Contributing to the Sustainable Built Environment

Your Dreams, Our Challenge

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- Introduction of AGC Group & AGC Glass Asia Pacific
- AGC's Journey Towards Sustainability
- Net Zero impacts on Green-Built Environment
- Zero Energy Building (ZEB) Concept and AGC's Glass Solutions
- Enhance performance with coating glass
- Energy-savings glass solutions
- Energy-generating glass solutions
- Importance of Environmental Product Declaration (EPD) & Green Product Certifications

AGC Group

A worldwide leader in Glass, Electronics, Chemicals, Life Science, Ceramics & Other Materials

¥2,035.9bn
Net Sales

57,600
Employees (est.)

HQ and Stock Exchange in
Tokyo

AGC

Architectural Glass
& Automotive

Electronics

Chemicals

Life Science

Ceramics
& Other Materials

AGC Glass Asia Pacific

Singapore – Regional HQ

Thailand – AGC Flat Glass, Samut Prakan Plant

3 Float Lines, Mirror, Magnetron Coated Glass, Processed Glass, Sales & Marketing

Indonesia – PT Asahimas Flat Glass TBK, Sidoarjo & Cikampek Plants

4 Float Lines, Interior Glass , Mirror, Pyrolytic & Magnetron Coated Glass, Sales & Marketing

Representative Offices

Australia, Hong Kong, Malaysia, Taiwan, Vietnam

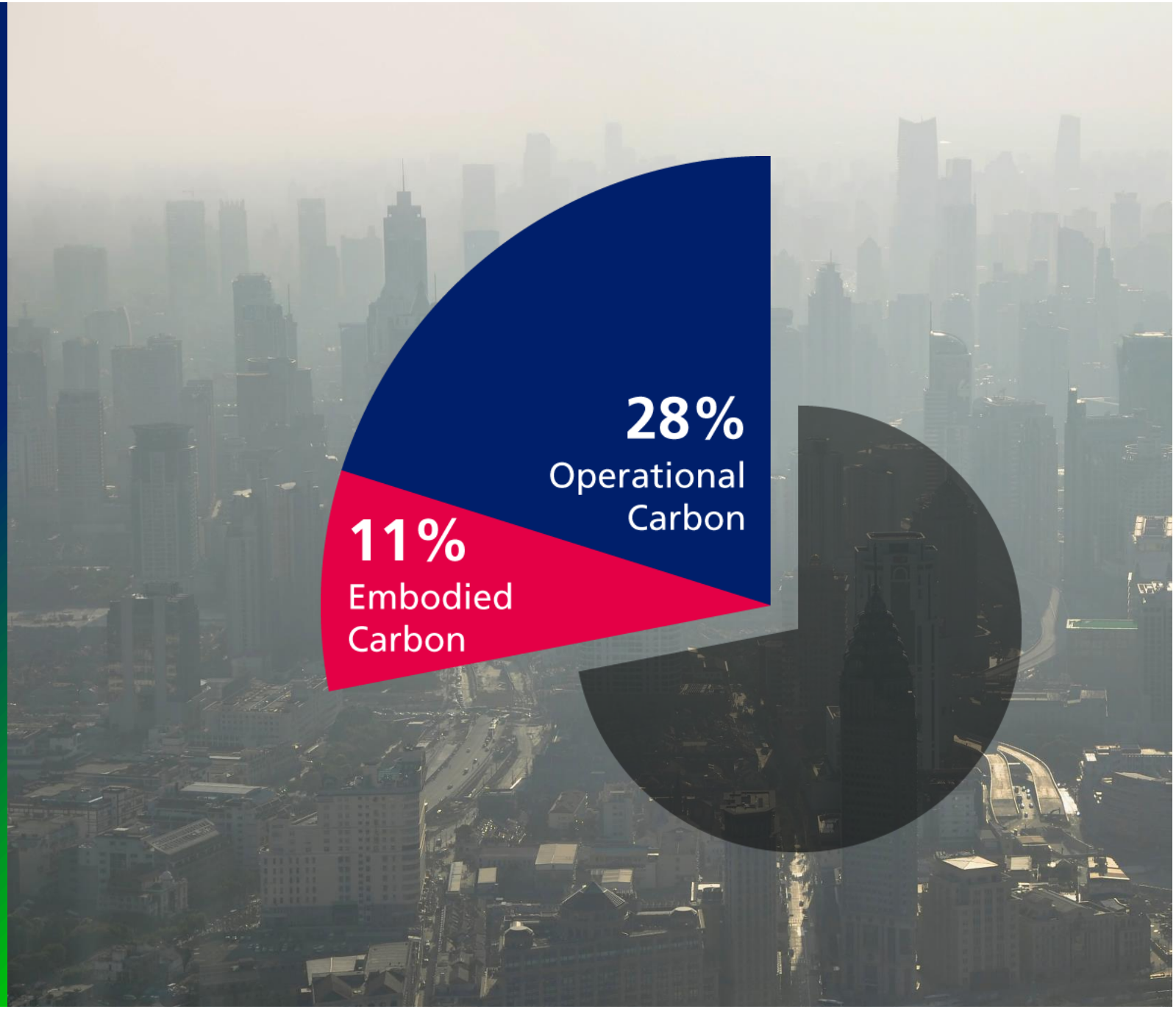
Did you know? Solutions

Buildings account for 39% of global GHG emissions

Green buildings can contribute significantly to reducing GHG emissions

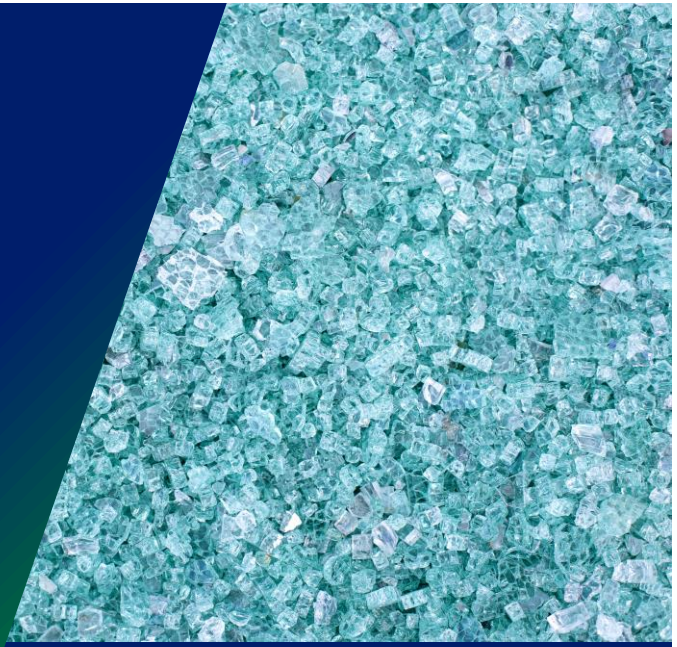
Energy-efficient glass can play a role to reduce energy consumption and associated CO_2 emissions

Source: *https://worldgbc.org/article/profile-of-an-asia-pacific-network-partner-agc/*



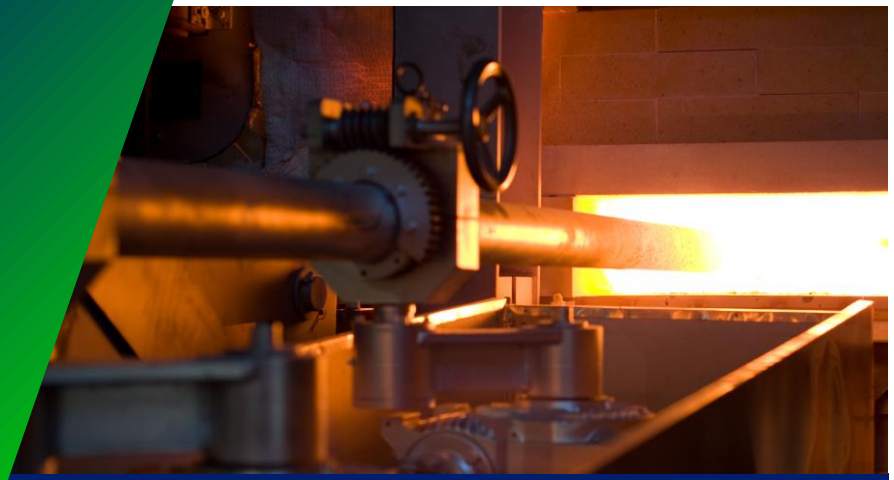
AGC

AGC's sustainability **various focus points**



Glass Cullet Recycling

Green Energy Adoption



New Combustion Technologies

Certifications

AGC's roadmap to **carbon neutrality**

Reduce overall greenhouse gas emissions **by 30% by 2030**

Achieve net zero carbon **by 2050**

United Nation & Countries today are actively pushing Sustainability policies

What does it mean?

Local Government develop Sustainability Roadmap referencing international standards (Eg: ISO/TS23764)

What is ZEB?

ZEB (Zero Emission Building) = Building without CO2 emission

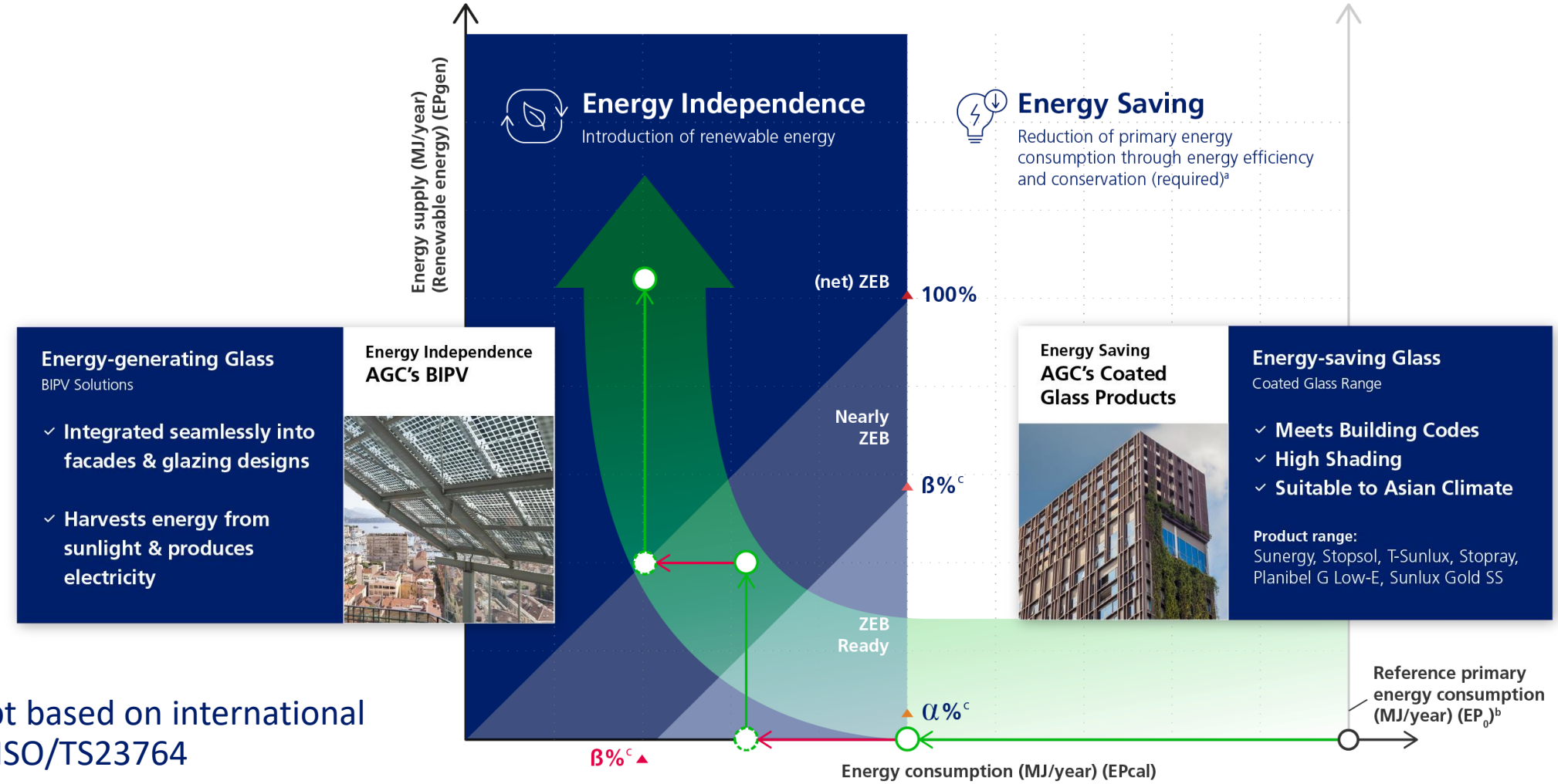
Energy consumption < Renewable Energy

ZEB Way of thinking	
No	Just collecting renewable energy bigger than consumption
Yes	-Minimize energy consumption as much as possible first, at lease complying energy saving regulation - The rest should be compensated by renewable energy

* Criteria: Japan, depend on country

ZEB Family Way to ZEB		
ZEB Ready	50%*	Energy saving measure
Nearly ZEB	75%*	Energy saving + renewable energy almost reach ZEB
(Net) ZEB	100%	Renewable energy > energy consumption

ZEB Concept with AGC's Glass Solutions



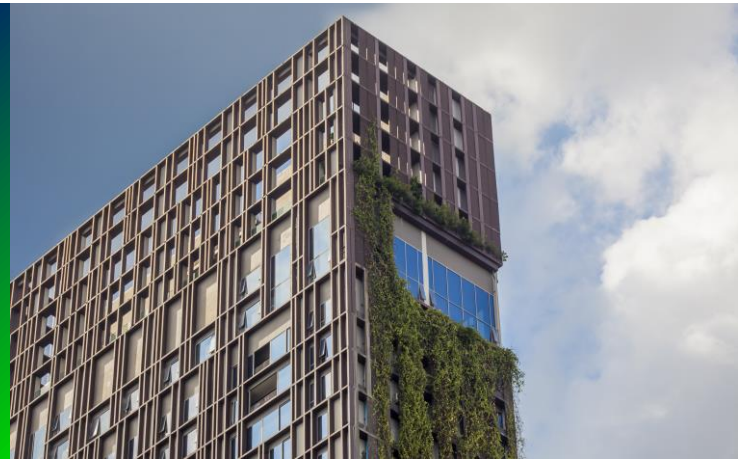
ZEB Concept based on international standards: ISO/TS23764

AGC Glass Asia's Glass Solutions towards **Net Zero Building**

Energy-saving Glass
Coated Glass Range

- Meets Building Codes
- High shading
- Suitable to Asian climate

Product range: Sunergy, Stopsol, T-Sunlux, Planibel G Low-E, Gold Sunlux SS, Stopray



Energy-generating Glass
BIPV Solutions

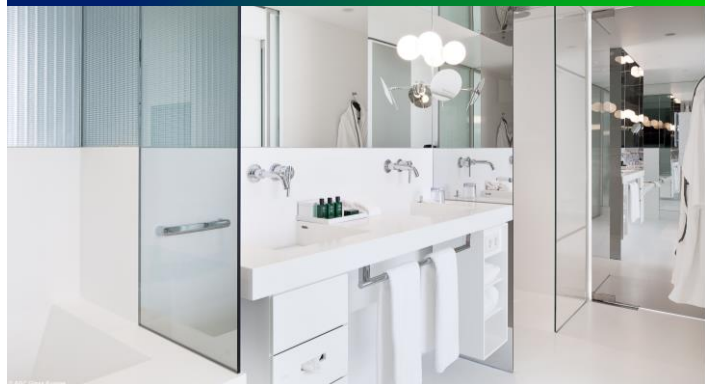
- Integrated seamlessly into facades & glazing designs
- Harvests energy from sunlight & produces electricity

Product range: SunEwat Vision, SunEwat Origin, SunEwat Colour, SunEwat Design

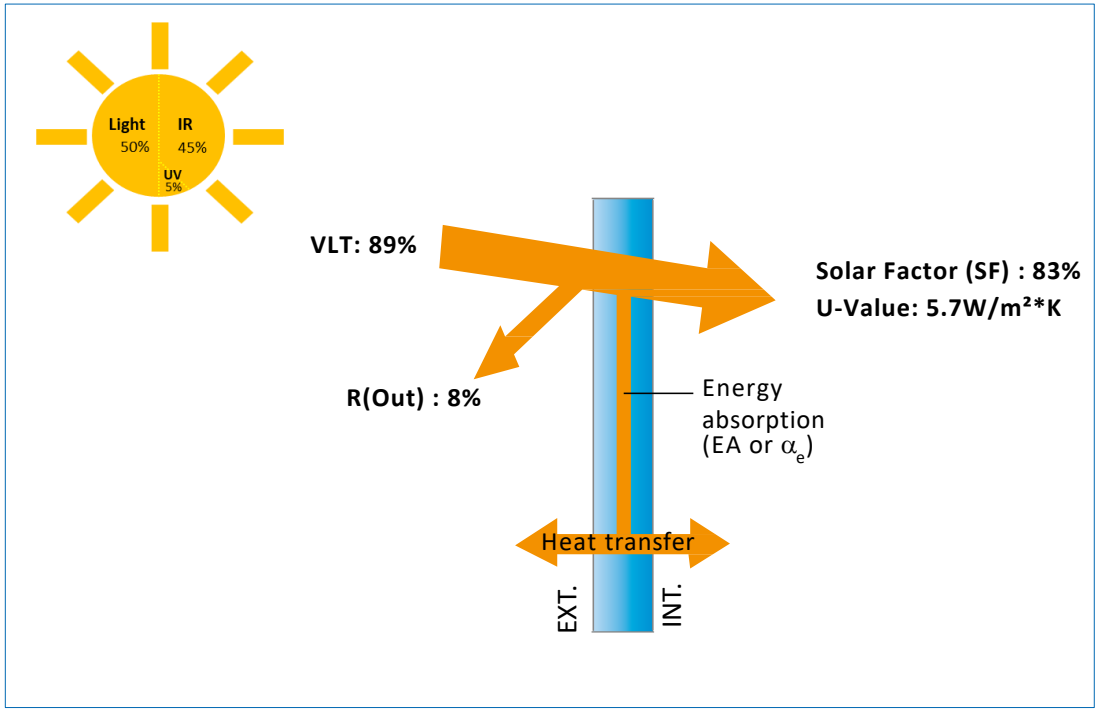
Environmentally-friendly Glass
Decorative Glass

- Texture, colour & light varieties
- Unlimited design possibilities
- Preserves indoor air quality due to low VOC

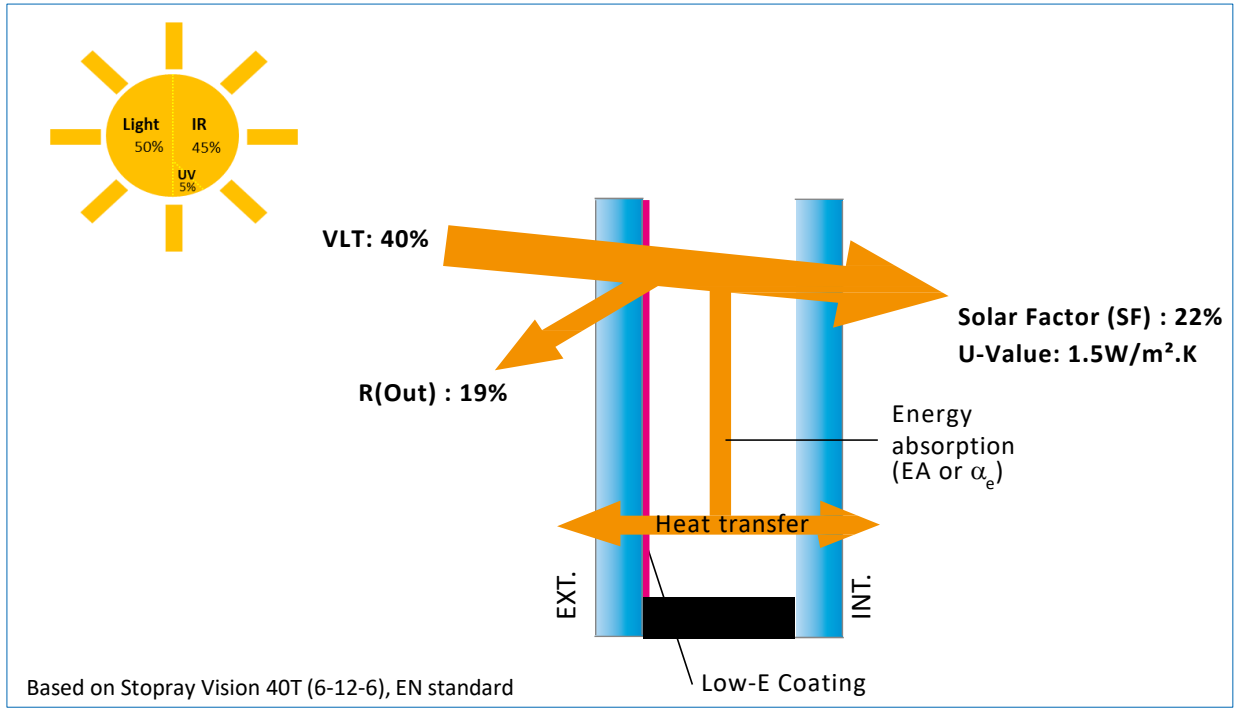
Product range: MIROX MNGE, Lacobel, Matelac, Matelux



Enhance performance with coating glass



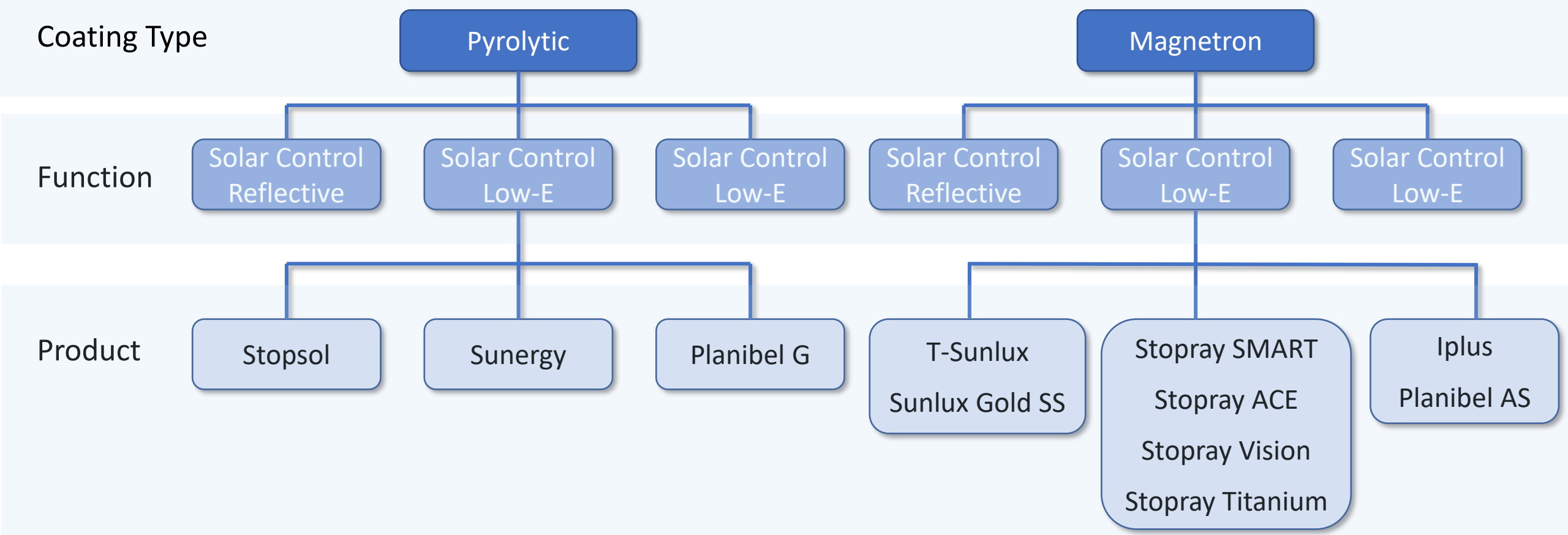
Clear Float Glass



Coating Glass

OUR ENERGY-SAVINGS RANGE

COATED GLASS OFFERINGS



Czech Republic, ArtGen

Stopray Vision 50T

LEED BD+C, Core and Shell, Gold

Italy, Generali Tower

Sunergy Clear, Stopray Vision 50T

LEED BD+C, Core and Shell, Platinum

Credit: 3-5 Acoustic Performance

Singapore, Guoco Tower

Stopray Titanium, Stopsol Supersilver

LEED BD+C, Core and Shell, Platinum

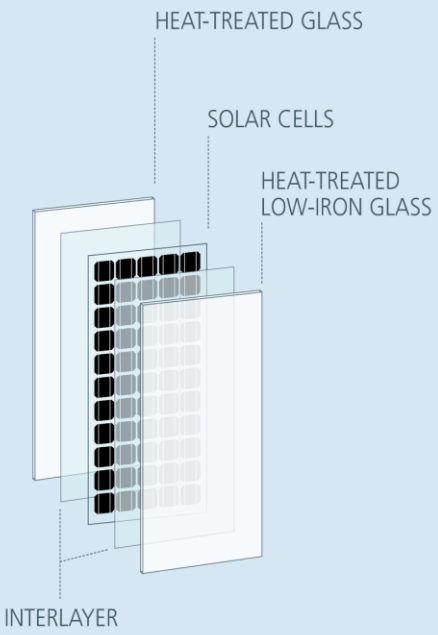
Singapore Green Mark, Platinum

SunEwat

Range for various
Energy-generating facades

SunEwat the range of building integrated photovoltaic glazing

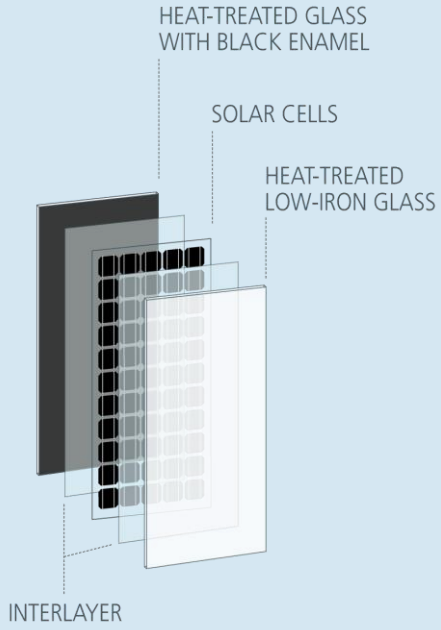
SunEwat Vision
Transparent



Applications

Facades, canopies, sunshades, balustrades, louvres, spandrels, roofs, sound walls, carports

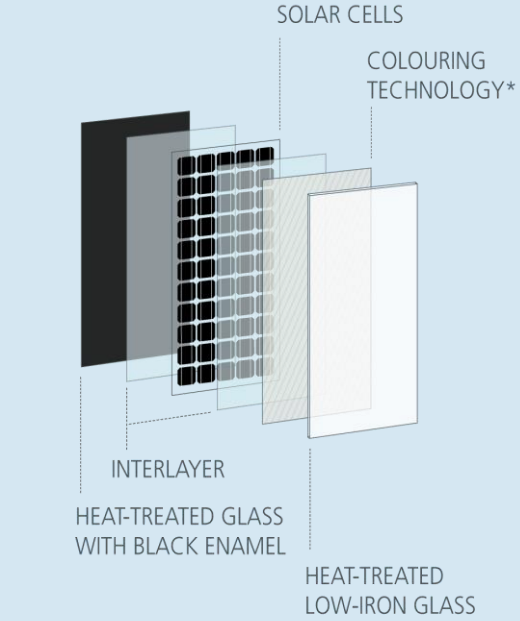
SunEwat Origin
Opaque



Applications

Spandrels, cladding, balustrades

SunEwat Colour
Opaque

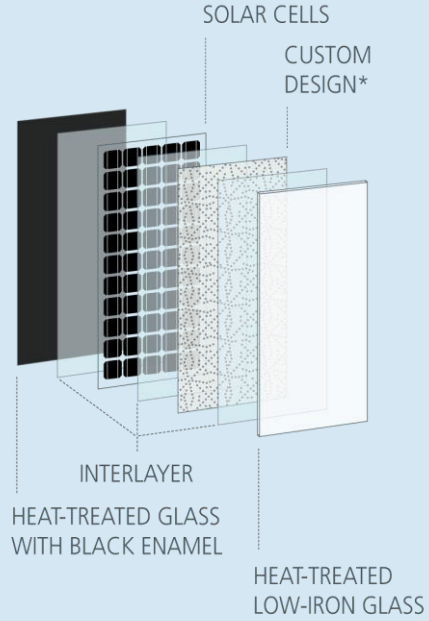


*special energy-transmitting technology

Applications

Spandrels, cladding, roofs

SunEwat Design
Opaque



*special energy-transmitting technology

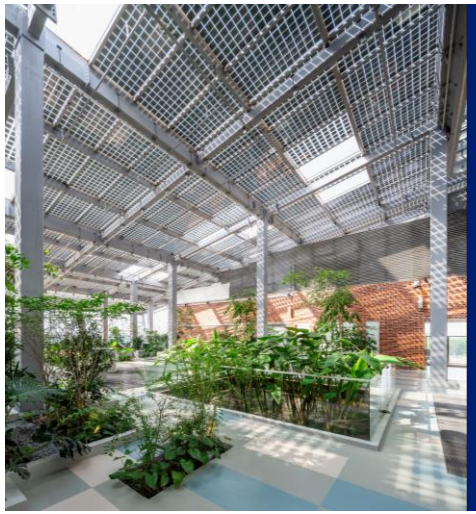
Applications

Cladding, corporate logos and messaging, roofs

Project Reference: Skylight & Horizontal Fins

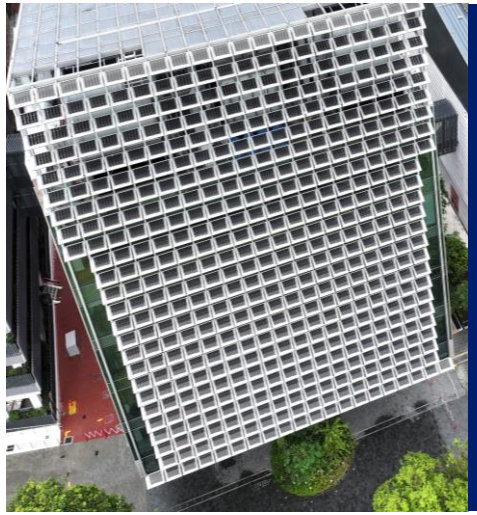
Dulwich College – The Greenhouse

Singapore | DP Architects



Reference	**Skylight**
Product	**SunEwat Vision**
Area (m^2)	1000
Electrical Capacity	**160 kWp**

Image Credit: DPA



Reference	**Horizon Fins**
Product	**SunEwat Vision**
Area (m^2)	340
Electrical Capacity	**48 kWp**

Image Credit: EDP Renewables APAC

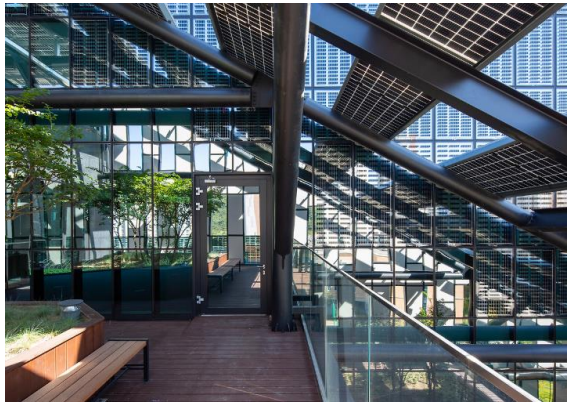
Project Reference: Energy X

Seoul, South Korea
Zero Energy Building by KR1EA

Achieved Higher than Grade 1 in Building Energy Efficiency

- Energy generation throughout the building
- SunEwat Vision installed in North, West and West South facing of the façade

A + Energy building with 121.7% energy independence rate



Reference	**Facade**
Product	**SunEwat Vision / Sudare (Alt)**
Area (m^2)	440.82
Electrical Capacity	**235.3 kWp**

Project Reference: Cladding

Bold Overhoeks
Amsterdam, The Netherlands | OZ Architects

Functionality meets aesthetic

- Residential building integrating Solar energy and heat pumps to generate renewable energy.

Product	**SunEwat Origin**
Area (m^2)	4150
Electrical yield over 20 years	**442,598 kWh/year**

Brysengfaret School
Oslo Norway | © HRTB Arkitekter

Zero Energy Building

- Integration of photovoltaics with façade design

Product	**SunEwat Origin**
Area (m^2)	1000
Electrical yield over 20 years	-

Project Reference: Design

TNO
The Netherlands

Functionality meets aesthetic

- Use of state-of-the-art solar facility dedicated to groundbreaking research on new solar energy applications.

Product	**SunEwat Design**
Area (m^2)	-
Electrical yield over 20 years	**-**

Shell Technology Centre
The Netherlands

A LEED Gold certified Building

- Renewable energy integrated to meet its green building target.

Product	**SunEwat Design**
Area (m^2)	200
Electrical yield over 20 years	**15,400kWh/year 442,598 kWh/year**

Importance of Environmental Product Declaration (EPD) & Green Product Certifications

Many green building certification systems require submission of an Environmental Product Declaration (EPD) and proof of using Green-certified products to earn points in the Energy Efficiency category.

EPD Requirements from green building certification systems

Green Mark 2021 Cn Whole Life Carbon

WHOLE LIFE CARBON		
CN1 CARBON	**Green Mark Points**	
CN1.1 Whole Life Carbon	**New**	**Existing**
CN1.1 Whole Life Carbon (WLC) Assessment Whole Life carbon assessment consistent with EN 15978 and EN 15804. *Useful references: https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf* *https://www.architecture.com/-/media/GatherContent/Whole-life-carbon-assessment-for-architects/Additional-Documents/11241WholeLifeCarbonGuidancev7pdf.pdf* (i) **Minimum Scope Requirement of WLC Assessment** **Minimum Scope of WLC assessment** Building elements to be included: 1. Substructure 2. Superstructure Lifecycle stages to be included: 1. Product stage [A1-A3] 2. Construction Stage [A4-A5] 3. Maintenance Stage [B2] Façade 4. Replacement Stage [B4] ACMV 5. Operational Energy [B6] • *New building projects that conduct the **full scope** of WLC assessment will score up to additional 2 points under the **Innovation section**.* • *New building projects scoring under CN1.1(i) will be excluded from scoring under CN 1.1(ii)(a)*	(i) **Non Residential:** 3 points **Residential:** 3 points (ii) **Non Residential:** 0.5 point for (a) 1 point for (b) OR	(i) **Non Residential:** N.A **Residential:** N.A (ii) **Non Residential:** 1 point for (a) N.A for (b) OR

(ii) **Embodied Carbon Computation**

a) Calculation of embodied carbon of the development
Using the Embodied Carbon Calculator (ECC) hosted at the SGBC website or embodied carbon software tools which are linked to robust carbon data sets such as the Inventory of Carbon and Energy (ICE) database, the RICS Building Carbon Database, etc.

b) >10% Reduction from the reference embodied carbon (for Concrete, Glass and Steel)

c) >30% Reduction from the reference embodied carbon (for Concrete, Glass and Steel)

	Reference values (kgCO2e/m2)
Non-Residential	1000
Residential	1500
Industrial	2500

(Reference values based on A1-A4 emissions for superstructure)

2 points for (c)

Residential:
0.5 point for (a);
1 point for (b) OR
2 points for (c)

N.A for (c)

Residential:
1 point for (a)
N.A for (b) OR
N.A for (c)

(ii) is applicable only to Existing Buildings with Addition and Alteration (A&A) works involving additional gross floor area (GFA) with new construction, addition of floors with independent substructures

U.S. GREEN BUILDING COUNCIL USGBC

Material and Resources (MR)

Credit	Intent
Building Product Disclosure and Optimization - Environmental **Product Declarations (EPD) | 2-1** Up to 2 points	To reward project teams for selecting products from manufacturers who have verified improved environmental life-cycle impacts

Green Product Certifications

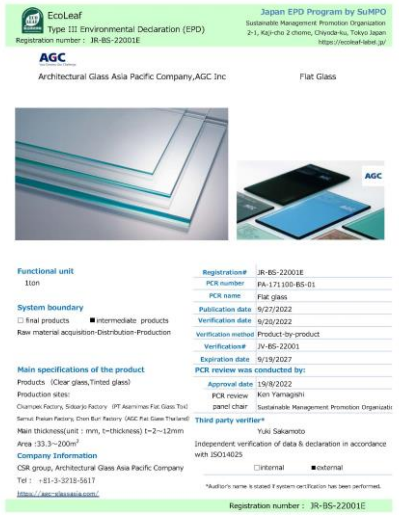
SINGAPORE GREEN BUILDING PRODUCT SGBC

CERTIFIED cradle to cradle PRODUCTS PROGRAM

Certifications

Environmental Product Declaration (EPD)

AGC Glass Asia's float and tinted, Coated and Interior glass product categories are EPD verified by SuMPO under **ISO14025** and selected product categories with **ISO21930**. Continuous work is done to onboard more product categories to be EPD verified.



Flat Glass EPD

Mirror & Painted Glass EPD

Magnetron Coated Glass EPD

Pyrolytic Coated Glass EPD

Certifications
Green Product Certifications

AGC Glass Asia has 2 product categories certified under SGBP & Cradle to Cradle Certified®.

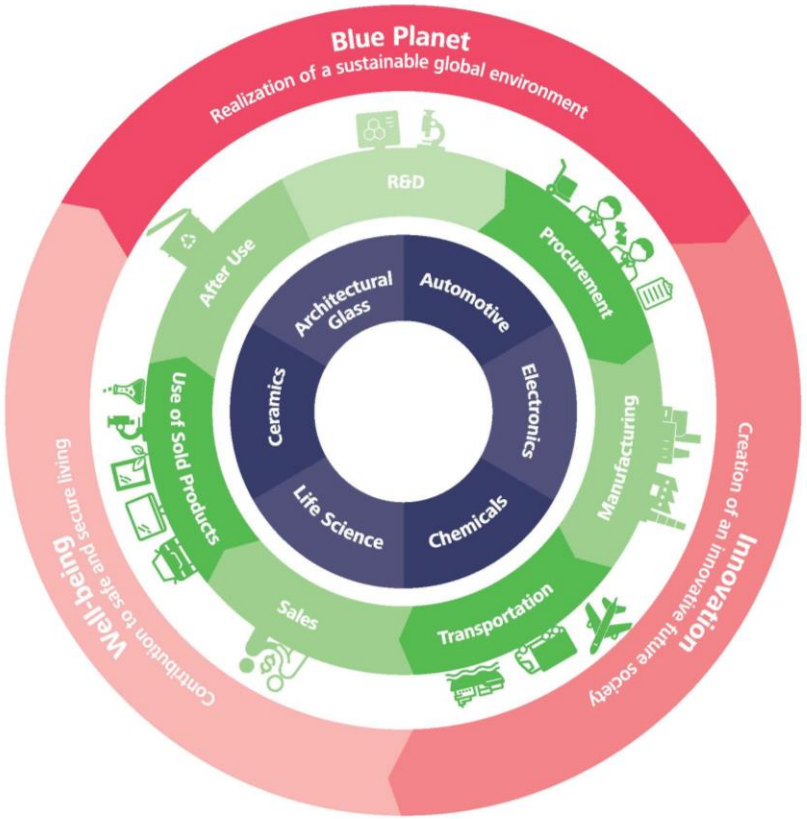
Categories	Products	Certification Logos
Energy-Saving Glass	Pyrolytic & Magnetron Coatings	SINGAPORE GREEN BUILDING PRODUCT SGBC EXCELLENT; SINGAPORE GREEN BUILDING PRODUCT SGBC LEADER; CERTIFIED cradle to cradle BRONZE
Environmentally Friendly Glass	Mirox MNGE	SINGAPORE GREEN BUILDING PRODUCT SGBC VERY GOOD; CERTIFIED cradle to cradle BRONZE

Resilience meets Sustainability

AGC's Vision 2030 is to provide differentiated materials and solutions, where AGC strives to help realise a sustainable society and become an excellent company.

The AGC Group has defined "three social values" to be created through its products and technologies in its medium-term management plan, "***AGC plus-2026***."

Blue Planet **Realization of a sustainable global environment**	We contribute to the sustainability of the planet on which all life depends by reducing the environmental impact of our products from raw material procurement to use by customers.
Innovation Creation of an innovative future society	We contribute to the creation of innovative future society by providing materials and solutions that support the world's most advanced technologies
Well-being Contribution to safe and secure living	We contribute to safe, secure, comfortable, and healthy lives by providing products necessary for daily life, infrastructure, and healthcare in a more stable manner.



AGC Asia Pacific as the Founding Regional Partner of World Green Building Council in Asia Pacific Network.

AGC Glass Asia at a glance

- ✓ First in Asia to obtain
- ✓ Classified as a "A-List" company for "Climate Change"
- ✓ Recognized as "WB2°C (well below 2°C)"

AGC Glass Asia

Towards Sustainability

We adopt a holistic approach to support sustainability in the Asia continent. Actively supports & promotes green building activities across Asia Pacific

- A founding partner in the World Green Building Council Asia Pacific Regional Network
- First glass manufacturer in Asia to have AGC glass products verified with EPD and green product certified

AGC’s Journey Towards Sustainability

Thank you

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Your Dreams, Our Challenge

Understanding Key Parameters in Glass Evaluation

Visual properties of glass

Light Transmission, LT

Amount of visible light that enters indoors.

Preference varies by application

Application	Preference
Commercial	Lower
Residential	Higher

Light Reflection

Amount of visible light reflected.

Some countries regulate external reflection.

But, internal reflection is unregulated.

Country	Ext. Ref
Middle East	> 30%
Malaysia, Vietnam, Thailand	< 25%
Singapore	< 20%
Thailand (Bangkok)	< 15%

Understanding Key Parameters in Glass Evaluation

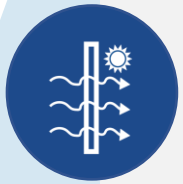
Solar and Thermal protection of glass

Solar Factor, SF

Percentage of total solar heat entering through.

- **The lower the value, the better the shading.**
- Highly adopted in tropical climates.
- A similar term, Shading Coefficient, SC can be converted from SF:

$$\frac{\text{SF}}{0.87} = \text{SC}$$



U-Value, U

Represents the insulation effect or heat transfer between outdoor and indoors.

- **The lower the value, the better the insulation.**
- Highly adopted in colder climates.
- To further improve the U-value in an Insulating Glazing Units (IGU), argon gas can be used.

Performance Data Output

Example of a manufacturer's datasheet

AGC

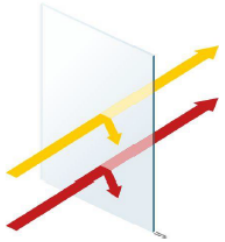
30-Aug-22

Glass Configuration

6mm Indoflot Clear

LIGHT
Transmission 89
Selectivity 1.07

ENERGY
Solar Factor (g) 83
Shading Coefficient (SC) 0.95



Standard: EN 410:2011/673:2011

LIGHT PROPERTIES		
Light Transmission	[%]	89
Light Reflection	[%]	8
Internal Light Reflection	[%]	8

ENERGY PROPERTIES		
Solar Factor (g)	[%]	83
Energy Reflection	[%]	7
Direct Energy Transmission	[%]	80
Total Energy Absorption	[%]	13
UV Transmission	[%]	57

Solar Factor (g)	0.83
Shading Coefficient (SC)	0.95
Selectivity	1.07

THERMAL PROPERTIES		
U Value	W/(m2·K)	5.7
U Value(Summer)	W/(m2·K)	---

LIGHT PROPERTIES		
Light Transmission	[%]	89
Light Reflection	[%]	8
Internal Light Reflection	[%]	8

Solar Factor	(g)	[%]	83

U Value	W/(m2·K)	5.7