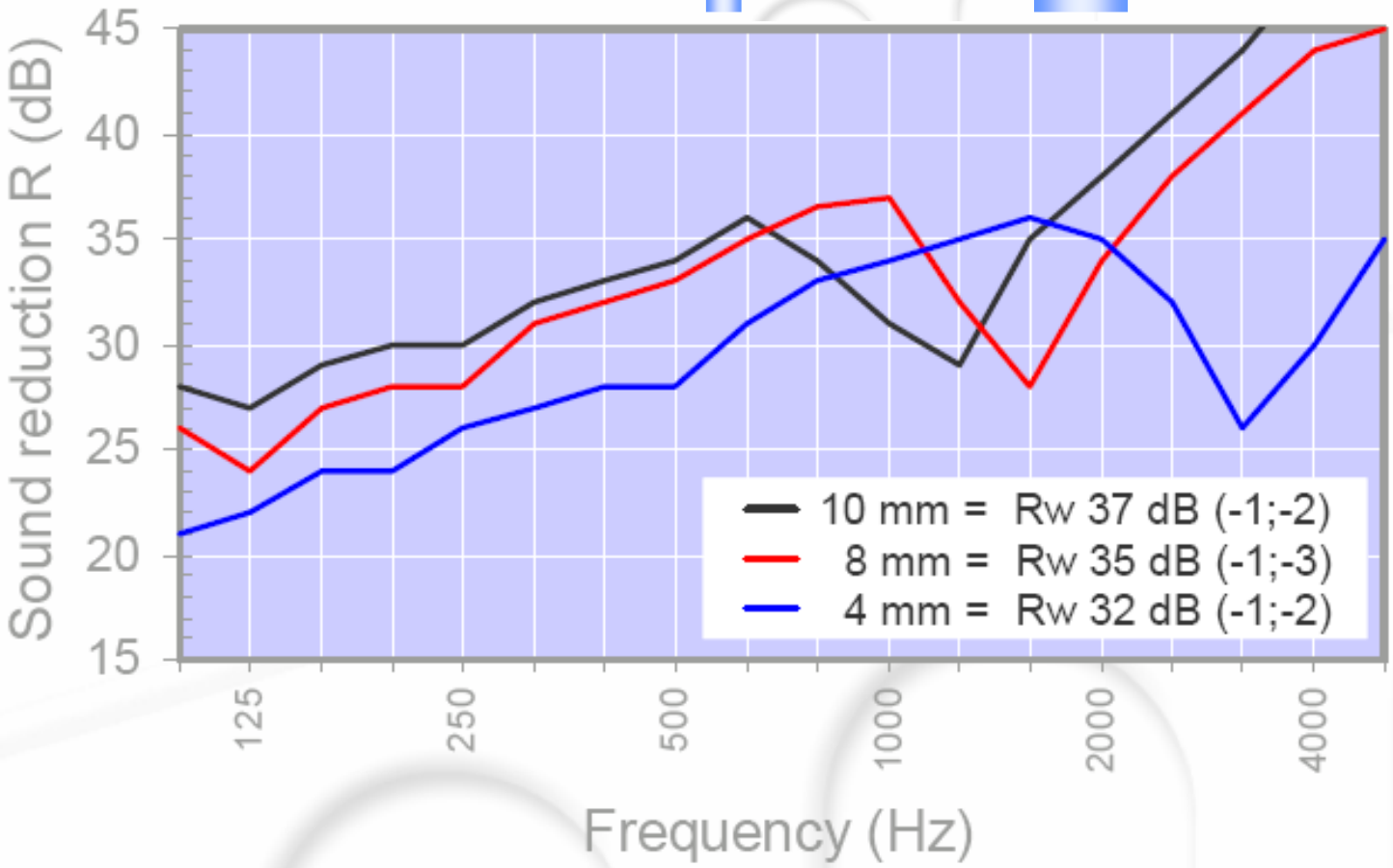
Mass : law



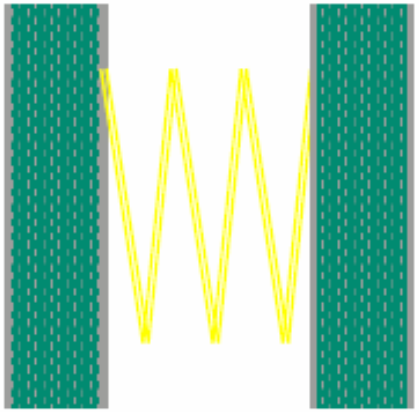
The heavier, the better !

Single glazing





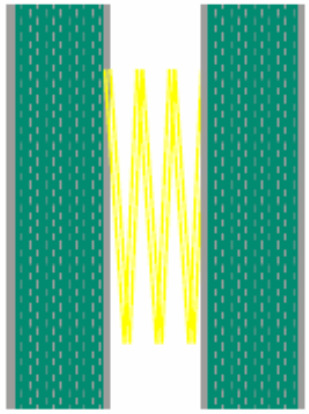
Mass-spring-Mass



Separated masses

Resonance

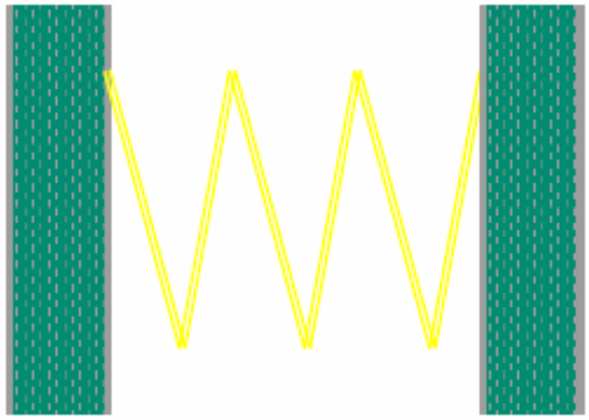
Mass-spring-Mass



Separated masses

Resonance

Mass-spring-Mass

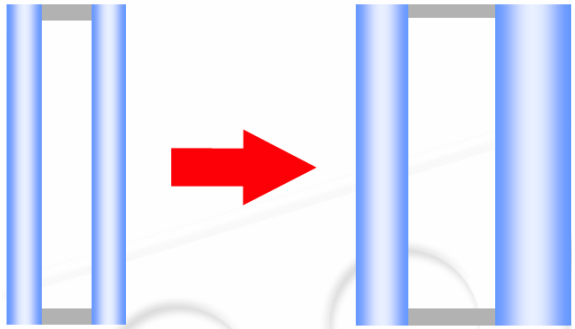


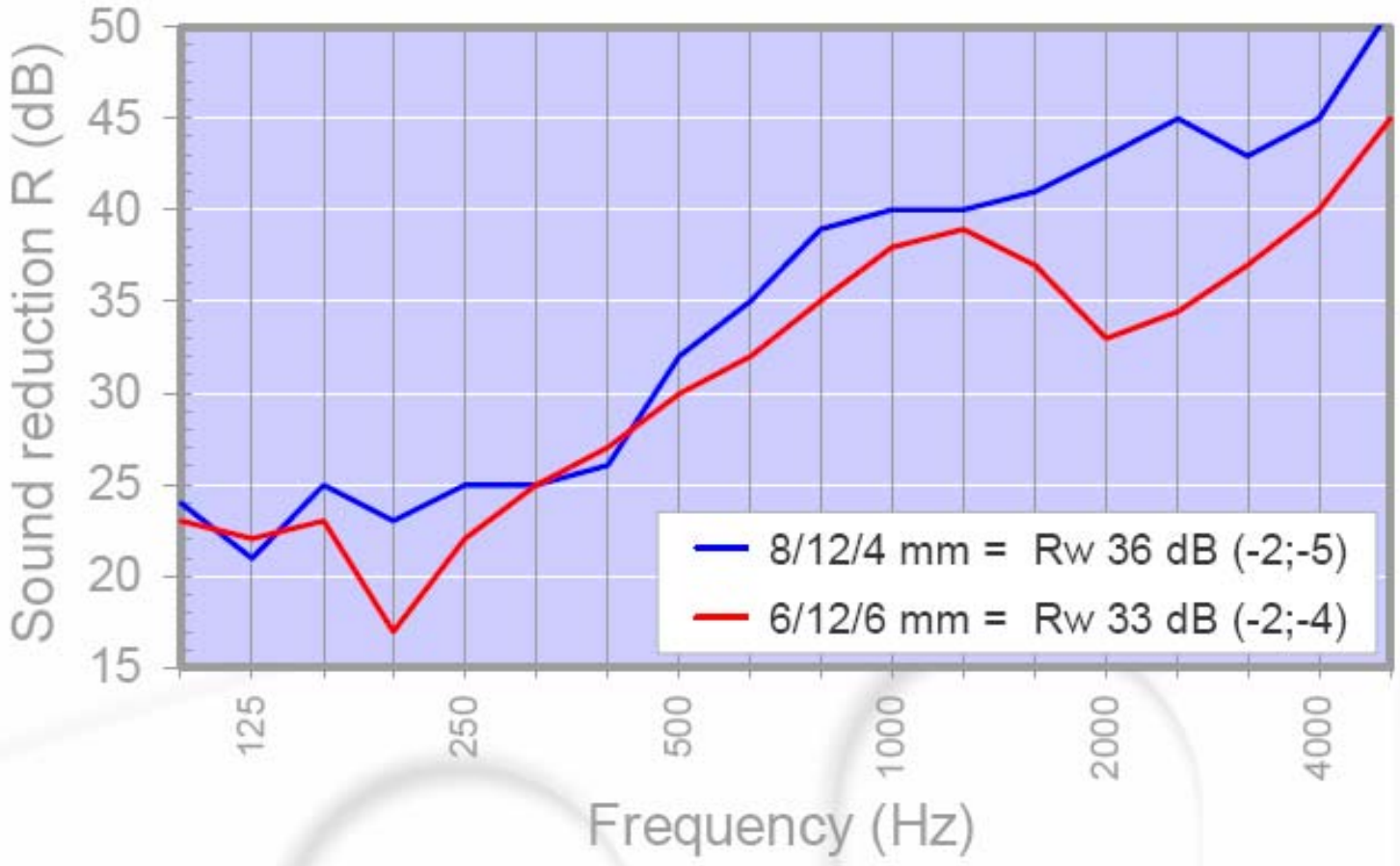
Separated masses

Resonance

Double glazing : asymmetrical

SGG CLIMAPLUS ACOUSTIC

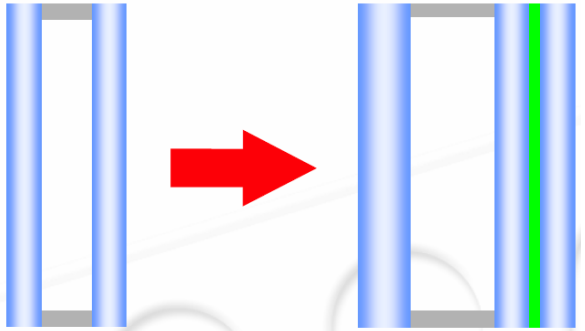


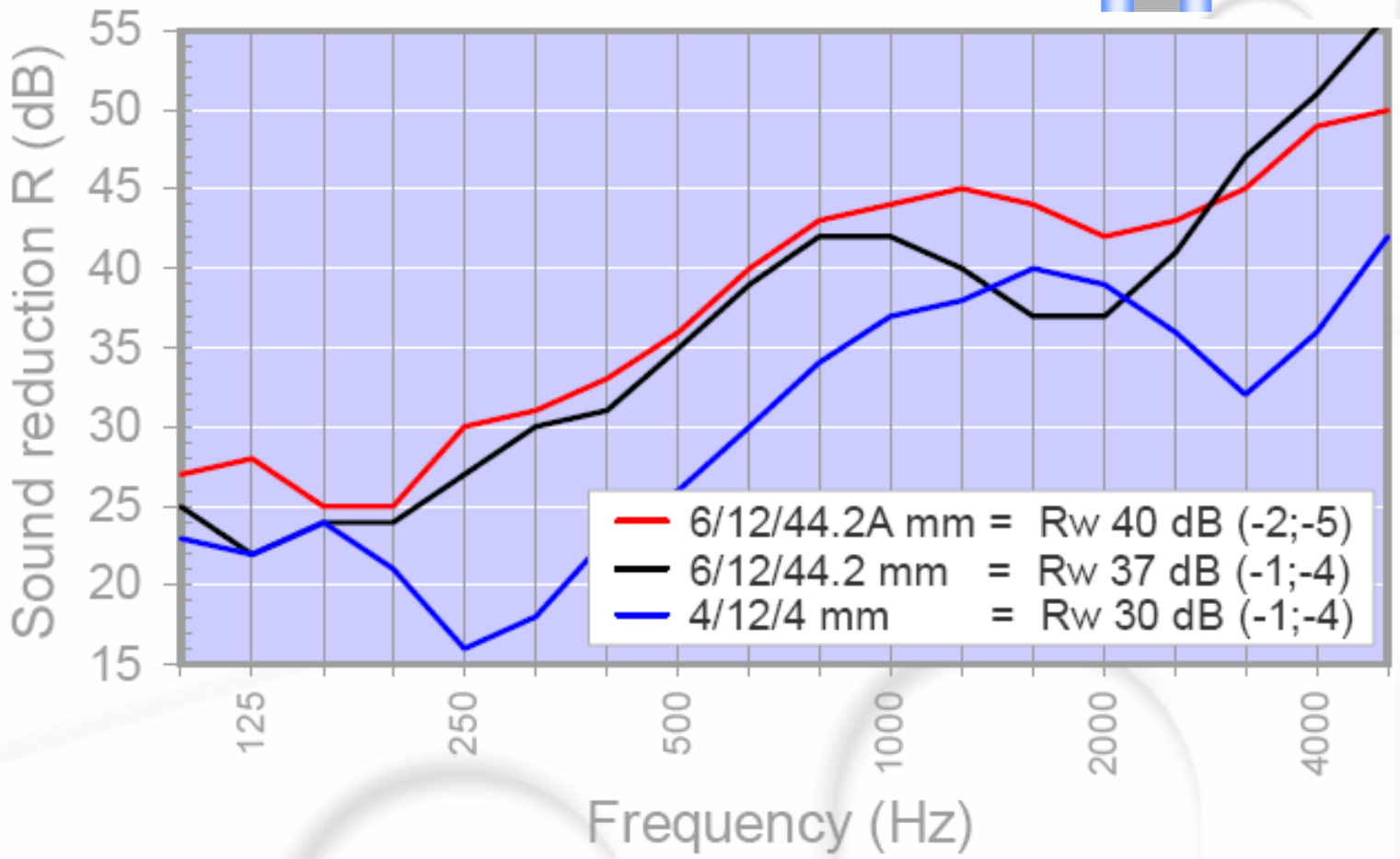


SAINT-GOBAIN GLASS

Double glazing : laminated

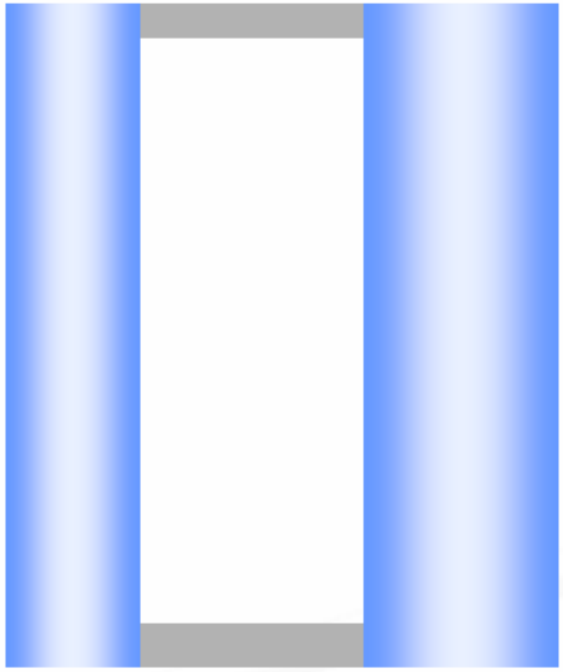
SGG CLIMAPLUS PROTECT / SILENCE

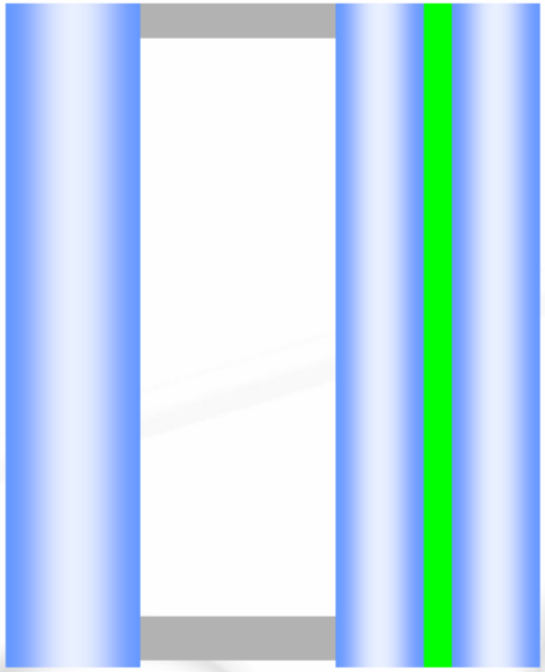




SAINT-GOBAIN GLASS

Acoustical double glazing

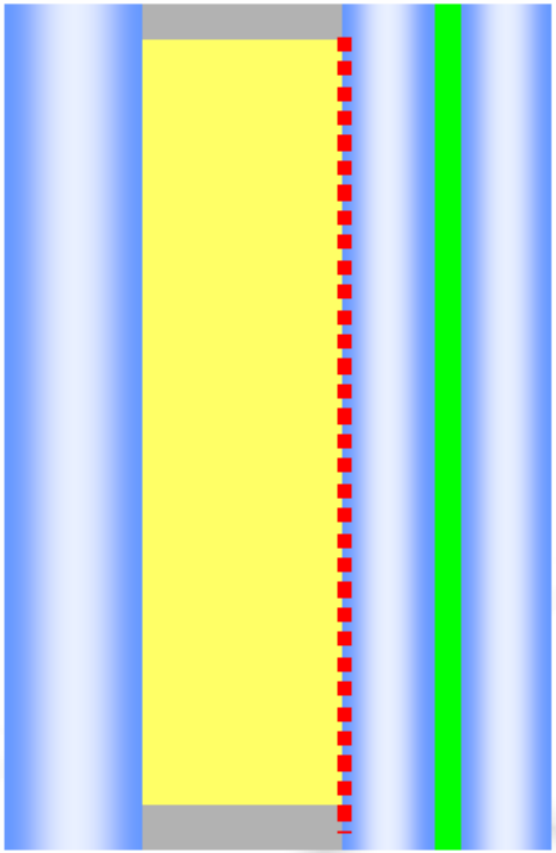




35 - 40 dB	R_w	40 - 52 dB
30 - 35 dB	$R_{A,tr}$	37 - 43 dB

SAINT-GOBAIN
GLASS

Multifunctional glazing



- low-E
- solar control
- safety
- acoustics
- self-cleaning
- esthetics

SGG STADIP SILENCE®

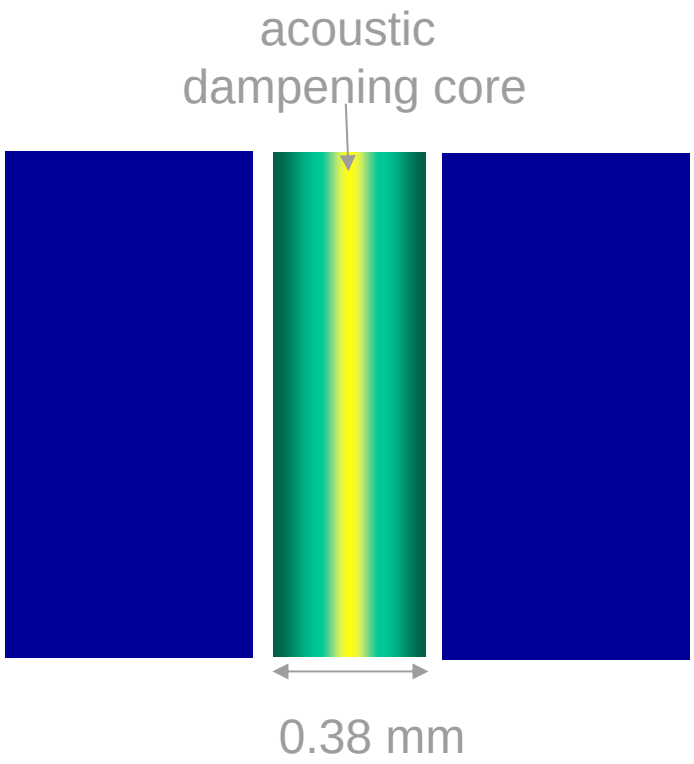
Acoustic laminated glass

SAINT-GOBAIN
GLASS

SGG STADIP SILENCE®

Acoustic PVB laminated safety glass

- SGG patented PVB-A interlayer
  - 3-ply interlayer
  - 2 layers standard PVB
  - 1 acoustic PVB core
- Safety / security properties of standard PVB laminates
- UV protection of standard PVB laminates
- Acoustic performance:
  - 3-4 dB (Rw) superior to monolithic glass of same thickness
  - 2-4 dB (Rw) superior to standard laminate
  - Both perceptible to the human ear



SAINT-GOBAIN
GLASS

SGG STADIP SILENCE®

Acoustic PVB laminated safety glass

- **Applications:**
- Interior
  - **Partitions and internal screens**
  - **Recording studios**
  - **Sound demonstration rooms**
  - **Home entertainment rooms**
  - **Plant rooms**
- Exterior
  - **Windows, doors, conservatories, patio doors, roof lites**
  - **Near to railways, stations, airports, flightpaths, roads**
  - **Pubs & clubs**
- Safety critical locations
- High risk security locations

SAINT-GOBAIN GLASS

SGG STADIP SILENCE

- optimal acoustics + safety
- lower weight, lower thickness
- multifunctional glazing

SAINT-GOBAIN
GLASS

SGG STADIP SILENCE®

	Rw (dB)	Reduction vs. float 4mm	Human perception
Stadip Silence 33.1	35	6 dB	Divided by 4
Stadip Silence 44.1	37	8 dB	Divided by 7
Stadip Silence 55.1	38	9 dB	Divided by 8

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
Double glazing unit	**Thickness (mm)**	**Weight (kg/m2)**	**Rw (dB)**	**Ra (dB)**	**Ra,tr (dB)**
CLIMALIT 3 (16) 3	22	15	**28**	**27**	**25**
CLIMALIT 4 (15) 4 mm	23	20	**29**	**28**	**25**
CLIMALIT 4 (16 Swisspacer) 4 mm	24	20	**30**	**29**	**26**
CLIMALIT 4 (16) 4 mm	24	20	**30**	**29**	**27**
CLIMALIT 4 (20) 4 mm	28	20	**30**	**30**	**26**
CLIMALIT 4 (20 Swisspacer) 4 mm	28	20	**30**	**29**	**26**
CLIMAPLUS 4 (16Ar) 4	24	20	**30**	**29**	**27**
CLIMALIT 4 (TGI 16) 4	24	20	**30**	**30**	**27**
CLIMALIT 4 (12) 4 mm	20	20	**31**	**30**	**27**
CLIMALIT ACOUSTIC 3 (16 Ar) 4	23	18	**31**	**30**	**27**
CLIMALIT ACOUSTIC 3 (16) 5	24	20	**31**	**30**	**26**
CLIMAPLUS ACOUSTIC 6 (15Ar) 4 mm	25	25	**32**	**31**	**28**
CLIMALIT ACOUSTIC 3 (16 Ar) 5	24	20	**32**	**31**	**27**
CLIMALIT ACOUSTIC 6 (7) 4 mm	17	25	**33**	**32**	**29**
CLIMALIT ACOUSTIC 6 (9) 4 mm	19	25	**33**	**32**	**29**
CLIMALIT ACOUSTIC 5 (12) 4 mm	21	23	**33**	**32**	**29**
CLIMAPLUS ACOUSTIC 6 (12Ar) 4 mm	22	25	**33**	**32**	**29**
CLIMALIT ACOUSTIC 5 (15) 4 mm	24	23	**33**	**32**	**29**
CLIMALIT ACOUSTIC 6 (15) 4 mm	25	25	**33**	**32**	**29**
CLIMALIT 6 (16) 6 mm	28	30	**33**	**32**	**29**
CLIMALIT SCREEN 4 (27) 4 mm	35	20	**33**	**32**	**28**
CLIMAPLUS ACOUSTIC 6 (10 Ar) 4	20	25	**33**	**32**	**30**
CLIMALIT 6 (16) 6	28	30	**33**	**32**	**29**
CLIMAPLUS ACOUSTIC 4 (6) 6 mm	16	25	**34**	**33**	**31**
CLIMALIT ACOUSTIC 4 (12) 6 mm	22	25	**34**	**33**	**29**
CLIMALIT ACOUSTIC 6 (12Kr) 4 mm	22	25	**34**	**32**	**29**
CLIMALIT ACOUSTIC 4 (16 Swisspacer) 6 mm	26	25	**34**	**33**	**30**
CLIMALIT ACOUSTIC 6 (20) 4 mm	30	25	**34**	**33**	**29**
CLIMAPLUS ACOUSTIC 6 (20Ar) 4 mm	30	25	**34**	**32**	**29**

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)

Double glazing unit	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
CLIMALIT ACOUSTIC 6 (25) 4 mm	35	25	**34**	**33**	**30**
CLIMAPLUS SILENCE 22-1SI (16 SWS Ar) 4	25	21	**34**	**33**	**30**
CLIMAPLUS ACOUSTIC 6 (16 Ar) 4	26	25	**34**	**33**	**30**
CLIMALIT ACOUSTIC 4 (16 Ar) 5	25	23	**34**	**33**	**30**
CLIMAPLUS PROTECT 5 (12) 33-2 mm	24	28	**35**	**34**	**31**
CLIMAPLUS ACOUSTIC 4 (16) 6 mm	26	25	**35**	**33**	**30**
CLIMALIT ACOUSTIC 8 (12) 6 mm	26	35	**35**	**33**	**30**
CLIMALIT ACOUSTIC 5 (15) 8 mm	28	33	**35**	**34**	**31**
CLIMALIT ACOUSTIC 4 (20) 6 mm	30	25	**35**	**34**	**30**
CLIMALIT ACOUSTIC 4 (20 Swisspacer) 6 mm	30	25	**35**	**33**	**30**
CLIMALIT ACOUSTIC 6 (24) 4 mm	34	25	**35**	**33**	**29**
CLIMAPLUS SILENCE 22-1SI (16Ar) 4	25	21	**35**	**33**	**30**
CLIMAPLUS PROTECT 4S 33-2 (16 Ar) 4	27	26	**35**	**34**	**30**
CLIMAPLUS SILENCE 5 (7) 33.2 SI	19	28	**36**	**35**	**32**
CLIMAPLUS ACOUSTIC 4 (6) 10 mm	20	35	**36**	**35**	**33**
CLIMAPLUS ACOUSTIC 4 (10) 10 mm	24	35	**36**	**35**	**32**
CLIMAPLUS ACOUSTIC 4 (12) 8 mm	24	30	**36**	**34**	**31**
CLIMAPLUS SILENCE 5 (12) 33.2 SI	24	28	**36**	**35**	**31**
CLIMAPLUS ACOUSTIC 4 (16) 8 mm	28	30	**36**	**34**	**31**
CLIMAPLUS PROTECT 8 (12) 44-2	29	40	**36**	**35**	**31**
CLIMALIT ACOUSTIC 8 (16) 6 mm	30	35	**36**	**35**	**32**
CLIMAPLUS PROTECT 6 (15) 44.2	30	35	**36**	**35**	**32**
CLIMALIT ACOUSTIC 10 (15) 6 mm	31	40	**36**	**35**	**33**
CLIMALIT PROTECT 44-2 (14) 44-2	32	40	**36**	**34**	**30**
CLIMALIT PROTECT 44-2 (15) 8	32	40	**36**	**35**	**31**
CLIMALIT ACOUSTIC 8 (20) 5	33	33	**36**	**35**	**32**
CLIMAPLUS PROTECT 44.2 (15) 44.2	33	40	**36**	**34**	**31**
CLIMAPLUS SILENCE 22-1SI (10 Ar) 6	21	26	**36**	**35**	**32**

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
Double glazing unit	**Thickness (mm)**	**Weight (kg/m2)**	**Rw (dB)**	**Ra (dB)**	**Ra,tr (dB)**
CLIMAPLUS PROTECT 8 (6) 44-2	23	40	**37**	**36**	**34**
CLIMAPLUS PROTECT 6 (12) 44-2	27	35	**37**	**36**	**33**
CLIMAPLUS ACOUSTIC 6 (12) 10	28	40	**37**	**36**	**34**
CLIMALIT ACOUSTIC 8 (14) 6	28	35	**37**	**36**	**32**
CLIMAPLUS PROTECT 4 (16) 44-2	29	30	**37**	**35**	**31**
CLIMAPLUS ACOUSTIC 8 (18 Ar) 6	32	35	**37**	**35**	**32**
CLIMAPLUS PROTECT 8 (16) 44-2	33	40	**37**	**36**	**32**
CLIMAPLUS PROTECT 10 (12) 64-2	33	50	**37**	**36**	**33**
CLIMALIT ACOUSTIC 8 (20) 6	34	35	**37**	**36**	**33**
CLIMALIT ACOUSTIC 10 (20) 6	36	40	**37**	**36**	**35**
CLIMALIT ACOUSTIC 8 (24) 5	37	33	**37**	**36**	**32**
CLIMAPLUS SILENCE 22-1SI (16 Ar) 6	27	26	**37**	**36**	**32**
CLIMAPLUS PROTECT ULTRA N 44-2 (14 Ar) PUN 6	29	35	**37**	**35**	**31**
CLIMAPLUS SILENCE 44-1SI (16 Ar) 4	29	30	**37**	**36**	**32**
CLIMAPLUS PROTECT 10 (6) 44-2	25	45	**38**	**38**	**35**
CLIMAPLUS SILENCE 6 (12) 44-1 SI	27	35	**38**	**37**	**34**
CLIMALIT SILENCE 33-2SI (15) 33-2 SI	29	30	**38**	**37**	**33**
CLIMALIT SCREEN 4 (27) 6	37	25	**38**	**36**	**32**
CLIMALIT ACOUSTIC 10 (24) 6	40	40	**38**	**36**	**35**
CLIMAPLUS SILENCE 33-1SI (16 Ar) 6	29	30	**38**	**37**	**33**
CLIMAPLUS SILENCE 33-1SI (12) 6	25	30	**38**	**36**	**33**
CLIMAPLUS SILENCE 6 (12) 44-2 SI	27	35	**39**	**38**	**34**
CLIMALIT PROTECT 33-2 (12) 44-2	28	35	**39**	**38**	**34**
CLIMAPLUS SILENCE 6 (12) 44.4 SI	28	35	**39**	**37**	**33**
CLIMAPLUS SILENCE 6 (15) 44.2 SI	30	35	**39**	**37**	**33**
CLIMAPLUS SILENCE 6 (16) 44-2 SI	31	35	**39**	**38**	**34**
CLIMALIT SCREEN SILENCE 33-1 SI (27) 4	38	25	**39**	**37**	**32**

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
Double glazing unit	**Thickness (mm)**	**Weight (kg/m2)**	**Rw (dB)**	**Ra (dB)**	**Ra,tr (dB)**
CLIMALIT SCREEN 8 (27) 4	39	30	**39**	**37**	**32**
CLIMAPLUS PROTECT 66-4 (15) 12	41	60	**39**	**38**	**34**
CLIMALIT SILENCE 33-2 (10) 44-1 SI	26	35	**40**	**38**	**35**
CLIMALIT SILENCE 44-2 (8) 44-1 SI	26	40	**40**	**39**	**35**
CLIMALIT SILENCE 44-2 (10) 44-2 SI	28	40	**40**	**39**	**35**
CLIMAPLUS SILENCE 8 (12) 44-1 SI	29	40	**40**	**39**	**35**
CLIMAPLUS PROTECT 10 (12) 44-2	31	45	**40**	**39**	**36**
CLIMAPLUS SILENCE 6 (16) 44-1 SI	31	35	**40**	**38**	**34**
CLIMALIT SILENCE 44-1 SI (16) 33-1	31	35	**40**	**39**	**35**
CLIMAPLUS PROTECT 10 (16) 44-2	35	45	**40**	**38**	**35**
CLIMAPLUS PROTECT 66.2 (15) 44.2	37	50	**40**	**39**	**36**
CLIMAPLUS PROTECT 66-4 (15) 10	39	55	**40**	**39**	**36**
CLIMALIT SCREEN SILENCE 44-1 SI (27) 4	40	30	**40**	**39**	**34**
CLIMALIT SCREEN 10 (27) 4	41	35	**40**	**39**	**35**
CLIMAPLUS PROTECT 12 (16) 66-2	41	60	**40**	**39**	**36**
CLIMALIT ACOUSTIC 10 (27) 6	43	40	**40**	**39**	**37**
CLIMAPLUS SILENCE 22-1SI (14 Ar) 10	29	36	**40**	**38**	**34**
CLIMAPLUS SILENCE 44-1SI (20 Ar) 6	35	35	**40**	**38**	**34**
CLIMAPLUS SILENCE PROTECT 44-1SI (16 Ar) 33-1	23	15	**40**	**39**	**34**
CLIMAPLUS SILENCE 44-1SI (16 Ar) 6	31	35	**40**	**38**	**34**
CLIMALIT SILENCE 44-2 SI (15) 8	32	40	**41**	**39**	**35**
CLIMAPLUS PROTECT 55-2 (15) 8	34	45	**41**	**39**	**36**
CLIMALIT PROTECT HS 15 (14) 6	35	0	**41**	**40**	**36**
CLIMAPLUS PROTECT 10 (16) 66-2	39	55	**41**	**40**	**37**
CLIMAPLUS PROTECT 66-2 (12) 66-4	39	60	**41**	**40**	**34**
CLIMALIT SILENCE 68-2 SI (16) 10	41	60	**41**	**40**	**37**
CLIMAPLUS SILENCE 8 (16 Ar) 44-1SI	33	40	**41**	**39**	**35**

SAINT-GOBAIN
GLASS

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
Double glazing unit	**Thickness (mm)**	**Weight (kg/m2)**	**Rw (dB)**	**Ra (dB)**	**Ra,tr (dB)**
CLIMAPLUS SILENCE 10 (12) 44-2 SI	31	45	**42**	**41**	**38**
CLIMALIT SILENCE 44-2 SI (15) 44-2 SI	33	40	**42**	**40**	**36**
CLIMAPLUS SILENCE 10 (12) 64-1 SI	33	50	**42**	**41**	**37**
CLIMALIT SILENCE 44-2 SI (15) 10	34	45	**42**	**40**	**37**
CLIMAPLUS SILENCE 6 (15) 66-1 SI	34	45	**42**	**40**	**36**
CLIMAPLUS PROTECT 10 (12) 88-2	39	65	**42**	**41**	**39**
CLIMAPLUS PROTECT 66-4 (12) 66-4	39	60	**42**	**41**	**37**
CLIMAPLUS SILENCE 8 (20) 66.2 SI	41	50	**42**	**41**	**37**
CLIMALIT SCREEN SILENCE 44-2 SI (27) 6	42	35	**42**	**40**	**37**
CLIMALIT PROTECT 1010-2 (10) 88-2	48	90	**42**	**41**	**37**
CLIMAPLUS SILENCE 8 (16 Ar) 66-2SI	37	51	**42**	**40**	**37**
CLIMAPLUS SILENCE 44-1SI (16 Ar) 44-1SI	33	41	**42**	**40**	**36**
CLIMALIT SILENCE 44-1SI (10 Ar) 10	29	45	**42**	**40**	**37**
CLIMAPLUS SILENCE 10 (12) 44.1 SI	30,5	45	**43**	**41**	**37**
CLIMAPLUS SILENCE 8 (16Ar) 46.1 SI	34	45	**43**	**41**	**37**
CLIMAPLUS SILENCE 10 (16) 44-1 SI	34,5	45	**43**	**42**	**38**
CLIMAPLUS N SILENCE 8 (16Ar) 46.2 SI	35	45	**43**	**41**	**37**
CLIMAPLUS SILENCE 33-2SI (20) 44-2 SI	36	35	**43**	**42**	**37**
CLIMAPLUS SILENCE 12 (15) 44.2 SI	36	50	**43**	**42**	**39**
CLIMAPLUS SILENCE 66-1 SI (15) 8	36	50	**43**	**41**	**37**
CLIMAPLUS PROTECT 88-4 (12) 66-4	43	70	**43**	**42**	**36**
CLIMALIT SILENCE 64-2SI (12) 44-1SI	32	47	**43**	**42**	**37**
CLIMAPLUS SILENCE 12 (12) 44.1 SI	32,5	50	**44**	**43**	**39**
CLIMALIT SILENCE 55-1(16 Ar) 44-1 SI	35	45	**44**	**43**	**38**
CLIMALIT SILENCE 44-2SI (16) 10	35	45	**44**	**42**	**38**
CLIMAPLUS SILENCE 44-1 SI (16 Ar) 55-1 SI	35	45	**45**	**43**	**38**
CLIMALIT SILENCE 55-2 SI (15) 55-2 SI	37	50	**45**	**43**	**39**
CLIMAPLUS SILENCE 10 (16) 66.1 SI	38,5	55	**45**	**44**	**40**
CLIMAPLUS SILENCE 10 (20) 44-1 SI	39	45	**45**	**44**	**40**
CLIMAPLUS SILENCE 12 (20) 44.2 SI	40	50	**45**	**43**	**41**
CLIMAPLUS SILENCE 12 (20) 66.2 SI	40	60	**45**	**44**	**42**
CLIMAPLUS SILENCE 12 (24) 66.2 SI	40	60	**45**	**44**	**43**
CLIMALIT SILENCE 10 (20) 66-2 SI	43	55	**45**	**44**	**40**
CLIMAPLUS SILENCE 10 (24) 86.2 SI	49	60	**45**	**44**	**42**
CLIMAPLUS SILENCE 44-2 SI (20) 64-2	40	45	**46**	**45**	**41**

SAINT-GOBAIN GLASS

Acoustic certificates for CE Marking

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
Double glazing unit	**Thickness (mm)**	**Weight (kg/m2)**	**Rw (dB)**	**Ra (dB)**	**Ra,tr (dB)**
CLIMAPLUS SILENCE 10 (12) 44-2 SI	31	45	**42**	**41**	**38**
CLIMALIT SILENCE 44-2 SI (15) 44-2 SI	33	40	**42**	**40**	**36**
CLIMAPLUS SILENCE 10 (12) 64-1 SI	33	50	**42**	**41**	**37**
CLIMALIT SILENCE 44-2 SI (15) 10	34	45	**42**	**40**	**37**
CLIMAPLUS SILENCE 6 (15) 66-1 SI	34	45	**42**	**40**	**36**
CLIMAPLUS PROTECT 10 (12) 88-2	39	65	**42**	**41**	**39**
CLIMAPLUS PROTECT 66-4 (12) 66-4	39	60	**42**	**41**	**37**
CLIMALIT SILENCE 66-2 SI (15) 66-2 SI	41	60	**47**	**45**	**41**
CLIMALIT SILENCE 86.1 (24Ar) 44.1 SI	47	55	**47**	**46**	**41**
CLIMAPLUS SILENCE 66-2SI (16 Ar) 44-2SI	38	52	**47**	**44**	**40**
CLIMAPLUS SILENCE 44-2 SI (20) 66-2 SI	42	50	**49**	**47**	**43**
CLIMALIT SILENCE 88-2 SI (15) 88-2 SI	49	80	**49**	**48**	**44**
CLIMAPLUS SILENCE 44-2 SI (24) 66-2 SI	46	50	**50**	**48**	**43**
CLIMAPLUS SILENCE 44-1 SI (24 Ar) 86-1 SI	47	55	**50**	**48**	**43**
CLIMAPLUS SILENCE 86.2 SI (24) 66.2 SI	52	65	**50**	**49**	**46**
CLIMAPLUS SILENCE 64-2 SI (24) 86-2 SI	50	60	**51**	**50**	**47**
CLIMAPLUS SILENCE 44-1SI (24 Ar) 68-1SI	47	56	**51**	**49**	**45**

Acoustic certificates for CE Marking (TGUs)

Composition	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)

Triple glazing unit	Thickness (mm)	Weight (kg/m2)	Rw (dB)	Ra (dB)	Ra,tr (dB)
CLIMATOP 3 (12 Ar) 3 (12 Ar) 3	33	23	**29**	**28**	**25**
CLIMATOP 3 (12 Ar) 4 (12 Ar) 3	34	25	**29**	**28**	**25**
CLIMATOP 4 (12) 4 (12) 4 mm	36	30	**31**	**30**	**26**
CLIMATOP 4 (12 Ar) 3 (12 Ar) 3	34	25	**31**	**31**	**27**
CLIMATOP 4 (12 Ar) 4 (12 Ar) 4	36	30	**31**	**30**	**26**
CLIMATOP 4 (12 Ar) 4 (12 Ar) 4	36	30	**31**	**30**	**27**
CLIMATOP 3 (12 Ar) 4 (12 Ar) 4	35	28	**31**	**30**	**27**
CLIMATOP 4 (16) 4 (16) 4 mm	44	30	**32**	**30**	**27**
CLIMATOP 4 (8 Ar) 4 (16 Ar) 4	36	30	**32**	**30**	**27**
CLIMATOP 5 (12 Ar) 4 (12 Ar) 3	36	30	**33**	**32**	**28**
CLIMATOP SILENCE 22-1SI (10 Ar) 3 (10 Ar) 3	31	26	**34**	**33**	**29**
CLIMATOP ACOUSTIC 6 (12) 4 (12) 4 mm	38	35	**35**	**34**	**30**
CLIMATOP SILENCE 22-1SI (12 Ar) 4 (12 Ar) 4	37	31	**35**	**34**	**30**
CLIMATOP ACOUSTIC 6 (12 Ar) 4 (12 Ar) 4	38	35	**35**	**34**	**30**
CLIMATOP ACOUSTIC 6 (12 Ar) 3 (12 Ar) 4	37	33	**35**	**34**	**30**
CLIMATOP ULTRA N ACOUSTIC 6 (12 Ar) 4 (12 Ar) 4	38	35	**36**	**35**	**31**
CLIMATOP ACOUSTIC 8 (12) 4 (12) 4	40	40	**36**	**35**	**31**
CLIMATOP ACOUSTIC 8 (10 Ar) 4 (10 Ar) 4	36	40	**36**	**34**	**30**
CLIMATOP ACOUSTIC 6 (16 Ar) 3 (8 Ar) 4	37	33	**36**	**34**	**31**
CLIMATOP PROTECT 44-2 (12) 4 (12) 4	41	40	**37**	**35**	**31**
CLIMATOP PROTECT 44-2 (10 Ar) 4 (10 Ar) 4	37	41	**37**	**36**	**32**
CLIMATOP SILENCE 22-1SI (12 Ar) 4 (12 Ar) 22-1SI	37	31	**37**	**35**	**31**
CLIMATOP SILENCE 44-1SI (12) 4 (12) 4	41	40	**38**	**37**	**33**
CLIMATOP ULTRA N ACOUSTIC 8 (12 Kr) 4 (12 Kr) 6	42	45	**38**	**37**	**35**
CLIMATOP SILENCE 22-1SI (12 Ar) 4 (12 Ar) 6	39	36	**38**	**37**	**32**
CLIMATOP SILENCE 44-1SI (10 Ar) 4 (10 Ar) 4	37	41	**38**	**37**	**33**
CLIMATOP ULTRA N ACOUSTIC 8 (12 Ar) 4 (12 Ar) 6	42	45	**39**	**38**	**34**
CLIMATOP ULTRA N ACOUSTIC 10 (12 Ar) 4 (12 Ar) 6	44	50	**40**	**39**	**37**
CLIMATOP SILENCE 44-2SI (12 Ar) 4 (12 Ar) 6	43	46	**41**	**39**	**35**
CLIMATOP ULTRA N SILENCE 6 (12 Ar) 4 (12 Ar) 44-1 SI	43	45	**42**	**41**	**37**
CLIMATOP SILENCE 44-1SI (14 Ar) 4 (14 Ar) 6	33	46	**42**	**40**	**35**
CLIMATOP SILENCE 8 (12 Ar) 4 (12 Ar) 44-2SI	45	51	**42**	**40**	**36**
CLIMATOP ULTRA N SILENCE 6 (12 Ar) 44-1 SI (12 Ar) 44-1 SI	48	55	**44**	**42**	**38**
CLIMATOP ULTRA N SILENCE 8 (12 Ar) 4 (12 Ar) 44-1 SI	44	50	**45**	**43**	**39**
CLIMATOP ULTRA N SILENCE 8 (12 Kr) 4 (12 Kr) 44-1 SI	45	50	**45**	**43**	**39**
CLIMATOP SILENCE 44-2SI (12 Ar) 4 (12 Ar) 44-1SI	46	51	**45**	**43**	**38**
CLIMATOP ULTRA N SILENCE 10 (12 Ar) 6 (12 Ar) 44-1 SI	49	60	**46**	**44**	**40**
CLIMATOP ULTRA N SILENCE 44-1 SI (12 Ar) 4 (12 Ar) 44-1 SI	45	50	**47**	**45**	**41**
CLIMATOP ULTRA N SILENCE 66-1 SI (12 Ar) 6 (12 Ar) 44-1 SI	51	65	**50**	**48**	**44**

SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

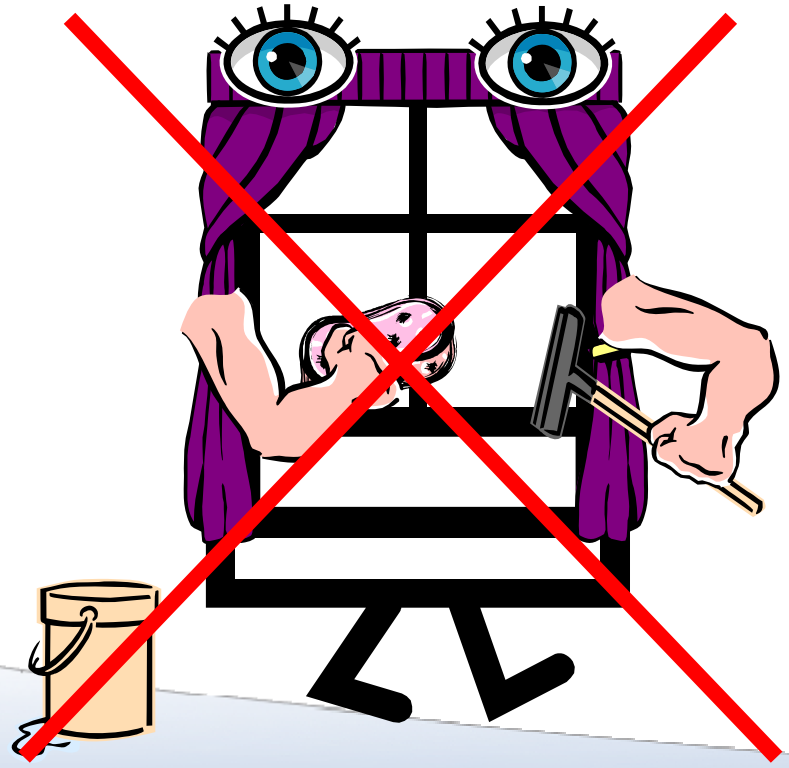
5 | A look at the future

6 | Interior - Design

SAINT-GOBAIN GLASS

SGG BIOCLEAN® : How does it work?

1



DON'T THINK THERE IS ANY MAGIC WHEN IT'S ONLY TECHNOLOGY!

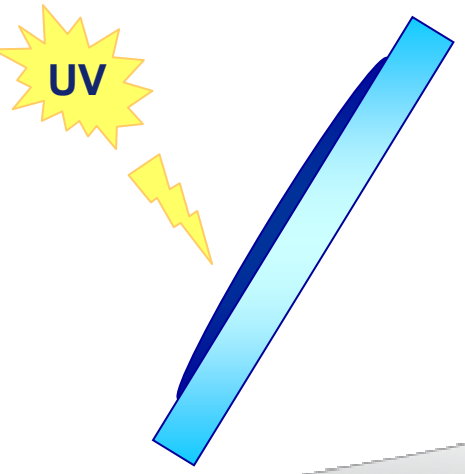
SAINT-GOBAIN GLASS

SGG BIOCLEAN®

- the ***self-cleaning*** glass of the SAINT-GOBAIN GLASS CLEAN family is a high technology glass:
- Saint-Gobain Glass has developed and patented a ***New generation of coating*** with revolutionary properties :
- Using Sun's UV rays it becomes
- ***Photocatalytic***

and

- ***Super-Hydrophilic***

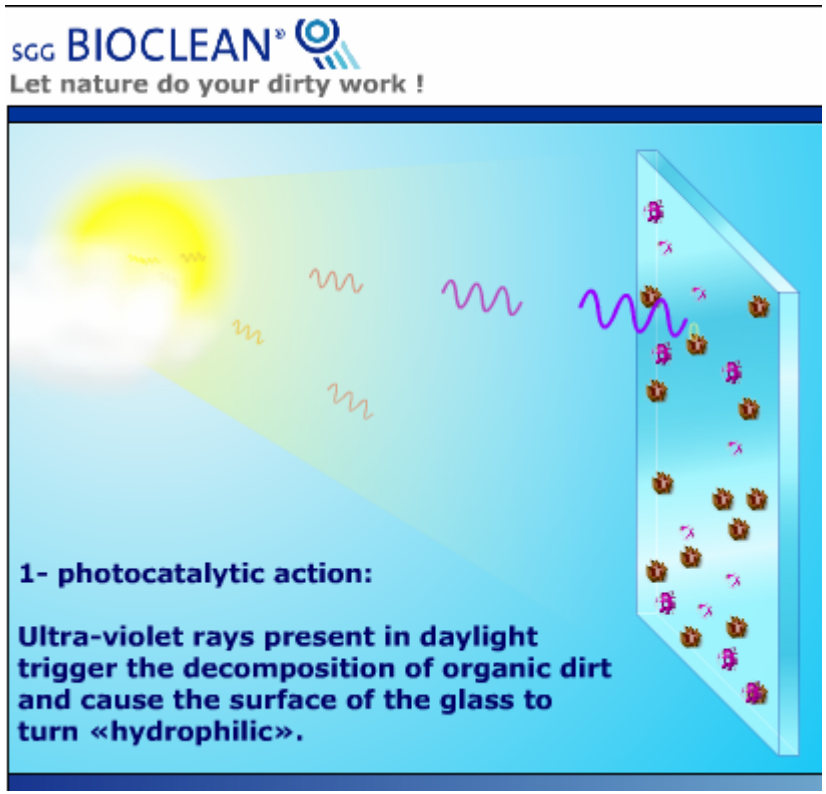


SAINT-GOBAIN
GLASS

Self-cleaning glass : dual action
1- Photocatalytic

Action of UV rays (daylight):

- Trigger the decomposition of organic dirt (grease, oil, hydrocarbons…) deposited on the coating
- Reduce the adherence of mineral dirt (dust, sand…)
- Turn to super-hydrophilic the glass surface



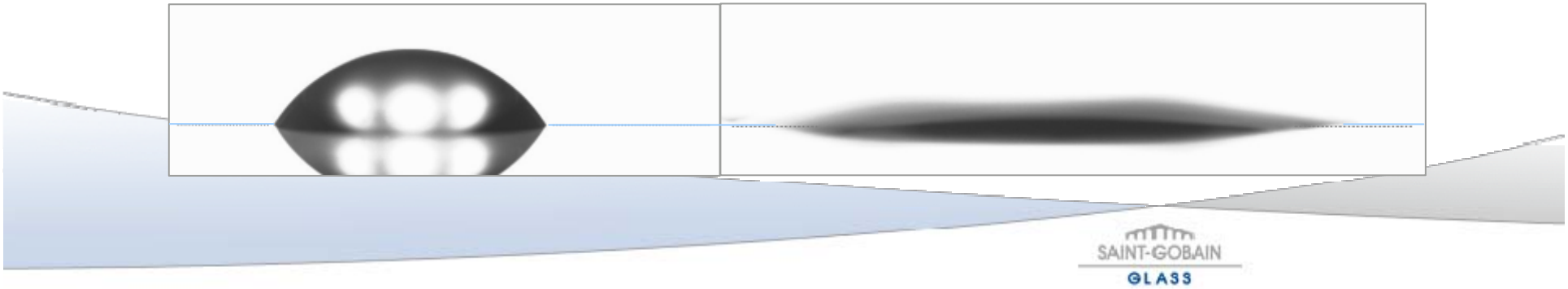
Demonstration available on the Web module
www.saint-gobain-glass.com/bioclean

Self-cleaning glass : dual action
2- Super-Hydrophilic

Action of water (e.g. rain):

- Forms a sheet of water across the surface of the glass

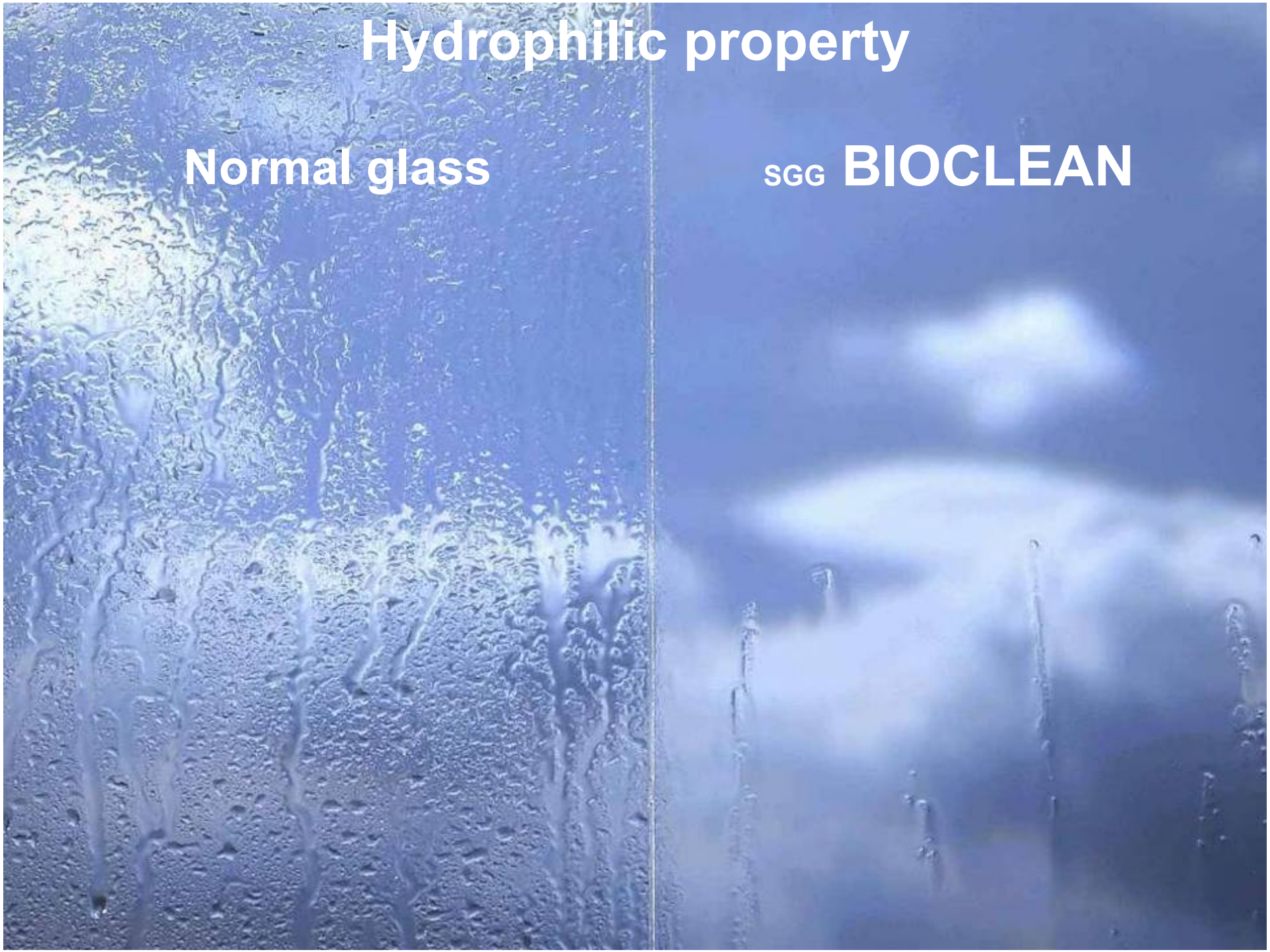
- Droplet of water on float glass (left) and on SGG Bioclean (right)



Self-cleaning glass: summary

1. **Photocatalytic:**
   - Trigger decomposition of organic dirt
   - Reduce the adherence of mineral dirt
   - Turn to hydrophilic the glass surface
2. **Super-hydrophilic:**
   - Water (e.g. rain) forms a film
   - Rinses away the dirt
   - Evaporates quickly without leaving any trace

Hydrophilic property




Result after 6 months without cleaning
Conventional glass
SGG BIOCLEAN

What does “self-cleaning” mean ?

- Cleaning assisted by natural elements : sun and rain
- Cleaner longer
- Easier to clean

But…

- Not 100% maintenance free
- A simple spray with water* is generally sufficient to clean the glass, in dry weather or if the glass is not exposed to the rain

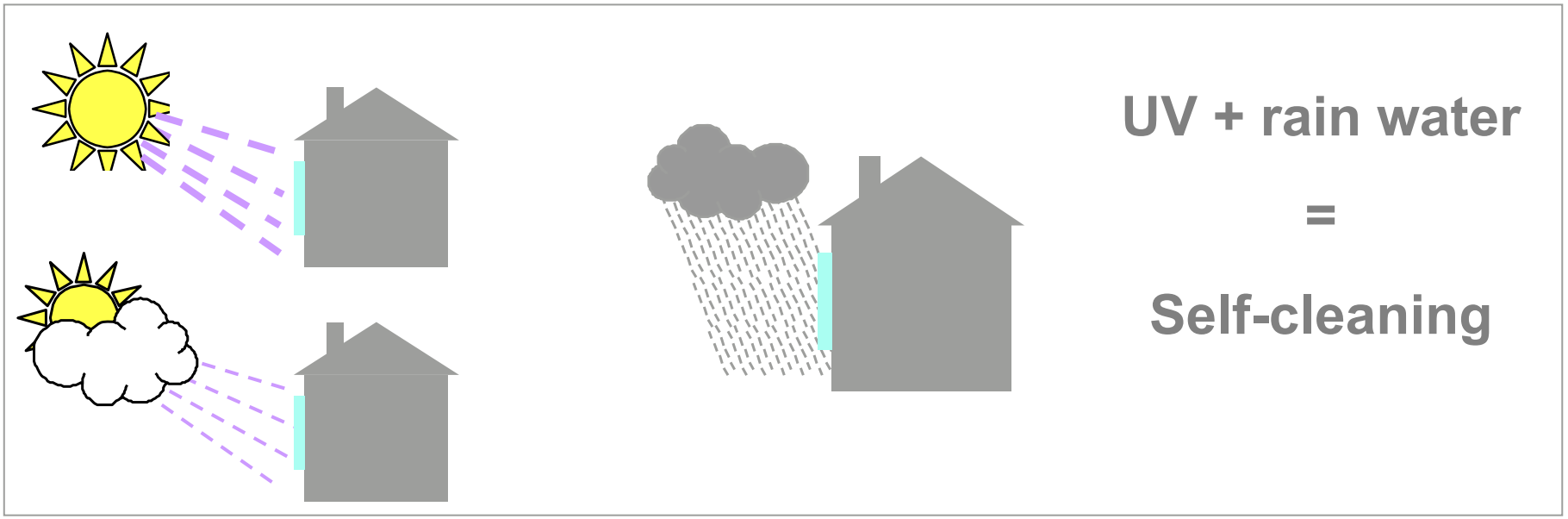
  * Soft or demineralised water

Result after 6 months without cleaning

Normal glass **SGG BIOCLEAN**

SAINT-GOBAIN GLASS

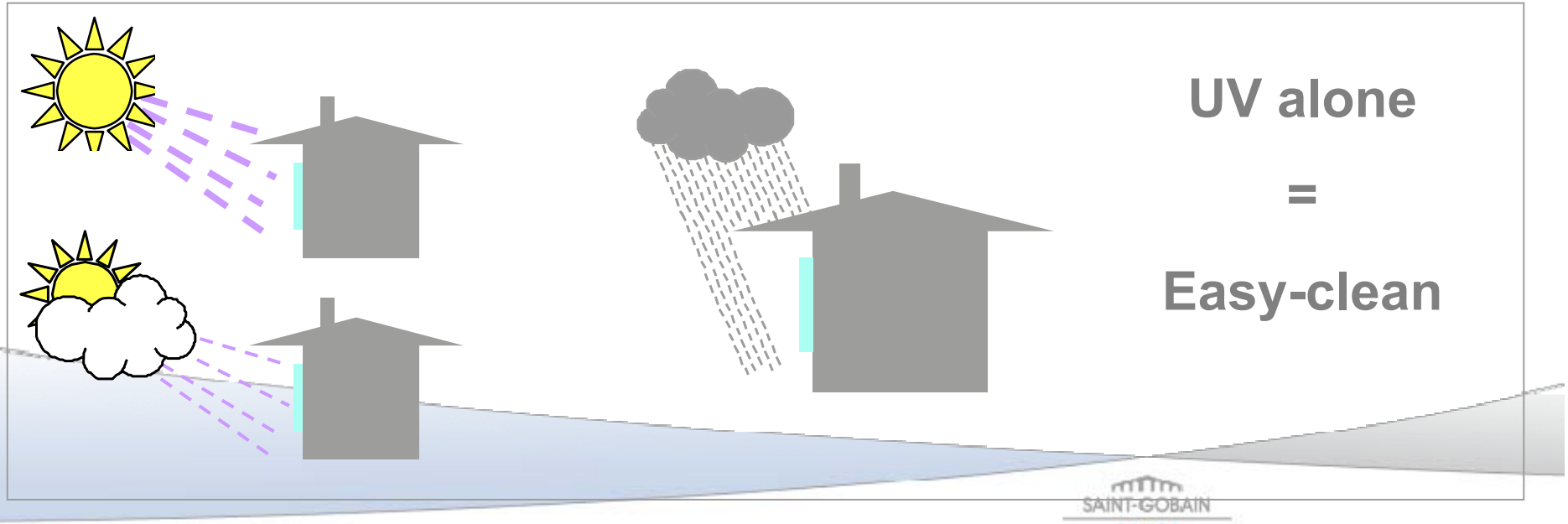
Self-cleaning or easy-to-clean ?



UV + rain water

=

Self-cleaning



UV alone

=

Easy-clean

SAINT-GOBAIN
GLASS

Efficiency / performance
SGG BIOCLEAN is …

- **…very efficient** against
  - Moisture condensation
  - Dried rain streaks
  - Organics (air pollution)
  - Salt spray
  - Dust
  - Insect residues
- **…moderately efficient** against
  - Finger prints
  - Bird droppings
  - Silicone vapours
- **…no efficient** against
  - Reactive silicone in direct contact
  - Spots of concrete and cement
  - Spots of paint
  - Spots of varnish

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GLASS

SGG BIOCLEAN

Behavior in respect with external soiling

SGG BIOCLEAN®
Consequence of the hydrophilic behavior against external condensation

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GLASS

SGG BIOCLEAN®

Self-cleaning glass with low maintenance benefits

- Applications where glass is exposed to rain (or water) and daylight
  - Domestic, Home Improvement, Local Authority
  - Commercial Projects
  - New build / renovation
- Glass in a vertical or sloping position
- All applications where access would otherwise be preclusive to cleaning
- Direct light and rain give the best results
- Lifetime : same as the glass itself
- Maintenance savings : 50% less cost of cleaning in average
- Average payback 2 to 5 years

SAINT-GOBAIN GLASS

Processing of SGG BIOCLEAN® :

- Assembly in IGU (with polysulfide, polyurethane and hot melt sealant)
  - Normal SGG BIOCLEAN
  - Dual-coated products (SGG BIOCLEAN with a soft coat on the opposite face)
- Tempering
- Laminating (mono or bi-coated)
- Enamelling (take care of aesthetics change on Bioclean)
- Screen – printing (take care of aesthetics change on Bioclean)

SGG BIOCLEAN®
Processing instructions (1/2)

- The coating is almost invisible :
- Correct identification of the coated side is very important along the processing chain:
  - On the big plates (jumbo, L.E.S.):
    - 2 series of 3 blue ink spots are present on the left coating side
  - After cutting and before further processing :
    - Cut pieces must have the coated side clearly identified
    - Mark the coated side with a chalk or a white Pentel pencil
  - In case of doubt on the coated side :
    - A coating detector is available
    - Coated side is more rough than uncoated side (touch them)
    - Coating is always on the air side (use a UV lamp to detect the tin side)

SGG BIOCLEAN®
Processing instructions (2/2)

- Avoid all contact between the coating and pointed or sharp objects
- Cut and toughen the product with the SGG BIOCLEAN coating face up *
- Avoid all direct contact with silicones (sealants, sprays, suckers, gloves…)
- Always position the coated face towards the outwards of a sealed unit or a laminated unit
- Identify the coated side using the special SGG BIOCLEAN label
- Please refer to our detailed instructions

* Except in the case of bi-coated products

SAINT-GOBAIN
GLASS

SGG BIOCLEAN®
Processing guidelines

SAINT-GOBAIN GLASS | SGG BIOCLEAN | Recipients: technical managers, operators | Processing instructions | BIO 00

Contents

General ..... BIO 01
Quality control ..... BIO 02
Testing the hydrophilic function ..... BIO 03
Identification, marking, labelling ..... BIO 04
Transport, storage, handling ..... BIO 05
Unstacking, cutting ..... BIO 06
Washing during processing ..... BIO 07
Standard cleaning ..... BIO 08
Assembly in DGU ..... BIO 09
Edgeworking, drilling ..... BIO 10
Toughening, heat-strengthening, HST ..... BIO 11
Assembly in laminated glass ..... BIO 12
Cutting laminated glass ..... BIO 13

SAINT-GOBAIN GLASS | SGG BIOCLEAN | Recipients: technical managers, operators | Processing instructions | BIO 09

General recommendations

- Incompatible with the coating
- Special precautions
- Standard precautions (SGG PLANILUX)

SGG BIOCLEAN is very sensitive to silicone

Do not place the SGG BIOCLEAN coating in contact with silicone. Check that the equipment used does not contain any silicone and is not contaminated with silicone:

- Greases, oils, penetrating oils (machine maintenance)
- Suction cups, seals, adhesives, gloves

Assembly in DGU

Also refer to: BIO01 General | BIO04 Identification, marking | BIO05 Transport, Storage | BIO07 Washing during processing

Rules

- Always place the SGG BIOCLEAN coating on the outside of the DGU.
  If the coating is assembled inside a DGU, there is a risk of separation and loss of tightness of the seal.
- When on conveyors it must be placed with the coating on the opposite side to the conveyor (to avoid marking by the conveyor wheels, belts or rollers)

Mastics

- Do not use silicone mastic or mastic containing silicone
- If you use silicone seals for other products, check that the equipment to be used for SGG BIOCLEAN (suction cups, gloves, etc) does not contain silicon and is not contaminated with silicone.
  Test the hydrophilic function: to check this BIO03 Testing the hydrophilic function
- Mastics that can be used:
  - Polysulphide
  - Polyurethane
  - Hot melt

Presses

- Traditional presses or gas presses are compatible.
- Suction cups must be clean and silicone-free.

Exit conveyors

- Regularly clean the exit conveyors (in particular on *LISEC* line)

SAINT-GOBAIN GLASS

SGG BIOCLEAN®
Installation instructions document

SAINT-GOBAIN
GLASS

SGG BIOCLEAN®

Document B2

Installation and maintenance instructions for window-makers and installers.

SGG BIOCLEAN has been specially designed to remain cleaner for longer than conventional glass. A transparent coating on the external surface of the glass harnesses the power of ultra-violet rays and the rain to break down dirt and grime then wash it clean away.

The coating is totally integrated into the surface of the glass and is highly durable. However, as with all coated glass, certain guidelines must be followed to ensure correct installation and proper maintenance of SGG BIOCLEAN.

The instructions below must be followed carefully in order to maintain the special properties of this glass.

Receipt of glass
- SGG BIOCLEAN is delivered with a special label affixed to the coated surface. This label must remain attached until it is received on site. It should then be carefully removed at first clean-down.

Storage
- As with all coated glasses, SGG BIOCLEAN must be stored in a clean, dry, ventilated area, protected from any extreme variations in temperature and humidity.
- Keep the product away from confined areas where there is an obvious presence of silicone or sealant vapours.

Handling/Equipment
- Avoid all contact or friction with sharp, metal or abrasive objects which may scratch the special coating (e.g. belt buckles, Stanley knives, razors).
- Avoid contamination from hands which have been in direct contact with silicone.
- Use clean, dry cloth safety gloves. Avoid those with rubber or silicone grips.
- Hand held or machine suckers must be in a good condition, clean and completely silicone-free. In order to ensure their cleanliness, protective covers are available.

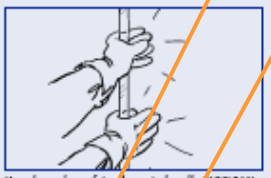
Assembly into a frame
- Always position the coated surface facing outward to the exterior. The coated face can be identified by the presence of a special SGG BIOCLEAN label.
- Avoid all contact with linseed oil and silicones during assembly and installation (including setting blocks, grease or silicone sealants, adhesives, glues, lubricants).
- Glazing tapes used in timber frames should not be capped with silicone.

Gaskets
- The use of pre-formed or dry gaskets (such as EPDM gaskets) is recommended with this product.
- Limit contact between the gasket and the glass to the precise area necessary.
- Glazing gaskets must not be lubricated with silicone oil.

Sealants
The use of silicone sealants must be avoided
- Where possible avoid all use of polymerisable mastics as they release a number of oils which diminish the efficiency of SGG BIOCLEAN especially around the edges.
- Avoid all use of linseed oil mastics or putties.

A comprehensive list of compatible sealants and gaskets is available from our marketing department or visit our website www.saint-gobain-glass.com/bioclean

SGG BIOCLEAN has a special label which identifies the coated face.


Use clean, dry safety gloves to handle BIOCLEAN. Avoid those with a rubber or silicone grip.


Ensure that hand held suckers are clean and in a good condition.


Avoid all contact between the glass and metal or abrasive objects.

SAINT-GOBAIN GLASS CLEAN

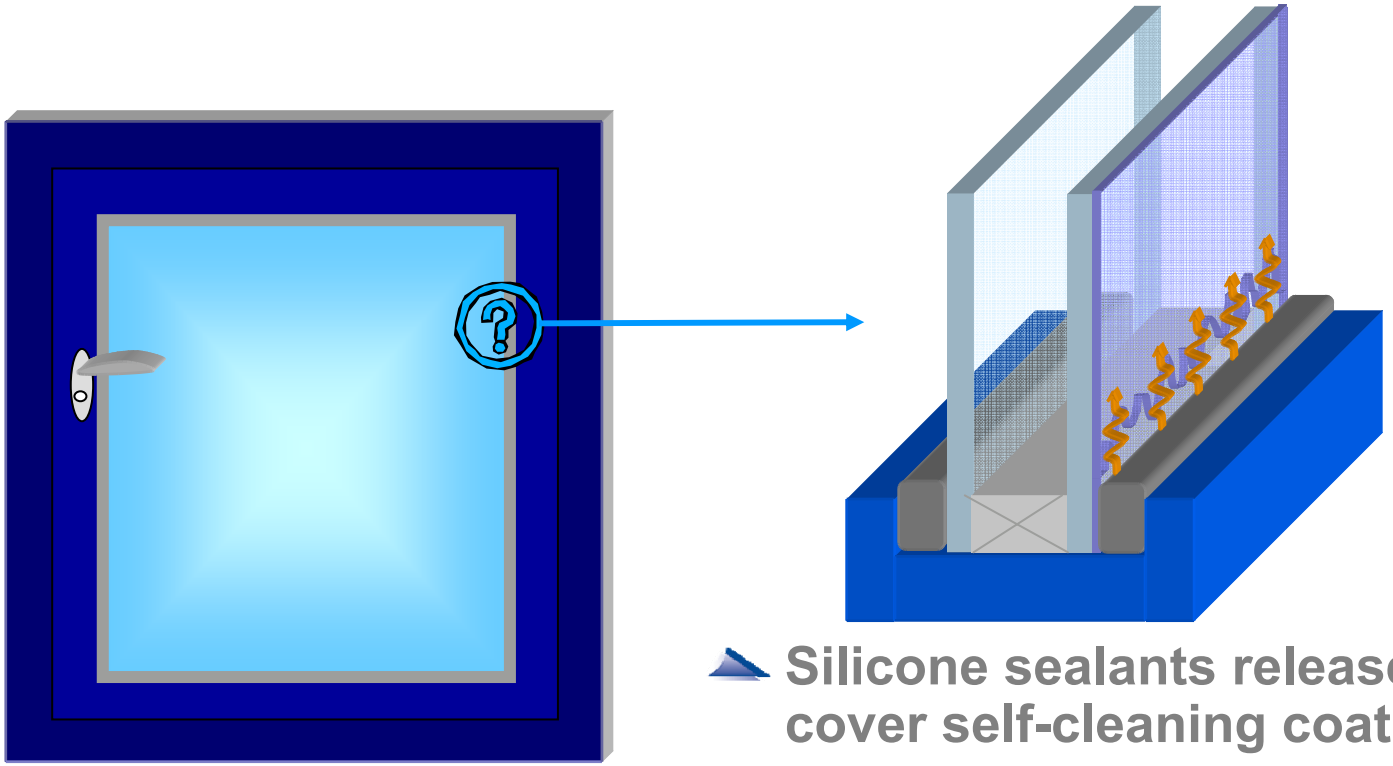
Gaskets
- The use of pre-formed or dry gaskets (such as EPDM gaskets) is recommended with this product.
- Limit contact between the gasket and the glass to the precise area necessary.
- Glazing gaskets must not be lubricated with silicone oil.

Sealants
The use of silicone sealants must be avoided
- Where possible avoid all use of polymerisable mastics as they release a number of oils which diminish the efficiency of SGG BIOCLEAN especially around the edges.
- Avoid all use of linseed oil mastics or putties.

A comprehensive list of compatible sealants and gaskets is available from our marketing department or visit our website www.saint-gobain-glass.com/bioclean

SAINT-GOBAIN
GLASS

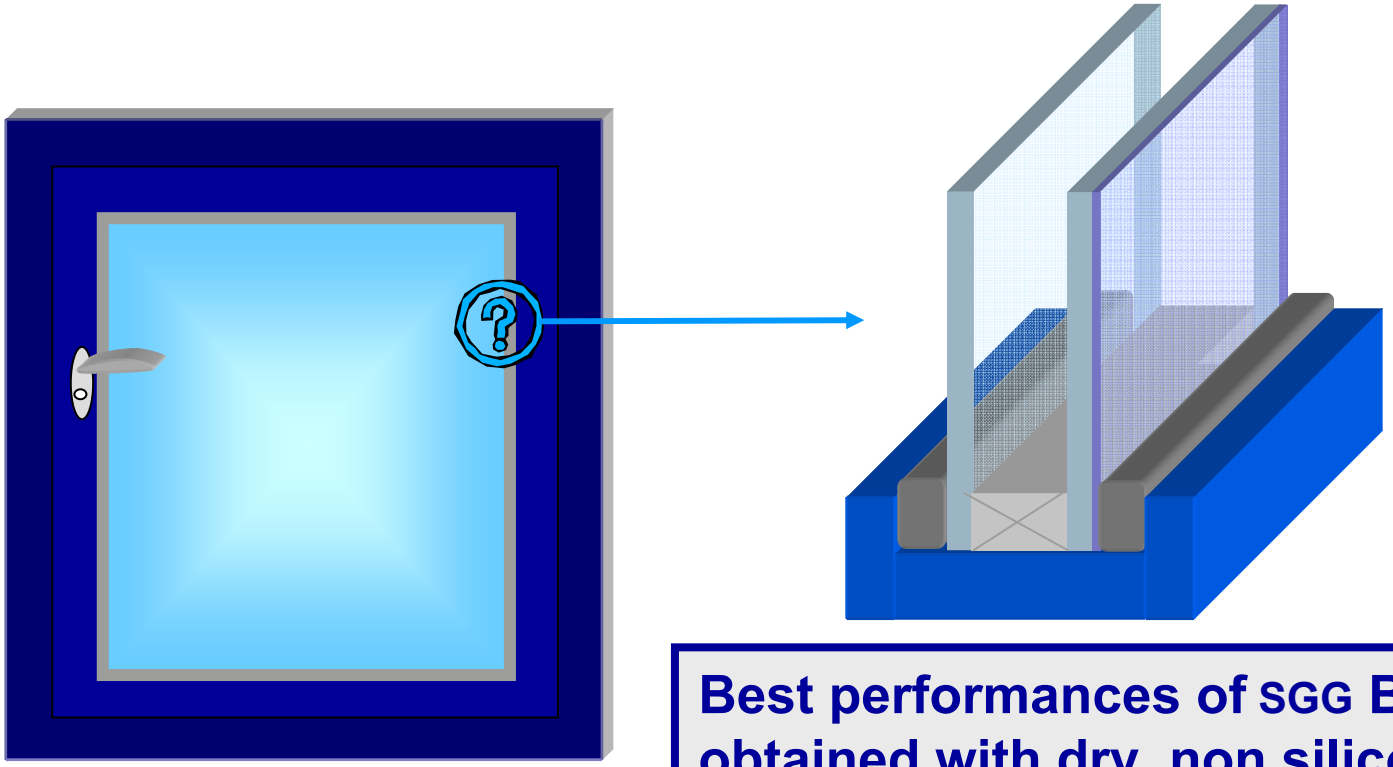
SGG BIOCLEAN®
Glazing silicone sealants issue



- Silicone sealants release oils which cover self-cleaning coating
- This induce an edge effect: coating is not hydrophilic anymore.
- This effect may last a long time

SAINT-GOBAIN GLASS

SGG BIOCLEAN®
Glazing silicone sealants issue

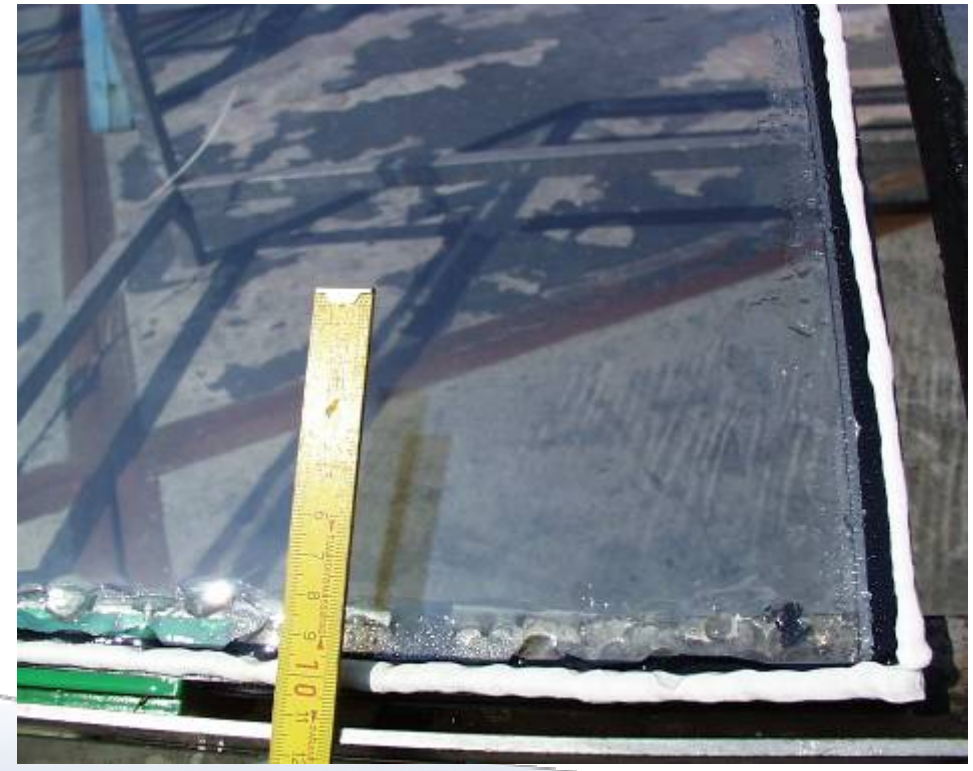


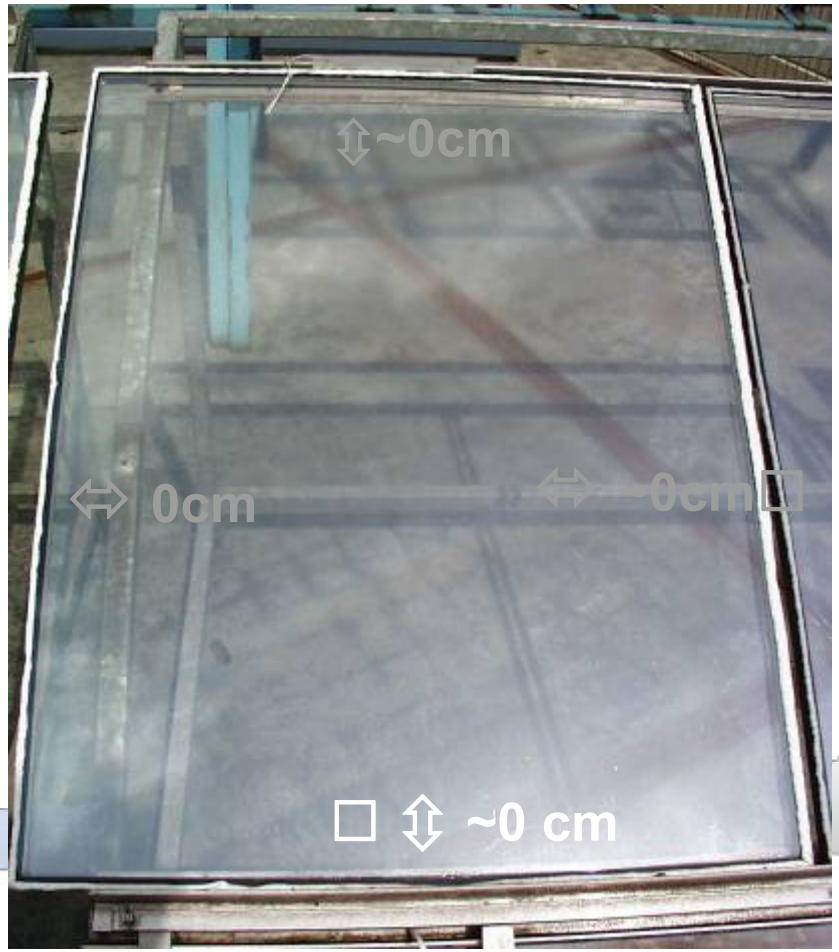
Best performances of SGG BIOCLEAN are obtained with dry, non siliconised gaskets (e.g. EPDM, TPE...) and non silicone sealants (MS Polymer, XMAP…)

SGG BIOCLEAN®
Glazing sealants

Standard silicone sealant : edge effect

Compatible sealant : edges are functional



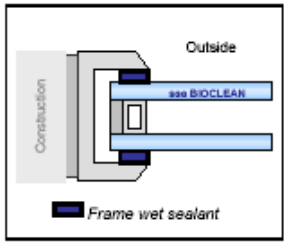


Sealants & gaskets :
list of recommended products per country

List of products compatible with SGG BIOCLEAN

The products mentionned in the graphs below are compatible with SGG Bioclean at the date tested. Verify with the supplier that the product hasn't been modified since is fully recommanded. Saint-Gobain Glass is not responsible for an eventual modification brougth to those products.

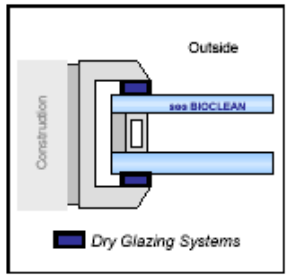
Glass Frame Sealing



Glass / Frame wet sealant

Important : no silicone sealant commercial reference has proved compatibility with SGG Bioclean. Product alternatives are the MS-Polymer based sealants below

Family	Supplier	Reference	Comment	Date tested	Internet	Denmark
MS-Polymer	Soudal	4 All Paint	Bioclean adhesion certified according to EN 11431	09.2003	www.soudal.be	084.18.60
MS-Polymer	Kent	Rotabond 2000	Need of the MS Prep Primer : Bioclean adhesion certified according to EN 11431	06.2003	www.kenteurope.com	049 17 78 88
Hybrid-PU	Sika	521 uv	Need of primer	06.2003	www.sika-industry.com	048 18 85 85



Dry Glazing Systems

Important : prevent any use of silicone oiled gasket. Prefer the gaskets listed below, dry or lubricated without silicone oil

Family	Supplier	Reference	Comment	Date tested	Internet	Denmark
EPDM dry	Linear	4058 - 101	Not oiled	12. 2003	www.linear.com	070-102211
EPDM dry	Linear	4100 - 101	Not oiled	12. 2003	www.linear.com	070-102211
EPDM oiled	Linear	4058 - 101	Slightly lubricated	12. 2003	www.linear.com	070-102211
EPDM oiled	Linear	4100 - 101	Slightly lubricated	12. 2003	www.linear.com	070-102211
EPDM dry	Trelleborg	EPDM	Not oiled	09.2003	www.trelleborg.com/industrialprofiles	075 64 72 52

Construction / Frame Wet Sealant

Important : no silicone sealant are prefered, to prevent any damage to the SGG Bioclean functionality due to water run-off polluted by silicone oils

Family	Supplier	Reference	Comment	Date tested	Internet	Denmark
MS-Polymer	Soudal	LM 215		06.2003	www.soudal.be	0841860

SAINT-GOBAIN GLASS

Version 1.1 - 04.2004

Updated list and instructions : go to www.selfcleaningglass.com

SAINT-GOBAIN GLASS

SGG BIOCLEAN®
End-user instructions document:

SAINT-GOBAIN
GLASS

SGG BIOCLEAN®

Document B1

Congratulations on choosing SGG BIOCLEAN for your home. Now let nature do your dirty work!

Please follow these instructions carefully in order to get the best out of your new product.

How does it work?

SGG BIOCLEAN has been specially designed to remain cleaner for longer than conventional glass. A transparent coating on the external surface of the glass harnesses the power of ultra-violet rays and the rain to break down dirt and grime then wash it clean away.

The coating is totally integrated into the surface of the glass and is highly durable. However, as with all coated glass a certain level of care must be exercised when handling and maintaining SGG BIOCLEAN.

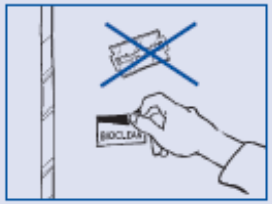
Guidelines for initial contact with SGG BIOCLEAN

Labelling
- If the SGG BIOCLEAN label is still attached to the glass carefully peel it off.
- Care must be exercised when removing the label from the glass to ensure that the special coating is not damaged. Do not use a razor, scraper or wire-wool to detatch the label.

Cleaning for the first time
- Wait at least a week before cleaning the product for the first time to ensure all sealants used in its installation are fully set.
- Start with a rinse or hose-down with clean water and complete, if necessary, with a normal maintenance routine (see reverse).

Self-cleaning function
- During the week after initial installation and clean-down the self-cleaning property of SGG BIOCLEAN will be progressively activated, triggered by exposure to UV light.
- This length of time required to activate the coating by UV rays can vary depending on the season, the orientation of the glass and so forth, but is normally within a week.
- When the glass is wet a small border of water droplets may appear around the perimeter surface of the glass. This is perfectly normal.

This document describes how to look after SGG BIOCLEAN. This information must be passed to your window cleaner.



Carefully peel off the special SGG BIOCLEAN label. Do not use tools or abrasives to remove it.

You are advised to wait at least a week before cleaning the installed product for the first time.

SAINT-GOBAIN GLASS CLEAN

Normal Maintenance

SGG BIOCLEAN has a special property which means that the glass stays cleaner for longer than normal glass. The more exposure the product has to both sun and rain, the cleaner it will stay, for longer. However, a number of other factors affect the time it takes for a mark to be naturally removed; the level of ambient pollution, atmospheric conditions (e.g. long periods without rain, ...) etc.

SGG BIOCLEAN is not a 'maintenance-free' product. Should the glass require occasional cleaning carefully follow these instructions:

Cleaning equipment required
- A soft, clean lint-free cloth or chamois leather
- or a clean, soft non-abrasive sponge
- or a clean, non-metal window squeegee

All equipment must be kept clean. This is to prevent any dirt or abrasive particles transferring from the equipment back onto the glass which may scratch or damage the coating.

Cleaning Products
- Clean water will normally suffice. Standard, mild glass-cleaning products can also be used.
- 'Soft' water is best for cleaning glass. In hard-water areas a small amount of washing-up liquid can be used to soften water.

Important
- Do not use any glass treatment products containing silicones or abrasive particles.
- Do not use any commercial cleaning products which are intended specifically for cleaning elements other than glass.
- Do not use chemical products: soda, bleach, washing powder, white spirit
- Avoid contact with all sharp or abrasive objects including jewellery, buckles, tape measures, razor blades, Stanley knives, scouring pads, steel wool, sandpaper and so forth.
- Never attempt to clean off a specific mark on the surface of SGG BIOCLEAN without first applying water.

Protection during building/maintenance works

If any other works are taking place in the vicinity of SGG BIOCLEAN then protect with a clean plastic sheet to prevent any splashes or staining from aggressive compounds (paint, varnish, glue, sealant, cement, plaster, mortar, etc). This will also protect the product from abrasive or hot particles (grinding or welding sparks, etc).

Important!

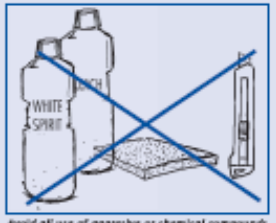
Please retain these instructions for future reference.
These instructions must be made known to anyone coming into contact with SGG BIOCLEAN glass e.g. your window cleaner.

SGG BIOCLEAN Let nature do your dirty work !

As and when cleaning is required, the use of a soft, clean sponge or cloth is recommended.

Alternatively a clean, non-metal window squeegee can be used.

Avoid all contact between the glass and metal or abrasive objects.



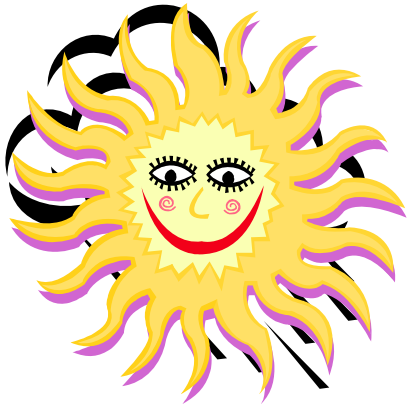
Avoid all use of aggressive or chemical compounds and abrasive equipment/tools.

SAINT-GOBAIN GLASS

Saint-Gobain Glass UK Limited
Marketing Department
Herald Way, Binley
Coventry CV3 2ND
Tel: 024 7654 7400
Fax: 024 7663 6473

www.saint-gobain-glass.com/bioclean

Distributor



With SGG BIOCLEAN,
like Julie,
you will more than ever like
SUN & RAIN & SUN…

THANK YOU FOR YOUR ATTENTION

www.selfcleaningglass.com

SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

5 | A look at the future

6 | Interior - Design

SAINT-GOBAIN GLASS

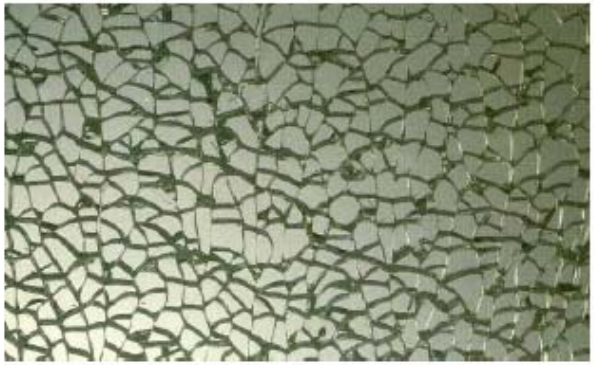
Definitions

Types of safety / security glass

- **Tempered / toughened glass**
- Laminated glass
- Fire resisting glass

Tempered glass vs. Heat Strengthened glass
EN 12150 vs. EN 1863

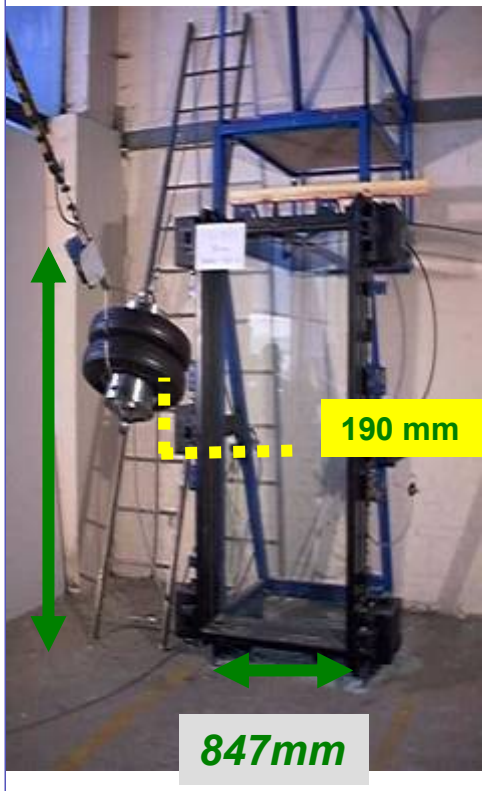
- Depending on the speed of cooling, result will be :

	Fully tempered glass (FT)	Heat strengthened glass (HS)
	SGG SECURIT	SGG PLANIDUR
		
	Fully tempered breakage pattern	Heat strengthened breakage pattern
Safety glass	**YES**	**NO**
Mechanical strength	x5	x2.5
Resistance to thermal stress	**200 °C**	**100 °C**
Heat Soak Test to reduce risk of spontaneous breakage	YES	NO
Structural applications (Bolted Point fixed glazings)	**YES**	**NO**

SAINT-GOBAIN GLASS

Tests : falling resistant glass EN 12600

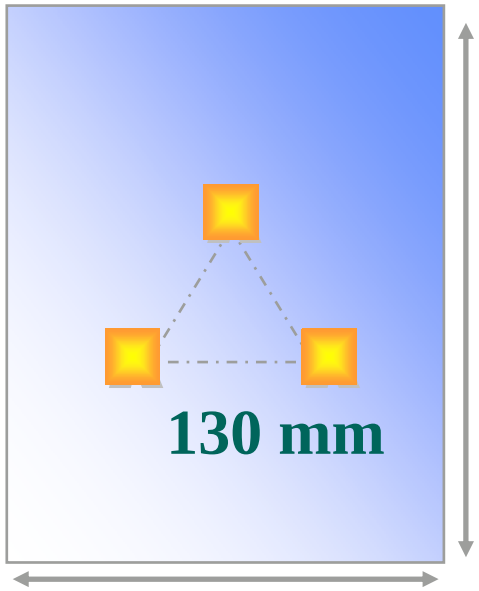
- 3 classes
  - class 1: 1200 mm
  - class 2: 450 mm
  - class 3: 190 mm
- 3 fragmentation modes
  - A: sharp fragments
  - B: bounded fragments
  - C: not sharp fragments

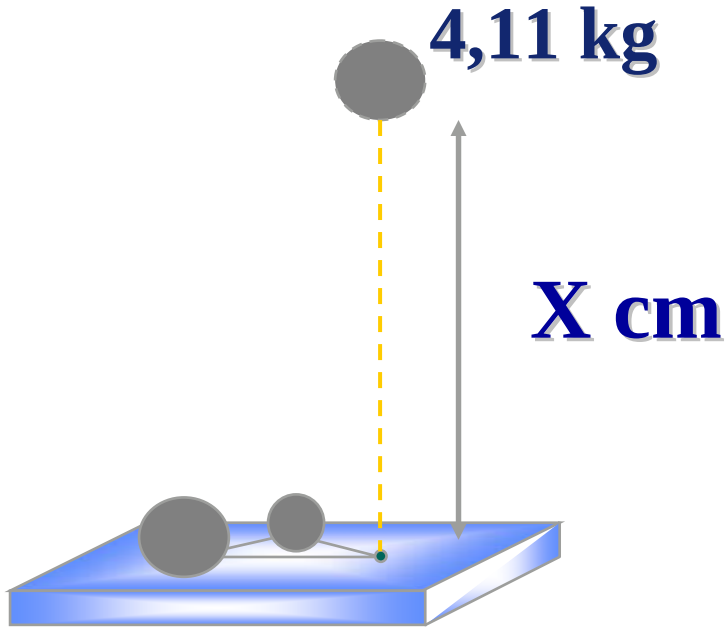


Tests : penetration resistant glass
EN 356

P1A to P5A

« Ball test »





20°C +/-2

Tests : penetration resistant glass EN 356

EN classes	Impact ball test	Energy (JOULES)
P1A	3 ball falls (4,1kg) height 1,5 m	181
P2A	3 ball falls (4,1kg) height 3 m	362
P3A	3 ball falls (4,1kg) height 6 m	724
P4A	3 ball falls (4,1kg) height 9 m	1.086
P5A	3 x 3 ball falls (4,1kg) height 9 m	3.258

Criterium : the ball must not pass through the glass

SAINT-GOBAIN GLASS

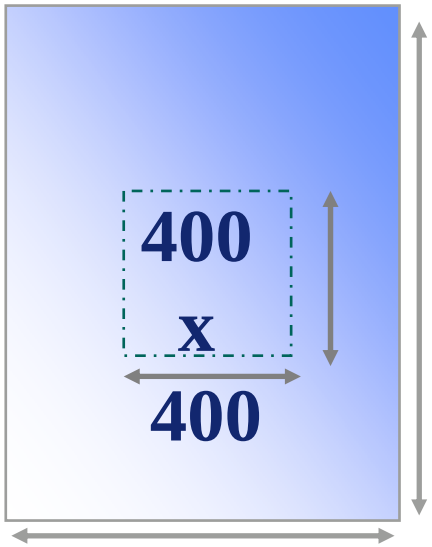
Test : penetration resistant glass
EN 356

EN classes	SGG STADIP PROTECT	Thickness (mm)	Weight (kg/m²)
P1A	33.2	7	16
P2A	44.2	9	21
P3A	44.3	9	21
P4A	44.4	10	22
P5A	SP 510 (44.6)	10	23

Test : penetration resistant glass
EN 356

P6B to P8B

Axe test



20°C +/-2

SAINT-GOBAIN GLASS

Test : penetration resistant glass
EN 356

P6B to P8B

EN classes	Test : hammer and axe – number of impacts	Energy (JOULES)
P6B	30 to 50 hits of hammer and axe	-
P7B	51 to 70 hits of hammer and axe	-
P8B	More than 70 hits of hammer and axe	-

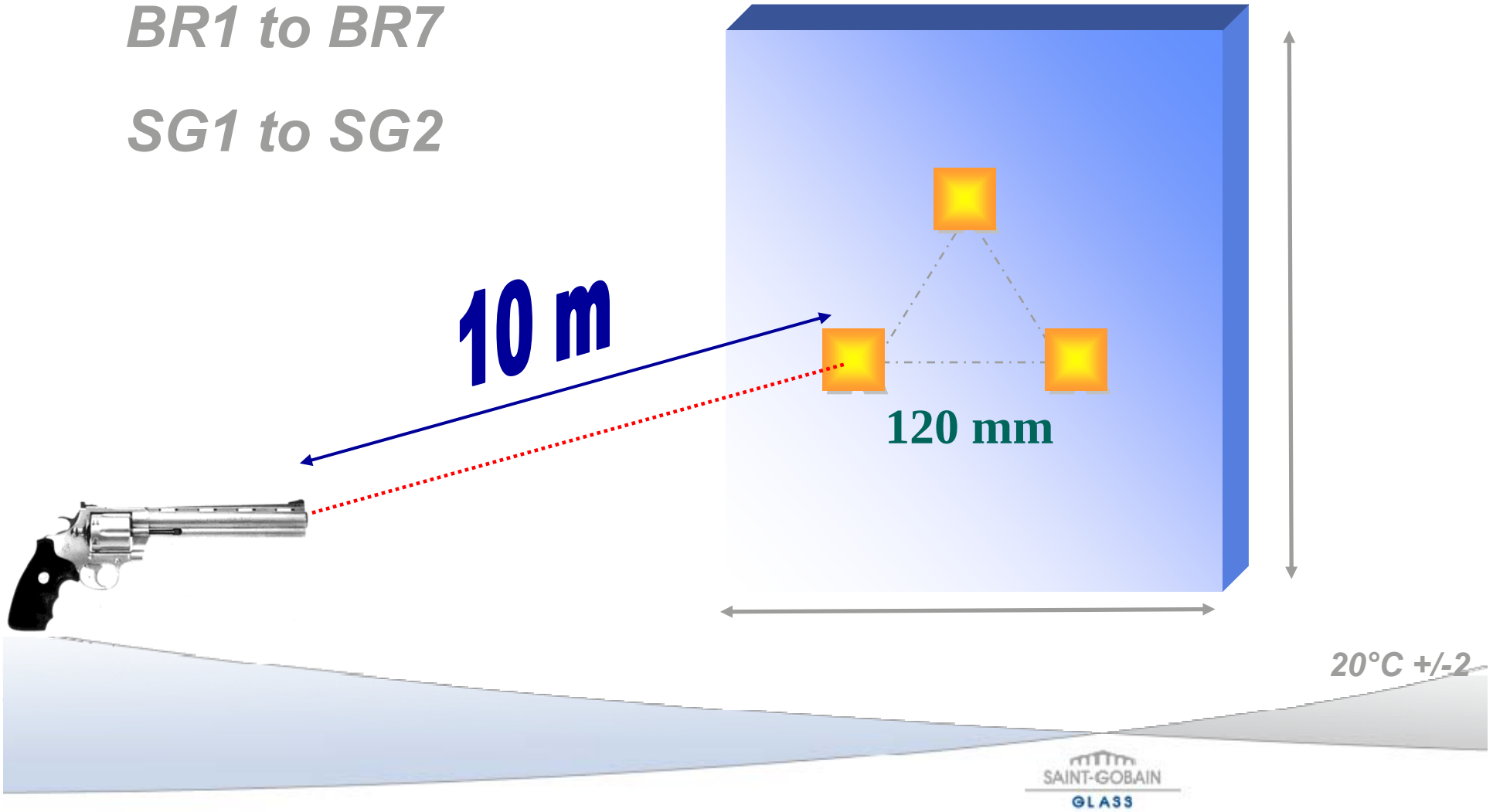
Test : penetration resistant glass EN 356

classes-EN	SGG STADIP PROTECT	Thickness(mm)	Weight (kg/m^2)
P1A	33.2	7	16
P2A	44.2	9	21
P3A	44.3	9	21
P4A	44.4	10	22
P5A	SP 510 (44.6)	10	23
P6B	SP 615	15	34
P7B	SP 722	22	51
P8B	SP 825	25	53

Test : bullet resistant glass
EN 1063

BR1 to BR7

SG1 to SG2

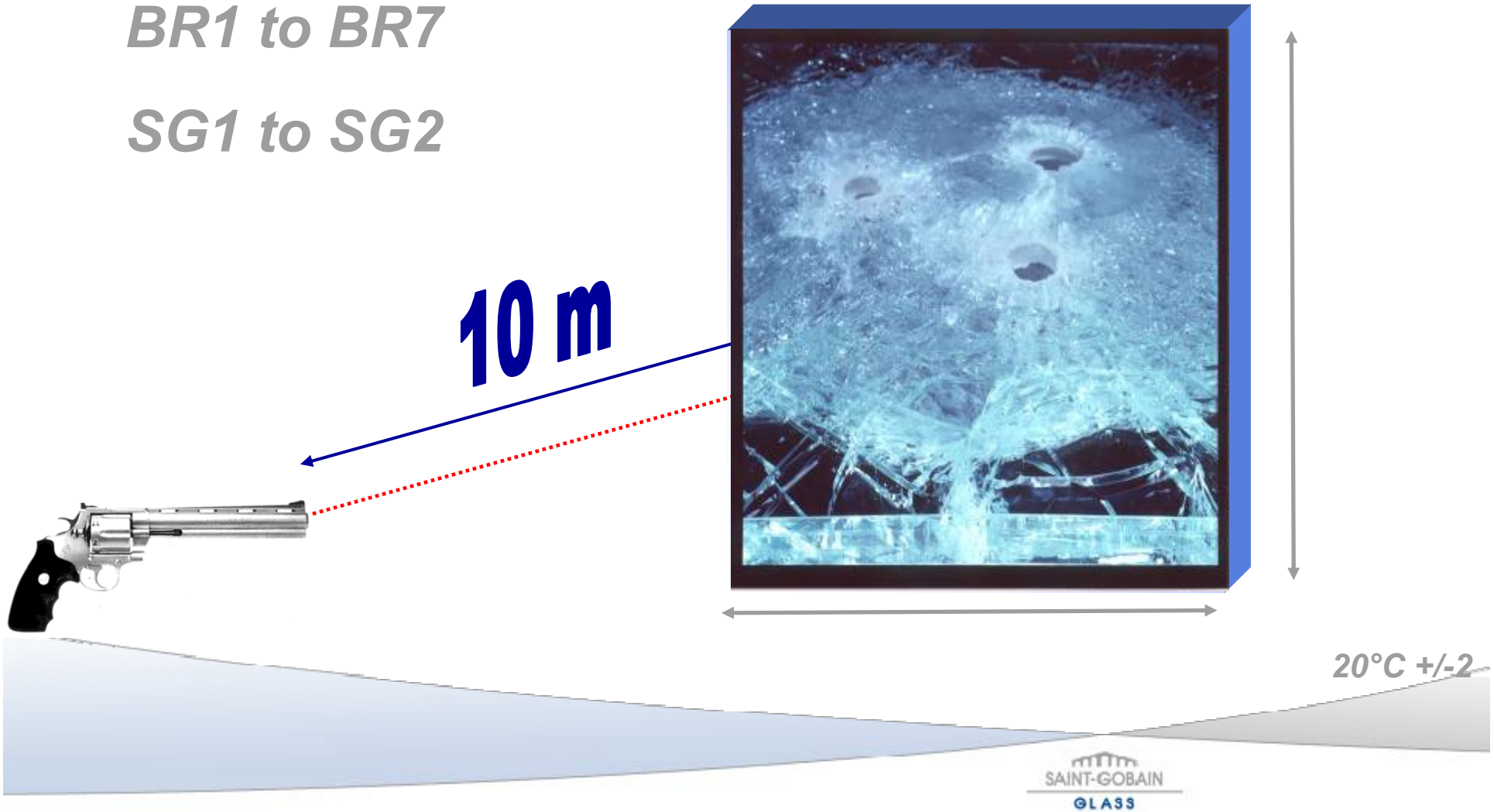


SAINT-GOBAIN
GLASS

Test : bullet resistant glass
EN 1063

BR1 to BR7

SG1 to SG2



SAINT-GOBAIN
GLASS

Bullet resistant glass
Saint-Gobain Glass product codification

EN 1063
Class

BR	**SG**
1 to 7	1 and 2
arme guerre arme au poing	fusil chasse
HS	**HC**

HS + HC + Retardateur = FS

NS (sans éclat vulnérant)
Not Splitting

S (risque d'éclat vulnérant)
Splitting

SAINT-GOBAIN
GLASS

Test : bullet resistant glass
EN 1063

classes EN	SGG STADIP PROTECT	Thickness (mm)	Weight (kg/m²)
BR1S	HS113 S	13	31
BR1 NS	HS120 NS	20	48
BR2	HS219 S (1)	19	44
BR2 NS	HS234 NS (1)	34	83
BR3	HS323 S (1)	23	53
BR3 NS	HS349 NS	49	119
BR4	HS431 S	31	73
BR4 NS	HS454 NS (3)	54	130
BR5 S	HS536 S (2)	36	82
BR5 NS	HS558 NS	58	140
BR6 S	HS647 S(1)	47	112
BR6 NS	CP-HS673 NS (3)	73	149
BR7 S	CP-HS783 S	83	176
BR7 NS	HS787 NS	87	205

HS = HIGH SECURITY

CP = ENKEL IN VI

S = SPLITTING

NS = NON SPLITTING

SAINT-GOBAIN GLASS

Test : bullet resistant glass
EN 1063

Les classes EN	SGG STADIP PROTECT	L'épais. (mm)	Le poids (kg/m^2)
SG1 S	HC133 S	33	75
SG1 NS	HC171 NS	71	171
SG2 S	HC247 S	47	114
SG2 NS	CP-HC284 NS	84	177

HC = HUNT CALIBER

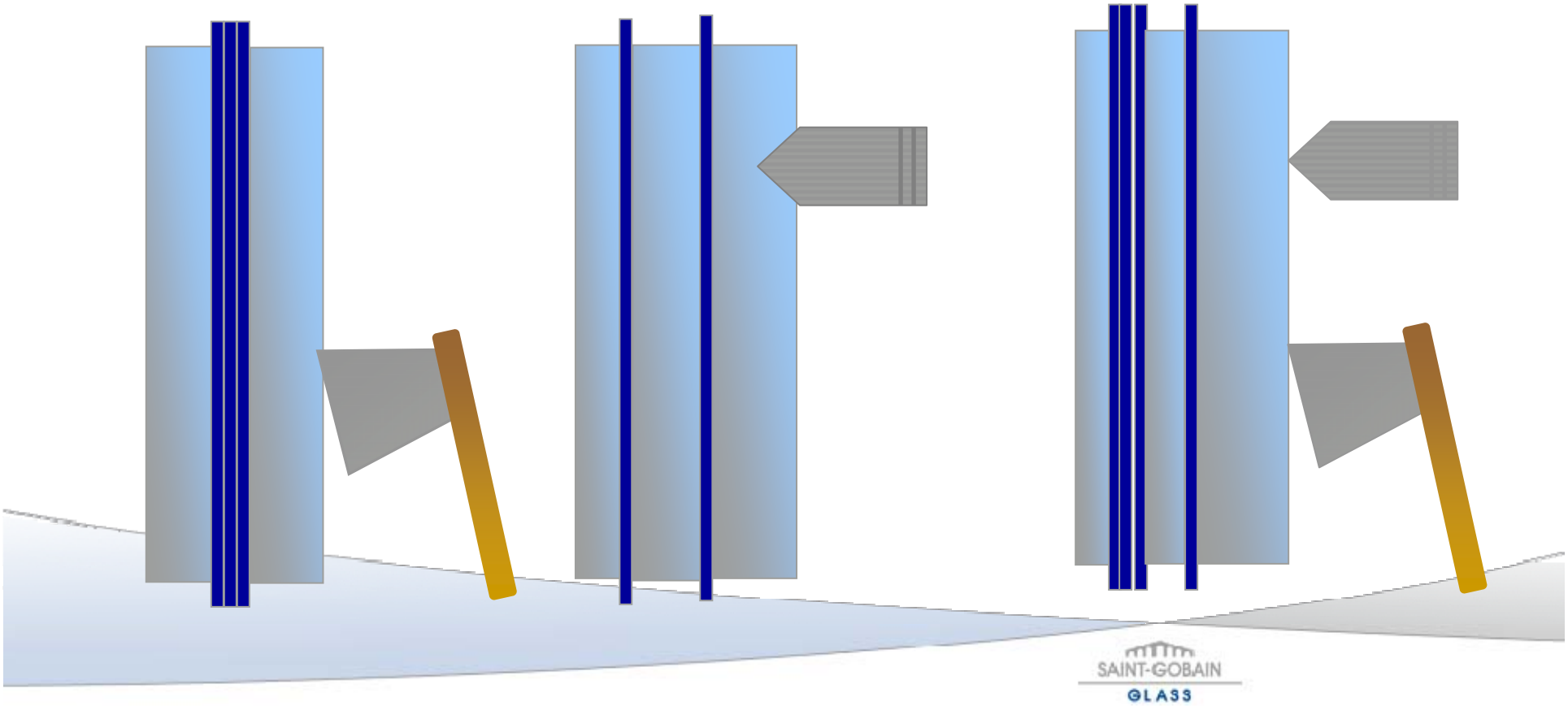
S = SPLITTING

NS = NON SPLITTING

SAINT-GOBAIN GLASS

Bullet + penetration resistant glass
EN 1063 + EN 356

- Protection levels can be combined



Bullet + penetration resistant glass
EN 1063 + EN 356

Classes EN	SGG STADIP PROTECT	Thickness (mm)	Weight (kg/m^2)
P6B+BR4 S+SG1 S	FS 641.34 S	34	82
P7B+BR6 S+SG2 S	FS 762.40 S	40	92
P8B+BR5 S+SG1 S	FS 851.36 S	36	82

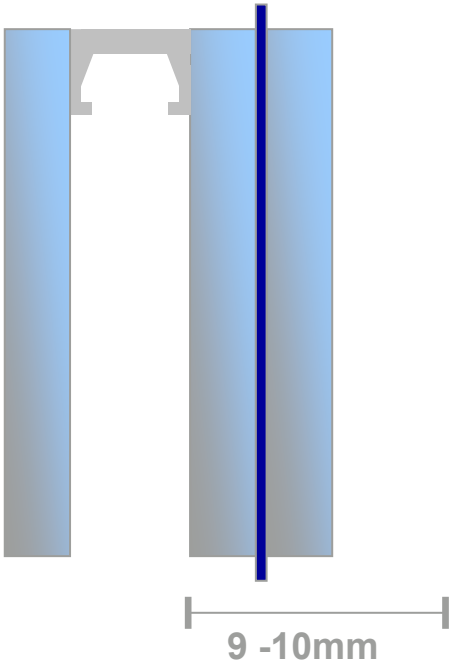
FS = FULL SECURITY

S = SPLITTING

NS = NON SPLITTING

Applications

Good protection (residential)



SGG STADIP PROTECT
44.2 or 44.4 or SP 510

SAINT-GOBAIN
GLASS

Applications

Street furniture

- Minimum specs :

SGG SECURIT 8mm

SGG STADIP PROTECT 44.2

Caution: Composition and thickness is function of size and fixation mode of the glazing

Applications

Shower cabins

- Minimum specs :

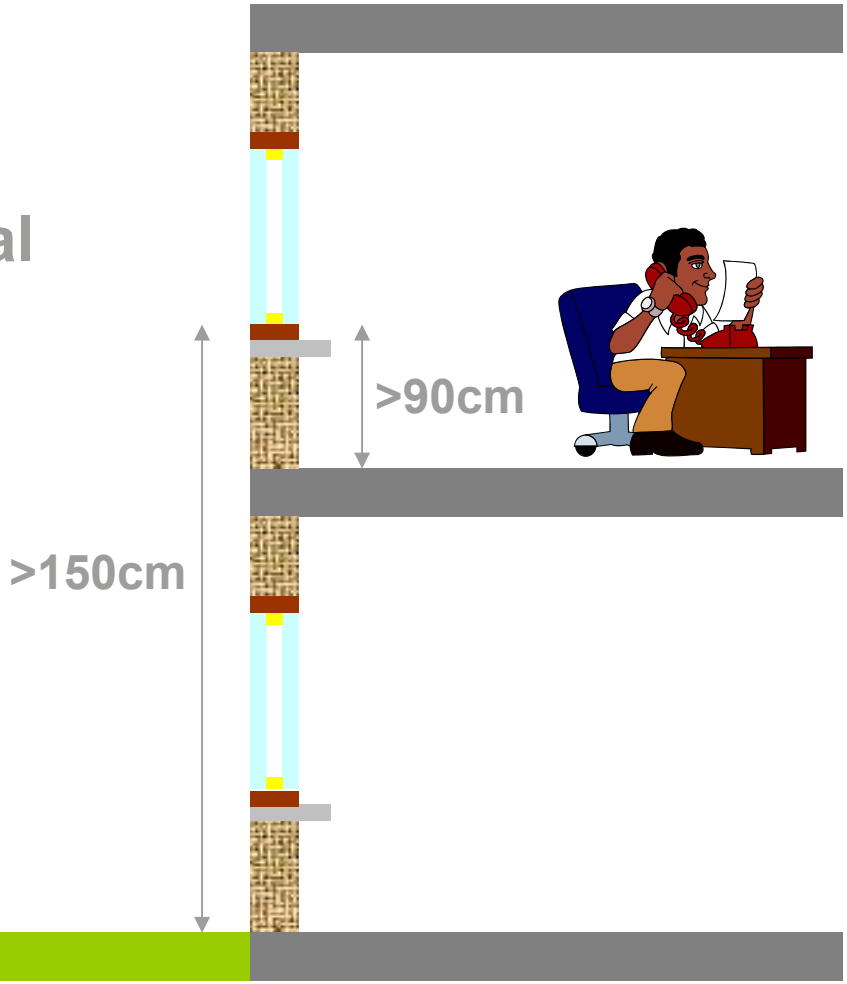
SGG SECURIT 8mm

SGG STADIP PROTECT 44.2

Caution: Composition and thickness is function of size and fixation mode of the glazing

Applications

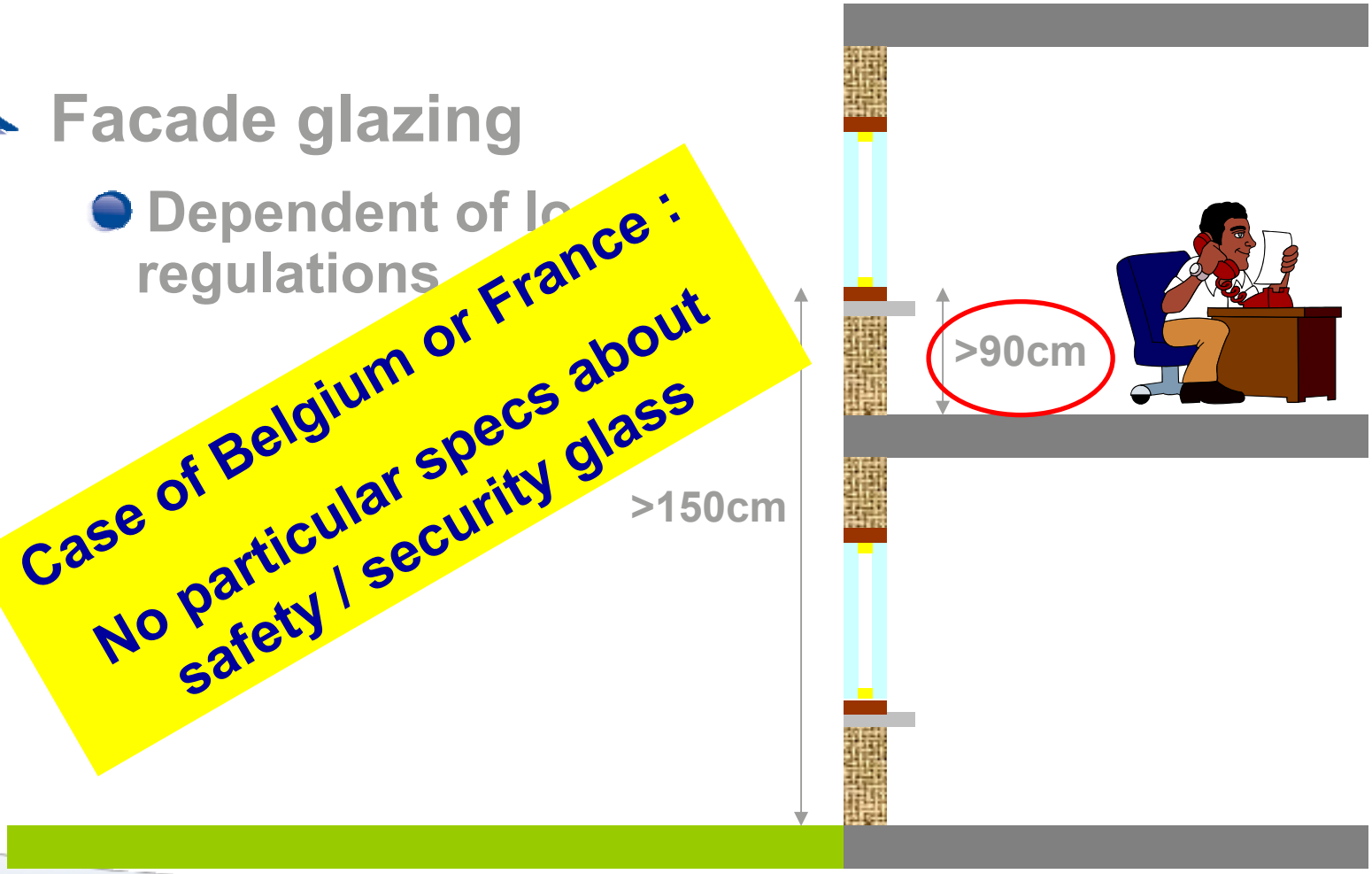
- Facade glazing
  - Dependent of local regulations



Applications

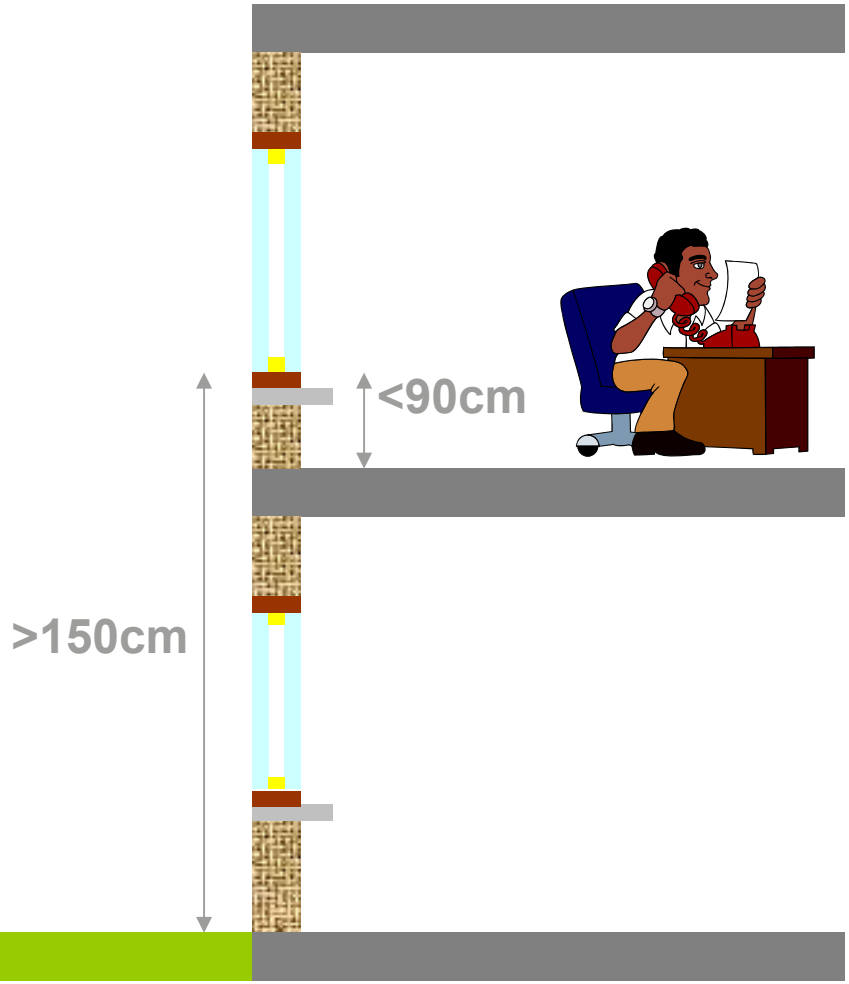
- Facade glazing
  - Dependent of lo
    regulations

Case of Belgium or France :
No particular specs about safety / security glass



Applications

Facade glazing

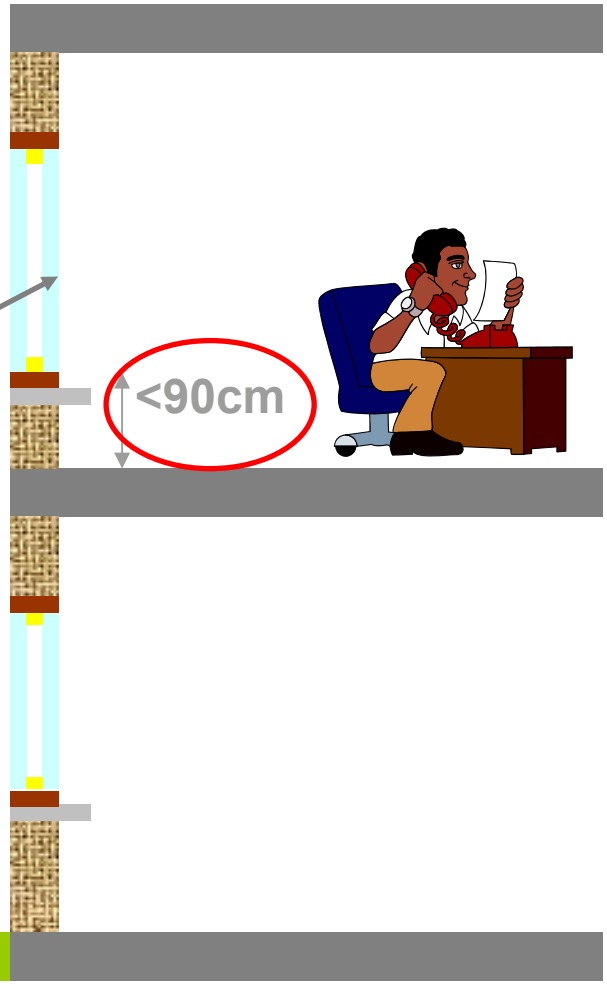


Applications

Facade glazing

Minimum

SGG STADIP PROTECT 44.2



Caution: Composition and thickness is function of size and fixation mode of the glazing

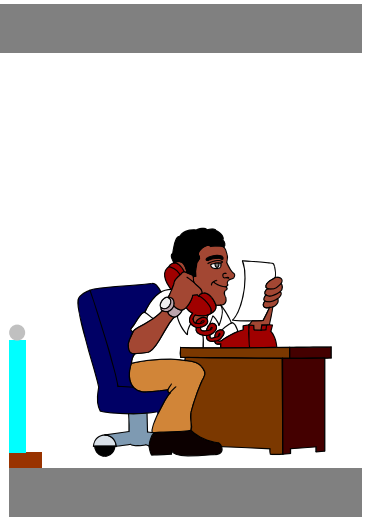
Applications

Facade glazing

Minimum

SGG STADIP PROTECT 44.2

SGG SECURIT 4 mm

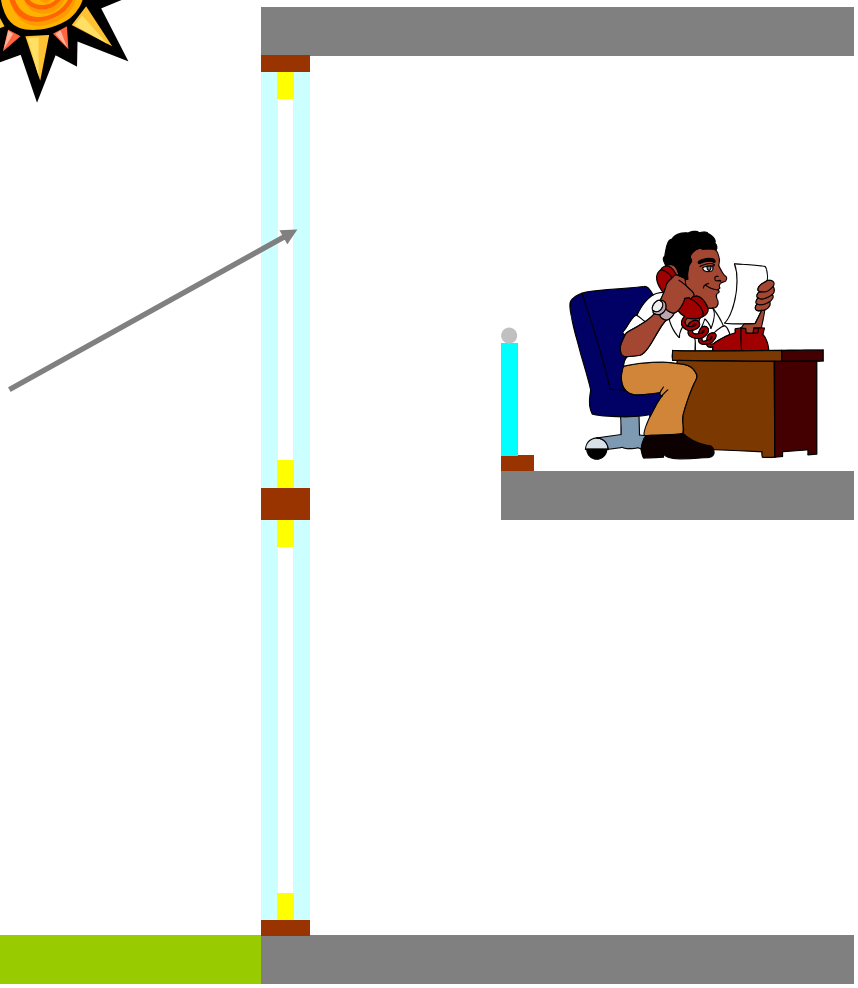


Caution: Composition and thickness is function of size and fixation mode of the glazing

SAINT-GOBAIN GLASS

Applications

Facade glazing



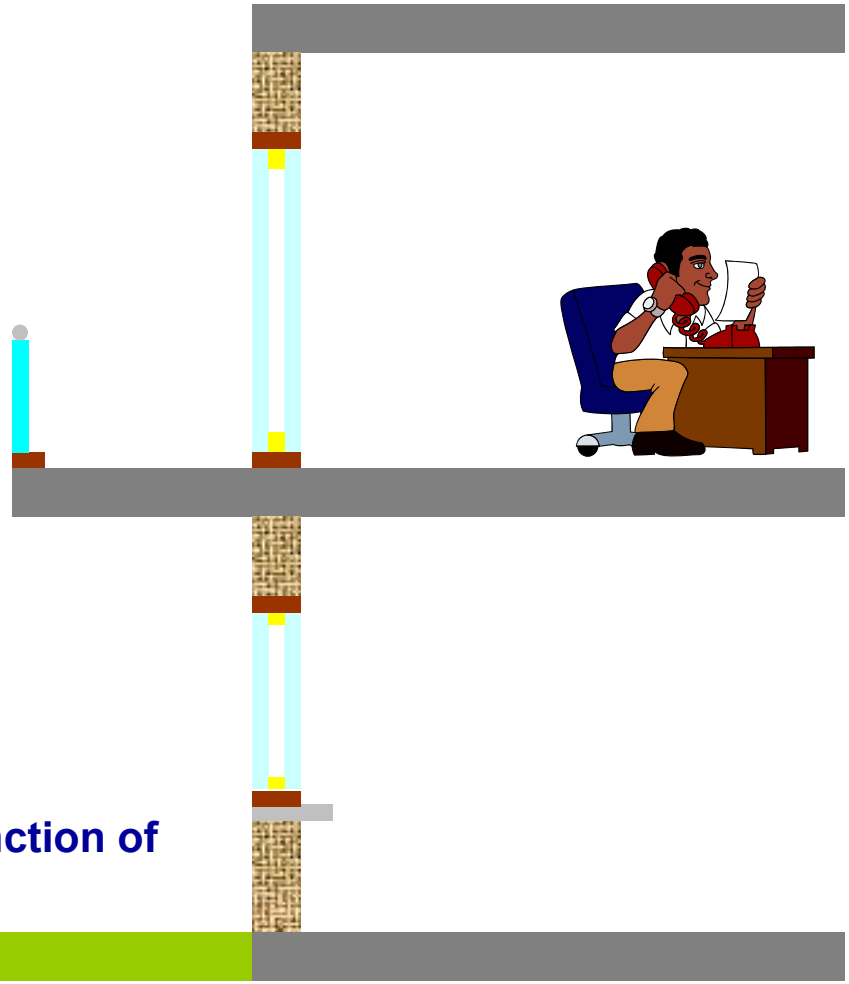
In case of sun exposure :

Glass must be heat treated if absorptance is higher than 50% or if there are areas possibly at different temperatures on the same glazing.

Ideally : FT + HST
Or HS if no structural glass

Applications

Guarding



Minimum

SGG STADIP PROTECT 44.2

Caution: Composition and thickness is function of size and fixation mode of the glazing

SAINT-GOBAIN GLASS

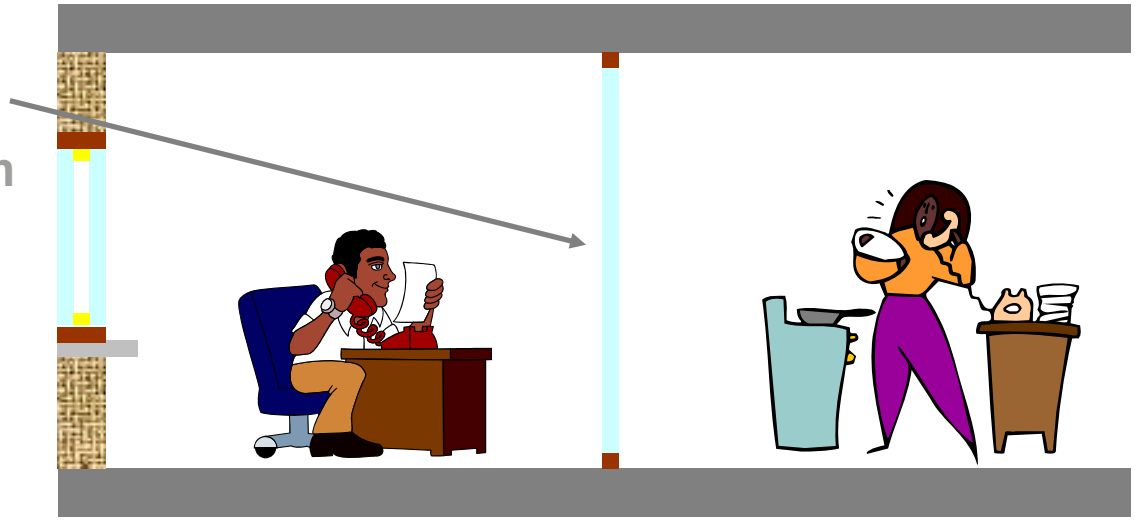
Applications

Interior partitions

Minimum

SGG STADIP 33.1

SGG SECURIT 4 mm



Caution: Composition and thickness is function of size and fixation mode of the glazing

SAINT-GOBAIN GLASS

Applications

Overhead glazings

Minimum

SGG STADIP 44.1

Caution: Composition and thickness is function of size and fixation mode of the glazing

SAINT-GOBAIN GLASS

Applications

Glass floor

Minimum

SGG STADIP PROTECT with 3 glass panes + Slip resistant treatment

(SGG LITE –FLOOR,

SGG SECURIT CONTACT)

Caution: Composition and thickness is function of size, load and fixation mode of the glazing

Fire Resisting Glass (FRG)
EN 357-1

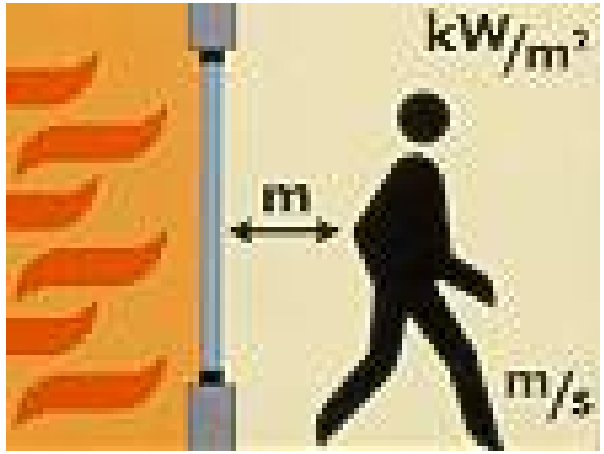
SAINT-GOBAIN
GLASS

Fire Resisting Glass (FRG)
EN 357-1

- Integrity only : class **E** (Pare-Flammes)

Fire Resisting Glass (FRG)
EN 357-1

- Integrity only : class **E** (Pare-Flammes)
- + Limitation of energy transfer (**EW**)



< 15 kW/m²

Fire Resisting Glass (FRG)
EN 357-1

- Integrity only: class **E** (ex Pare-Flammes)
- + Limitation of energy transfer : class **EW**
- + Insulation : class **EI** (Coupe-Feu)

< 140°C

SAINT-GOBAIN
GLASS

Fire Resisting Glass (FRG)
Specification datasheet

Determination need Data-sheet for FRG

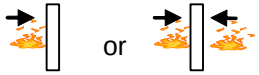
One request per protection type

All information in blue needs to be fulfilled

PROJECT NAME

1°	**Type of fire resistance**	**Click to select**
2°	**Duration of fire résistance**	**Click to select**
3°	**Type of framing system**	**Click to select**
4°	**Fire Direction**	**Click to select**
5°	**Application conditions**	**Click to select**
6°	**Type of framing element**	**Click to select**
7°	**Type of glazing**	**Click to select**

if other :



\-

\-

Acoustic Requirements (what value ?) dB

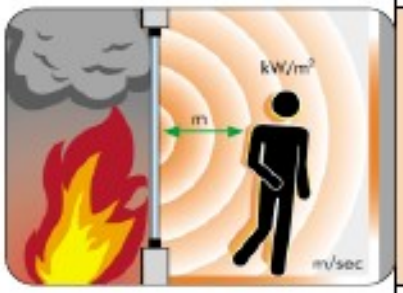
Thermal Reinforcement (what value ?)

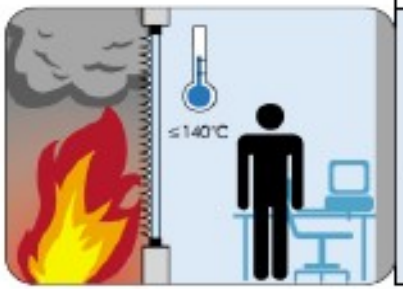
Glass dimensions and orientation (width X height) **X**

Quantities m² (sqm)

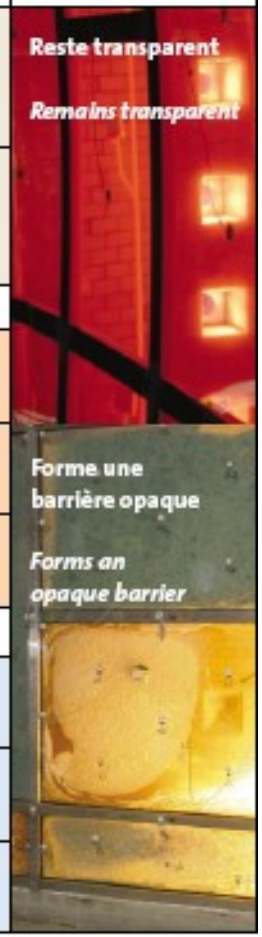
Comments

Vetrotech Saint-Gobain range





Classification de la résistance au feu *Classification of fire resistance*					Groupe Produit *Product Group*	Fonctions spéciales *Special Features*	en cas d'incendie *in case of fire*
(min.)	30	60	90	120		EN 13501-2 / EN 357	
E *Pare-Flammes*	✓				SGG PYROSWISS®	SGG SATINOVO SGG MASTERGLASS SGG DIAMANT SGG CLIMALIT SGG STADIP	**Reste transparent** ***Remains transparent***
	✓	✓	•	•	SGG PYROSWISS®EXTRA	Applications spéciales *Special Applications*	
EW	✓	•			SGG VETROFLAM®	< 15 KW/m² rayonnement à 1 m distance *radiation at 1 m distance*	
	✓	✓	•	•	SGG CONTRAFLAM®LITE	< 10 KW/m² rayonnement à 1 m distance *radiation at 1 m distance*	**Forme une barrière opaque** ***Forms an opaque barrier***
	✓	•			SGG SWISSFLAM®LITE	< 10 KW/m² rayonnement à 1 m distance *radiation at 1 m distance*	
EI *Coupe-Feu*	✓	✓	✓	✓	SGG CONTRAFLAM®	Les avantages du verre trempé *The tempered glass advantage*	
	✓	✓			SGG SWISSFLAM®	Propriétés multifonctionelles *Multifunctional features*	
	✓	✓			SGG SWISSFLAM® STRUCTURE	Système bord à bord *Butt-joint / flush-joint systems*	



✓ Disponible / *Available*

• Merci de contacter Vetrotech / *Please call Vetrotech*

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- Low-E glasses & Solar control glasses

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SAINT-GOBAIN GLASS

GENESIS

- 15 years of research on the electrochromic technology
- Transparent variable light & heat management
- Electrochromic glass sunroof for Ferrari cars

  - 2005/2007 : Superamerica

    1st worldwide serial application

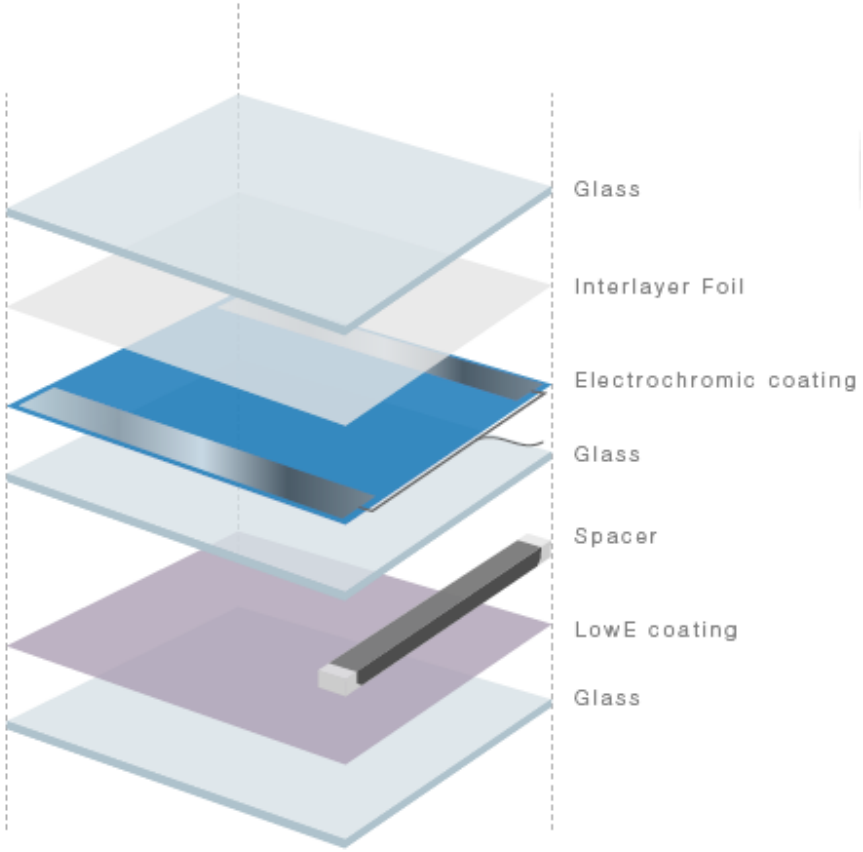
    World fastest cabriolet

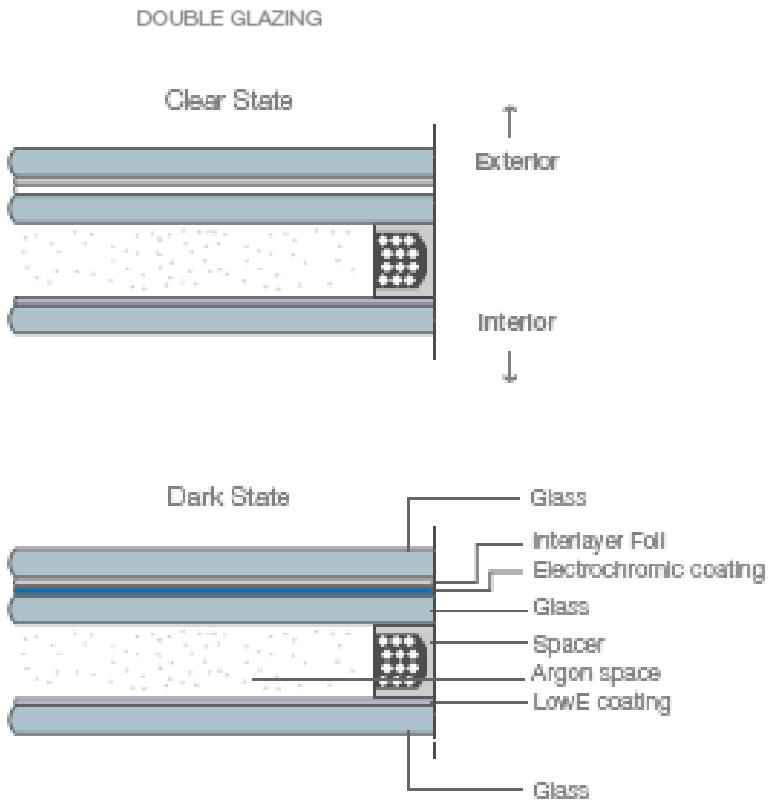
  - 2007/2009 : 612 Scaglietti for the 60th anniversary car of Ferrari

SUPERAMERICA – 2005/2007

612 SCAGLIETTI – 2007/2009

DESIGN CONFIGURATION





TECHNOLOGY

- Switching from clear to dark blue state on demand (from ~ 60 to 90 sec)
- High technological coating manufacturing process
- Many thin layers deposited on a glass (around 1µm thick - a hair is ~40µm)
- Like a thin battery deposited on the glass

- Range in double glazing unit
  - Ug = 1,08 W/(m².K)
- Electrochrome PLANILUX
  - LT ~60% to ~3%
  - g value 0,40 to 0,06
- Electrochrome SKN
  - LT ~40% to ~2%
  - g value 0,20 to 0,04

SAINT-GOBAIN GLASS

FUNCTIONS AND APPLICATIONS

PROTECTION, TRANSPARENCY, ENERGY-EFFICIENCY

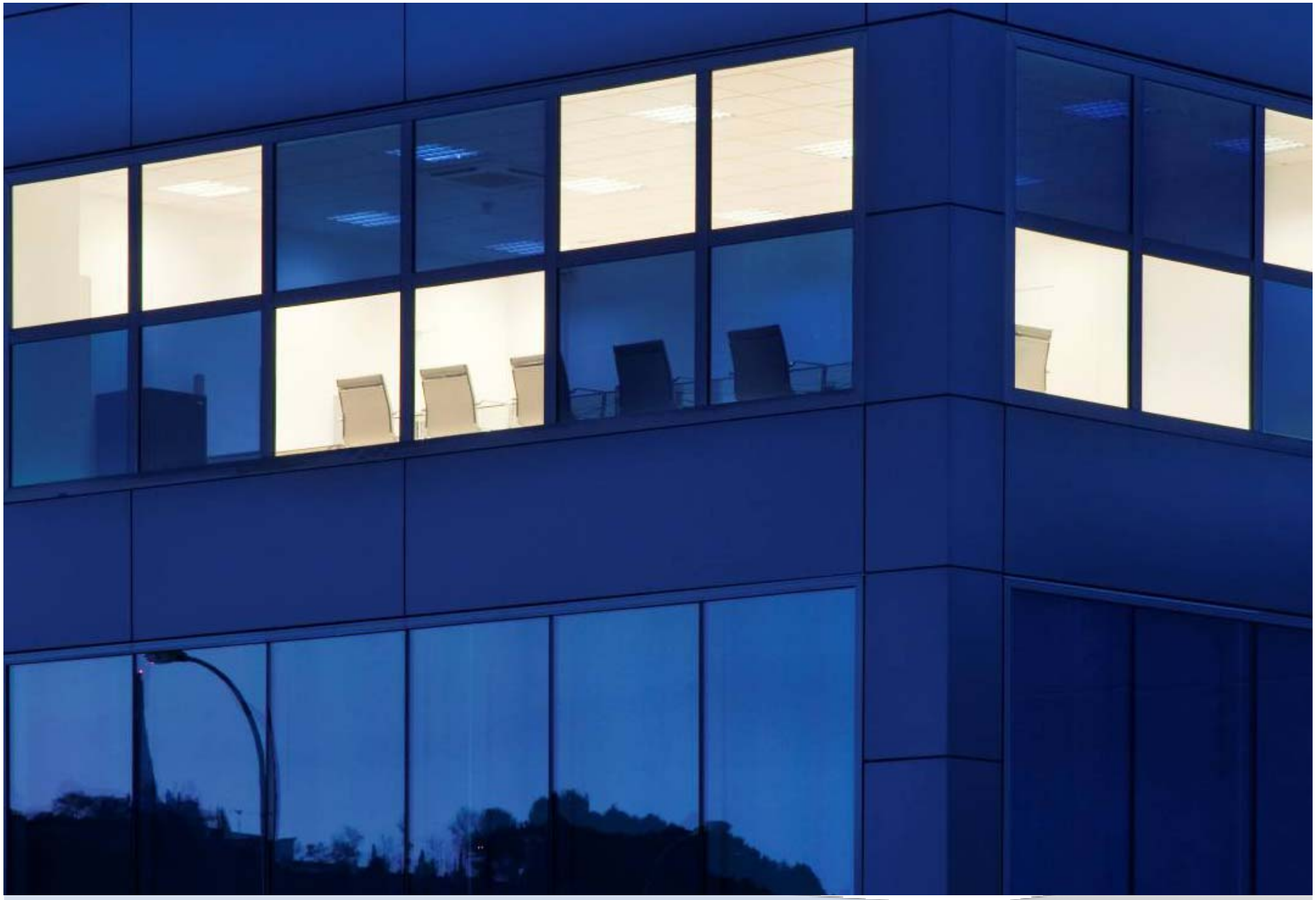
- Light & Glare Management
- Energy savings for buildings
- Comfort for users
- Always transparent

Potential applications

- atriums, facades walls, lobbies, verandas, etc.

SAINT-GOBAIN
GLASS

SAINT-GOBAIN
GLASS



SAINT-GOBAIN
GLASS

Agenda

1 | Energy efficient glass

- Background
- Energy balance / regulations trends
- Low-E glasses & Solar control glasses

2 | Noise protection glass

3 | Self-cleaning glass

4 | Safety / Security Glass

5 | A look at the future

6 | Interior - Design

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Labai ačiū!

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