Sustainable Glazing for Green Building

PT Asahimas Flat Glass Tbk

Bandung, 9 May 2017

ASAHIMAS
AGC Group

Topics :

- Asahimas Company Profile & Milestones
- Green Building Trends
  - OTTV & its Key Parameters
- Glazing Evolution
  - Online & Offline Coating
- Energy Saving Simulation
- Summary

Asahimas Company Profiles & Milestones

Company Profile

Joint Venture

Joint venture between Asahi Glass Company and Rodamas Company to perform PT Asahimas Flat Glass Tbk. As **The 1st Indonesian glass manufacturer.**

This strategic partnership - combining Asahi Glass technical expertise and technology, and Rodamas strong grasp of the local market. The cornerstone of success for Asahimas, making it the glass pioneer in the country.

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Factories

Jakarta Factory (Head Office)
1 Float Furnace + 1 Mirror Line

Sidoarjo Factory
2 Float Furnace
1 Online CVD Coater

Cikampek Factory NEW
1 Float Furnace
Future Development :
+ 1 Float Furnace
+ 1 Offline Magnetron Coater
+ 1 New Mirror Line

Aerial View of C1 factory, Cikampek

AGC Glass Production Sales Subsidiaries & Affiliations

38 float plants and over 100 sales offices globally

ASIA PACIFIC MAP

PT.ASAHIMAS FLAT GLASS TBK

JAKARTA FACTORY
SURABAYA FACTORY
CIKAMPEK FACTORY

China
Japan
Taiwan
Hong Kong
Thailand
Malaysia
Philippines
Singapore
Indonesia

LEGEND Production Sites Sales & Marketing

Milestones

Furnace	Technology	Loc.	Start	Coated Glass	Remark
F1 Line	Fourcault	JKT	1971		**First sheet glass** production in Indonesia (Closed in 1994)
F2 Line	Fourcault	JKT	1976		Closed in 1983
F3 Line	Float	JKT	1981		**First float glass technolgy** in Indonesia
				-Planibel G in 2012 -Sunergy Cool in 2015 -New Stopsol in 2016 -Sunergy Sigma in 2016	
C1 Line	Float	CKP	2016		**Most advance float glass technology**
			2018	Production of T-Sunlux & Stopray Series	**First 2Ag Low-E Glass produced in Indonesia**

Asahimas is the Glass Pioneer in Indonesia !!

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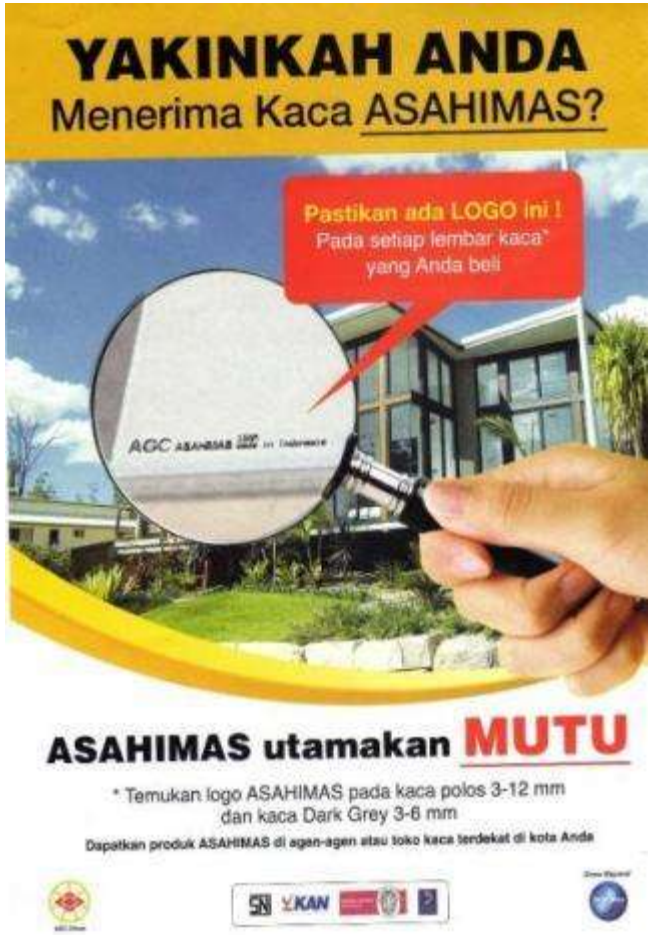
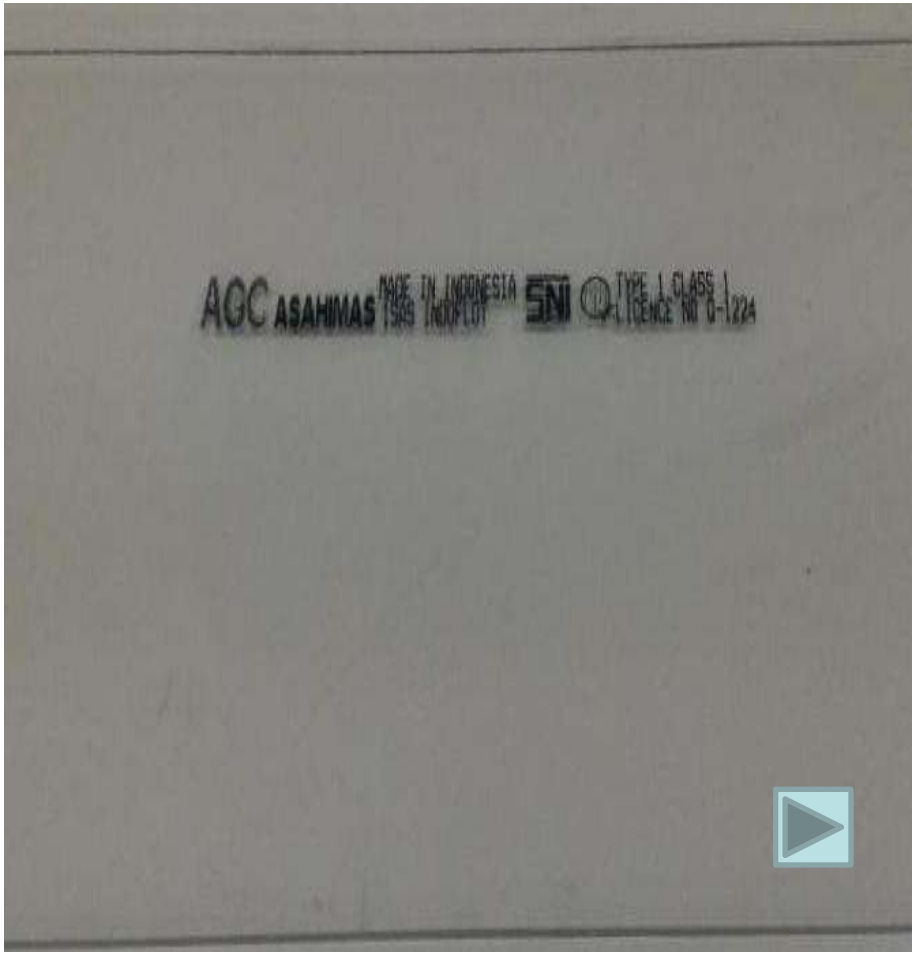
The Glass Pioneer – Logo Marking





Since 2011 – Asahimas, the 1st to initiated Logo Marking on glass surface

Until Now, Have been applied to Clear, DG, & Other Tinted Glass

Green Building Trends

Trend Toward Greenbuilding

Source: United Nations Environment Programme Report

Green Building in Indonesia

	2010	2012	2014	2015	2016	2017 - Next
Institutional	GBCI	Jakarta Provincial Govt.	GBCI	Ministry of Housing & Public Works	Bandung City Administration.	**Next Cities ???** **-Makassar (South Sulawesi)** **-Surabaya (East Java)** **- Medan (North Sumatera)** **- Semarang ?** **- Jogjakarta ?** **- Others ?**
Regulation	Greenship Rating Tool v.1	Jakarta's Green Building Regulation	Greenship Rating Tool v.1.2	National Green Building	Bandung's Green Building Regulation	
OTTV Req	≤ 45 w/m2	≤ 45 w/m2	≤ 35 w/m2	Gradually to ≤ 35 w/m2	≤ 45 w/m2	
Enforcement	Voluntary	**JKT Mandatory in April'12**	Voluntary	**Target : National Mandatory by 2018**	**BDG Mandatory in Jan'17**	
Incentive	Rating Certification	Building Construction Permit	Rating Certification	Based on City/Province's policy	**≤ 45 w/m2** Building Construction Permit **≤ 35 – 30 w/m2** -Increase Building storeys allowance - Building & Land Tax Reduction	
Applied To	Building (New & Existing)	New Building ≥10 KSqm ≥50 KSqm	Building (New & Existing)	Building classification based on City/Province	New and Renovated Building (≥ 5 KSqm)	

Green Building in Indonesia

Overall Thermal Transfer Value (OTTV)

DKI Jakarta Government Regulation No. 38/2012

- **OTTV ≤ 45 W/m² (Mandatory for New Building)**
- **Implementation in DKI Jakarta ~Apr 23,2013**

Bandung Government Regulation No. 1023/2016

- **OTTV ≤ 45 W/m² (Mandatory for New Building)**
- **OTTV ≤ 35 W/m² (Voluntary with incentive)**
- **Implementation in Bandung ~Jan 1,2017**

OTTV = Heat Conduction through Walls + Heat Conduction through Windows + Solar Heat Gain through Windows

0.2% to 5% | 10% to 20% | 70% to 85%

$$OTTV = \alpha((1-WWR)*Uw)*TDeq) + (WWR*Uf*\Delta T) + (WWR*SC*SF)$$

OTTV - What are the key parameters?

$$OTTV = \alpha((1\text{-}WWR)*Uw)*TDeq) + (WWR*Uf*\Delta T) + (WWR*SC*CF)$$

Wall factor | **Fenestration / Glazing Factor**

1. Identify which component contributes the most to OTTV.
2. Review Solar Correction Factor (CF)
   => Review building orientation (east, west, north, south)
3. Review glazing selection
   => Shading Coefficient (SC) & U Value (Uval)
4. Review sunshades
   => Will further improve glazing SC
5. Review WWR & Wall Material (Uw & TDeq)

For Glazing :
WWR, SC & U-Value are dominant factors in OTTV ...

Window-to-wall ratio

Definition :

The percentage of a building's facade taken up by glazing/windows.

WWR : <10%	WWR : 40%	WWR : 60%
		
Low OTTV ?	**Low OTTV ??**	**High OTTV..??**

Window-to-wall ratio

WWR : 40%

Tinted Glass

OTTV : 38.8 W/m²

WWR : 60%

Tinted	On-Reflec.	On-Solar Control Low-E
49.0 W/m²	**44.1 W/m²**	**34.9 W/m²**

Better Glazing selection will improve OTTV despite high WWR

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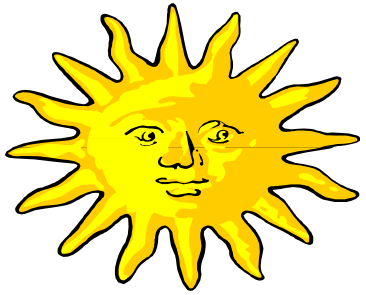
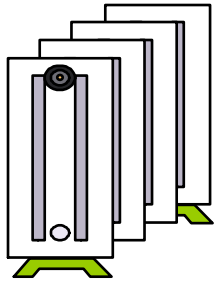
SC & U-Value (Heat Transfer)

Heat transfer into building by 2 ways.

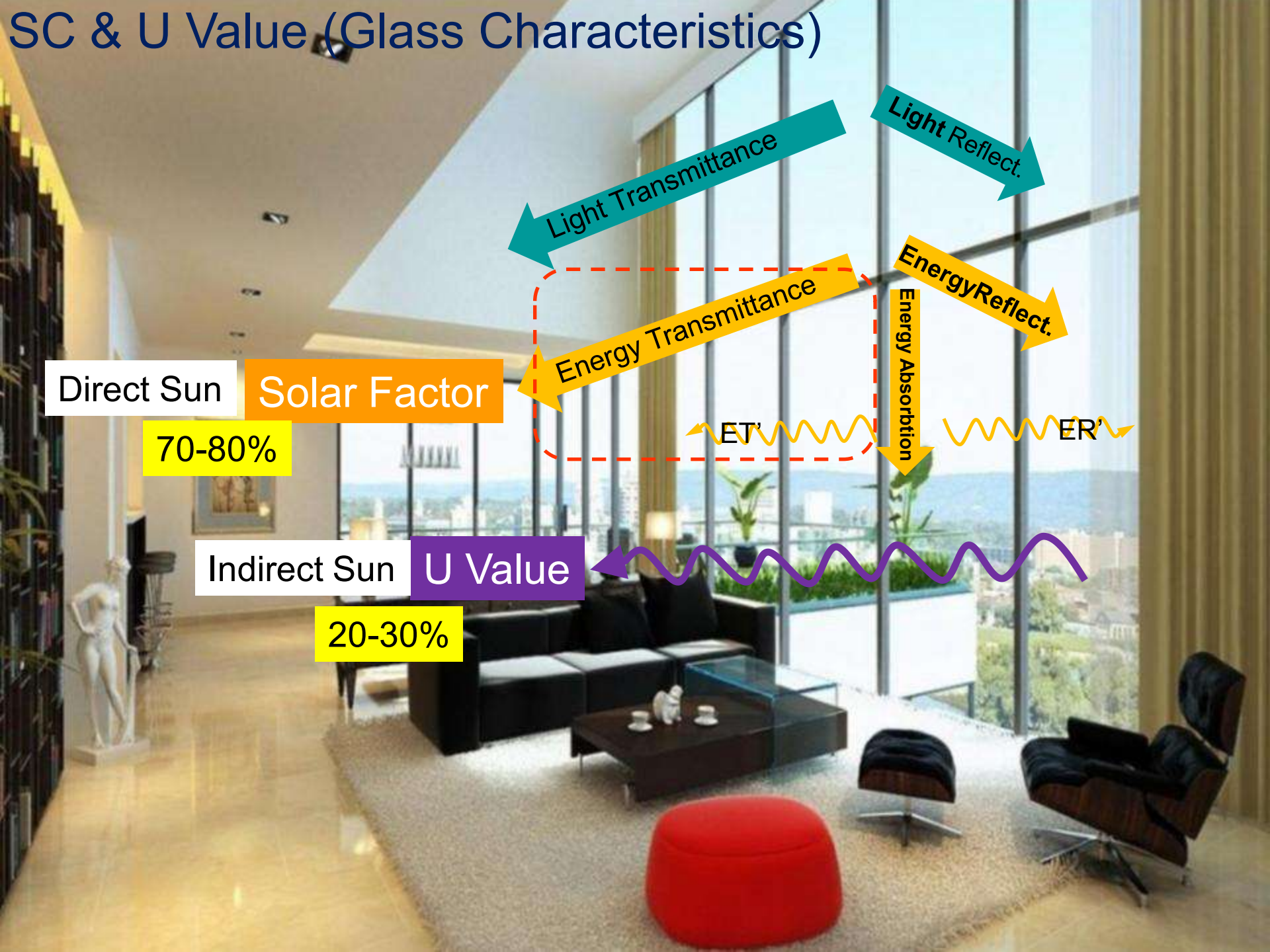




- Direct heat gain from sun
- Short infra-red.
- Measure by SF value (SC value)

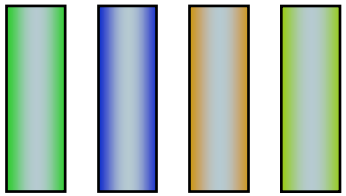
- In-direct heat gain from surrounding
- Long infra-red.
- Measure by U-Value

SC & U Value (Glass Characteristics)



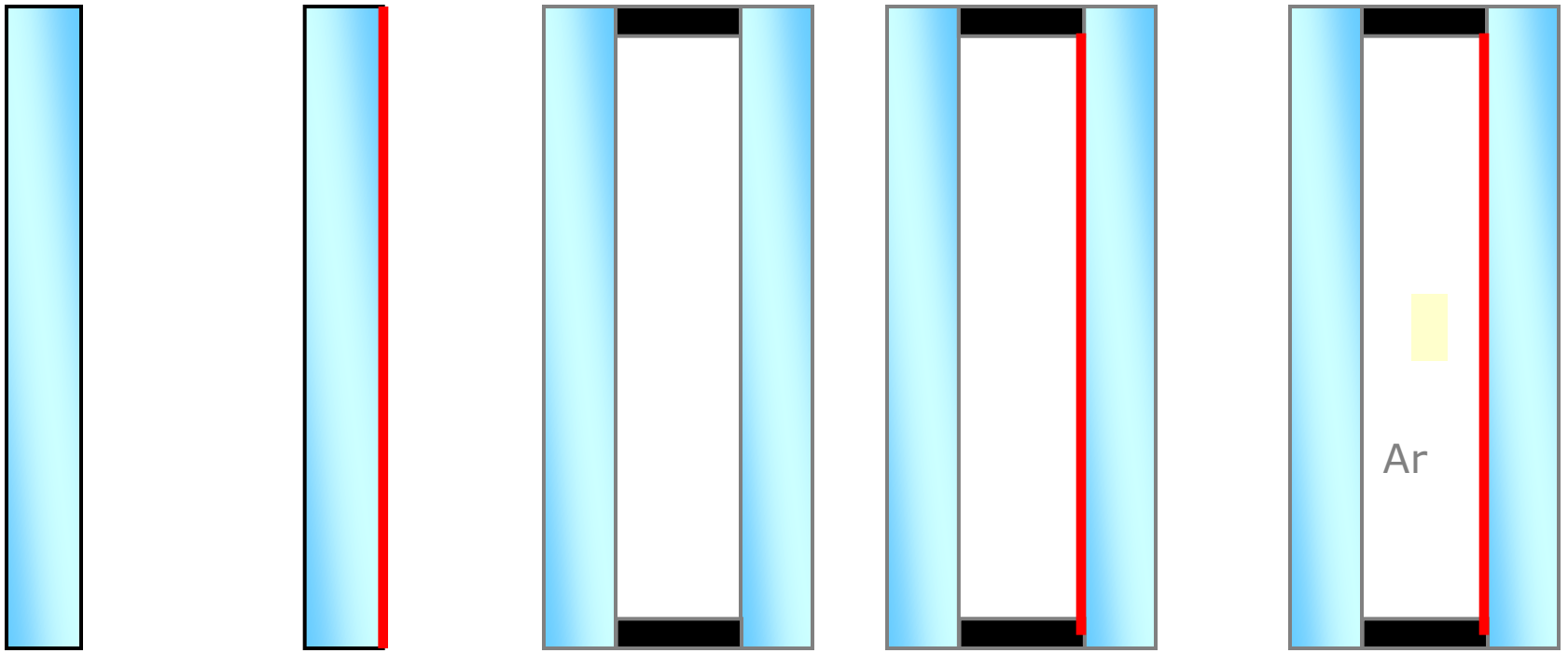
How to decrease the SC of a glazing ?

- **Modify the composition of the glass (increase absorption)**
  - **Coloured/Tinted Float**



- **Method of coating (increase energy reflection and/or absorption)**
  - ***Metal oxide coating on the glass to reflect / absorb heat***
  - **« Pyrolytic » Coating – On Line Coating**
  - **« Magnetron » Coating – Off Line Coating**

How to decrease the U Value of a glazing ?



4 mm Single Clear
U = 5,8 W/(m² K)

4 mm Single **Low E**
U = 3.7 W/(m² K)

4-12-4 IGU Clear
U = 2.9 W/(m² K)

4-12-4 IGU **Low E**
U = 1.9 W/(m² K)

4-12Argon-4 IGU **Low E**
U = 1.6 W/(m² K)

IGU with Low E coating give better thermal insulation (Lower U Value)

Glazing Evolution

Glazing Evolution for Green Building Solution

Coated Glass

Clear
Indoflot

1980..
First Float Glass Introduced in Indonesia

Tinted
Panasap

1985..
First innovation to reduce heat transfer

Online Reflective
Stopsol

1992..
First produced In Indonesia

2016
NEW STOPSOL

OnlineSolar Control Low-E
Sunergy

2009..
First produced In Indonesia

2015
Sunergy COOL

2016
Sunergy SIGMA

Offline Reflective
T Sunlux

2013..
Introduced in Indonesia as a new trend of reflective glass

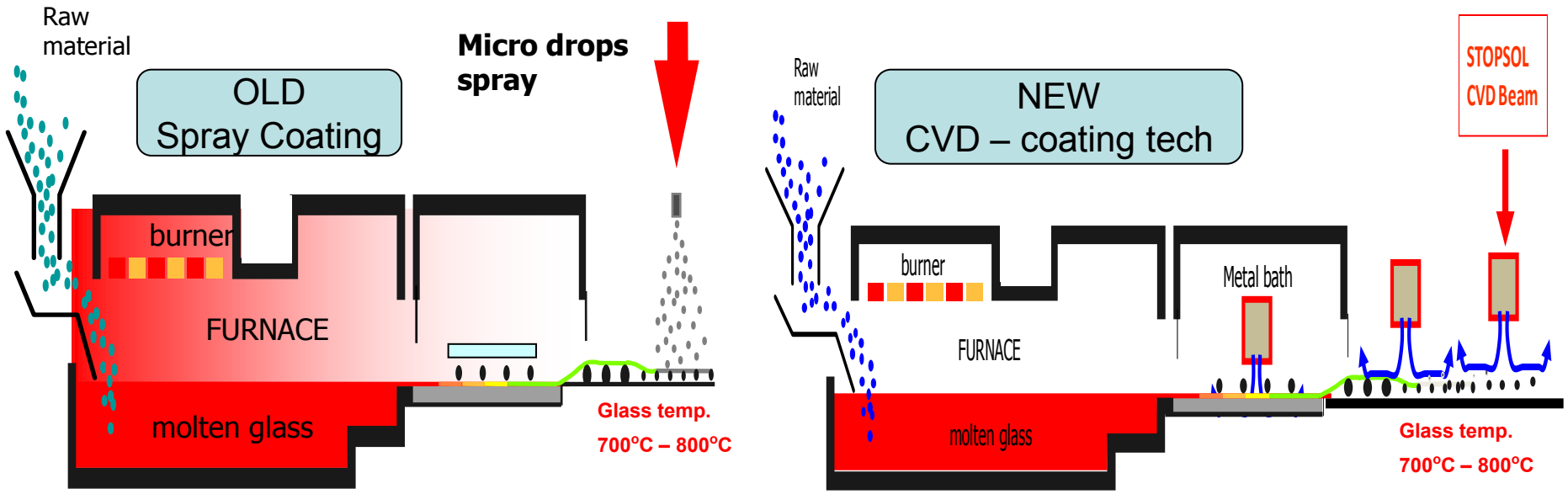
Online Solar Control Low-E
Stopray

2015..
Introduced in Indonesia as a new solution for better selectivity performance

2018
1st produce locally in Indonesia

New Online Coating Technology in 2016

- New CVD coating technology from AGC
  - Better coating uniformity & consistency ; same durability performance
  - Brighter visual image & slight performance improvement.



- New Stopsol : Brighter aesthetic (± 15%) & improved performance - SC (± 6%)
- Sunergy Cool : Bluish Grey tone & better performance (SC)
- Sunergy Sigma : Brighter image & better performance (SC) - 3 layers on-coating
  - New Sunergy Sigma on Dark Blue

OFF-LINE COATER INVESTMENT IN CIKAMPEK FACTORY

PT ASAHIMAS FLAT GLASS Tbk

ASAHIMAS BUILDING GLASS BUSINESS ENHANCEM
WITH NEW FLOAT AND OFF-LINE COATER INVESTM
IN CIKAMPEK FACTORY

Jakarta, 7 November 2016, PT Asahimas Flat Glass Tbk (the Company), Producer in Indonesia, announces the *heating-up* of its new Float Glass F Cikampek today with 210,000 ton production capacity p.a. This new *state-* float glass furnace with an approximately 16 billion Japanese Yen (USD 15 investment has been inaugurated. This Factory, which location is adjacer Company's Cikampek Automotive Glass Fabrication Factory, is expected to production in the beginning of December 2016.

With the operation of this new Factory, the Company's total capacities of fl will jump up to 630,000 tons p.a. Previously, the Company has two fl furnaces, each at its Jakarta Factory and Sidoarjo Factory (with a total production capacity of 570,000 tons p.a.) for the production of float glass used for architectural and automotive applications. In October this year, the Company has closed one of its two furnaces in Jakarta Factory with a capacity of 150,000 tons p.a., which in turn (after the start-up of the New Float Glass Factory), has made a significant enhancement in the Company's total float glass production by more than 10% or 60,000 tons p.a.

The overview of the New Factory is as follows:

1. Location : Cikampek, West Java, Indonesia
2. Production capacity : Approx. 210,000 tons of float glass/year
3. Special features :
   a. 40% greater production capacity as compared to the existing furnace.
   b. Environmentally friendly furnace with world-class fuel efficiency.
   c. Produce high-quality glass for various applications including architectural and automotive use
   d. Enables efficient integrated production in conjunctionwith the adjacent Automotive glass fabrication plant

CORPORATE SECRETARY & INVESTOR RELATIONS
Tel. (62-21) 6904041 (hunting), Fax (62-21) 6919245
WebSite: www.amfg.co.id

New Off Line Coater

-Magnetron coater with European

18

the latest and most

6 million sqm*

production capacity per year

AGC INTERPANE

2Ag Low E

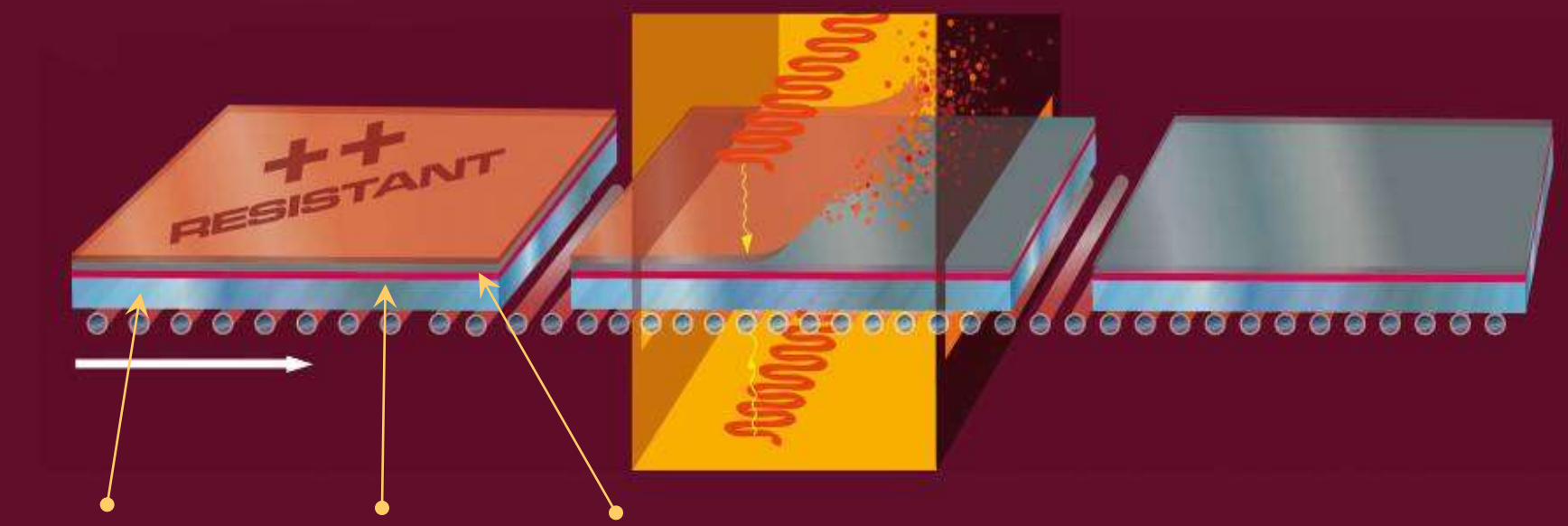
2nd Gen

production and operation supported by AGC Japan & AGC Europe

Offline product features : T – Coatings

AGC Innovation : Double Protective Layers (can be used for tempered)

Innovation: T products - double protective layers
The upper protective layer disappears during the tempering process



T-Sunlux (Magnetron Temperable Reflective Glass)

- Wide range of products
  - On Clear, Green, & Dark Blue
  - Thickness : 5, 6, & 8mm
  - Size :
    - 2440x 1829, 3048x2134, 3660x2134
    - In 2018 – in JB size
- T coatings
  - Process-able coatings
    - Tempered, Laminated, IGU
  - Single glazing application
- Low SC *(CS_20, _14, _08)*
  - $0.4 \leq SC \leq 0.2$
- Strong & Durability product
  - Asahimas – AGC Quality

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T-Sunlux (Magnetron Temperable Reflective Glass)

❖ Coating installed inside which create more privacy & energy saving performance

Satrio Square Office-Kuningan
IGU: 8mm T-CS 130
+AS12 + FL6

Green Office Park 6 - BSD
IGU: 8mm T-CS 140
+AS12 +Panasap Dark Blue 6mm

Sainath Office Tower-Kemayoran
8mm T-CS 208 #2

Stopray (Magnetron Temperable Solar Control Low E)

STOPRAY							
KOG 6mm Low E #2 + A12 + 6mm FL	Light Characteristic			Solar Factor (%)	SC	U Value W/m^2K	Selectivity (LT/SF)
	VLT (%)	VLR out (%)	VLR in (%)				
	EN 410	EN 410	EN 410	ISO 9050	ISO 9050	EN 673	
STOPRAY ACE							
Ace 42T	41	16	12	25	0.29	1.6	1.66
STOPRAY SMART							
Smart 30/20	30	28	15	21	0.24	1.6	1.43
Smart 51/33	50	25	17	32	0.37	1.6	1.56
STOPRAY VISION							
Vision 40T	40	19	15	21	0.24	1.5	1.90
Vision 50T	49	17	21	29	0.33	1.5	1.69
Vision 51T	51	14	14	26	0.30	1.5	1.96
Vision 60T	59	14	20	35	0.40	1.5	1.69
Vision 61T	61	13	13	32	0.37	1.5	1.91
Vision 72T	71	13	14	36	0.41	1.5	1.97

- Superb performance
  - High LT, Low SC
  - Low U Value
  - High Selectivity
    - Vision 40, 51, 61, & 72
- Various aesthetic
  - Greyish, Blue Greyish
  - Neutral to Reflective
- AGC T-Coatings
  - Processable coatings
    - Tempering, IGU, etc
- Only in Double Glazing application**
- Local supply in 2H 2018

Stopray – Certified Green Product

The well known AGC Europe high performance offline Low E :

- 1st to be certified Cradle to Cradle from MBDC (US-GBC)
- 1st to be certified by Singapore Green Building Council (SGBC) with (3 ticks - ✓ ✓ ✓) – Excellent Green product.

Stopray – Certified projects

Stopray Vision 50,
Torre Titanium, Chile,
LEED Gold.

Stopray Vision 50T,
Crown Square, Poland
LEED Gold

Torre Iberdola, Spain

Stopray Vision 60T

Architect Cesar Pelli

No green effect!!

LEED PLATINUM AWARD U.S. GREEN BUILDING COUNCIL LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

cradle to cradle

Nuvola, Roma Conference Building

Stopray Vision 60T on Clearvision

Architect Fuksas

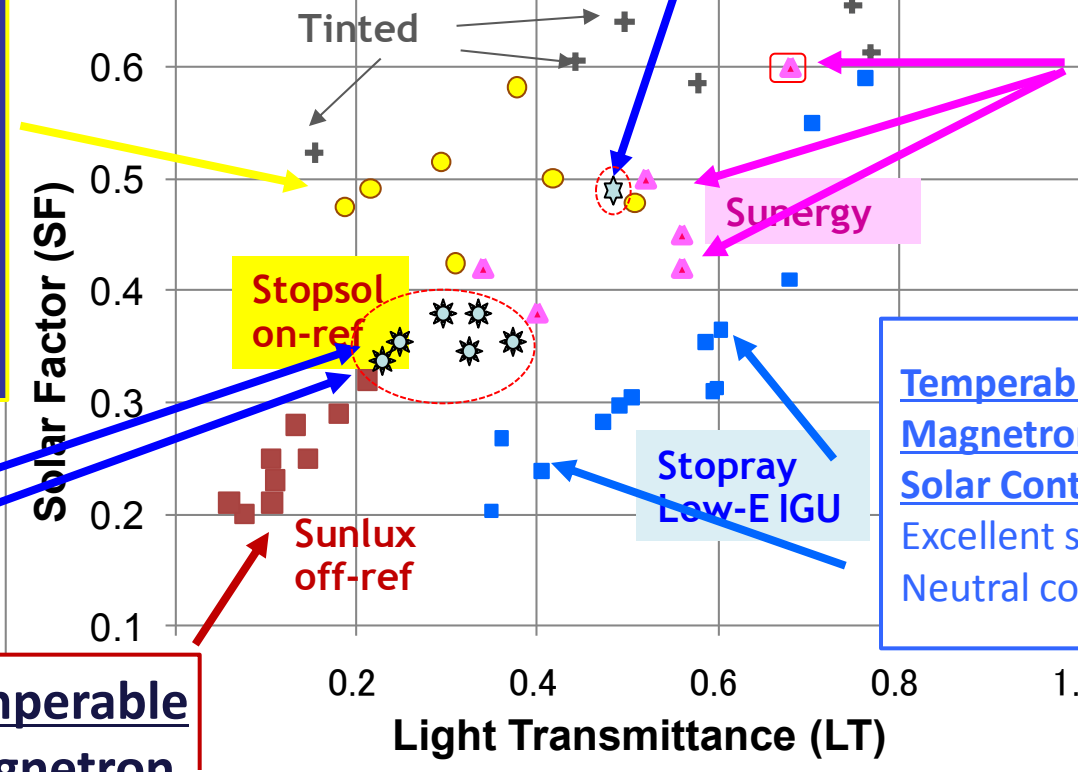

NATO HQ, Brussels
Stopray Vision 50
Architect SOM

Asahimas Coated Glass Range

Tinted
Good SHGC
Various color
Easy handling

Pyrolitic Reflective
Good SHGC
Easy handling

Pyrolitic Solar Control Low-E
Versatile pyrolitic
Easy handling



Temperable Magnetron Solar Control Low-E
Excellent selectivity
Neutral color Low E

Temperable Magnetron Reflective
Low SC
Easy handling

ASAHIMAS Wide range products for various requests, for all needs

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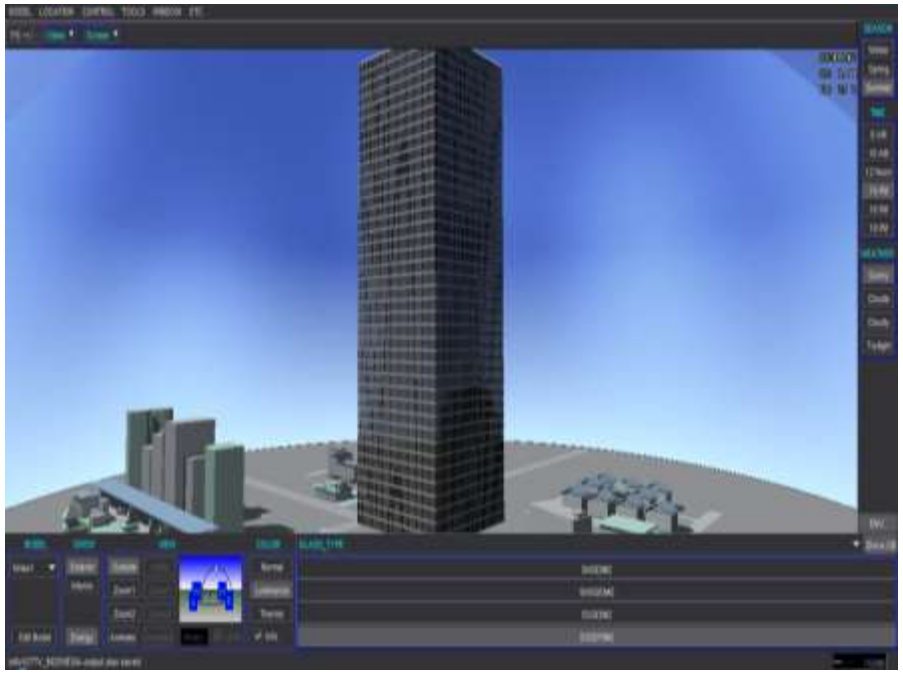
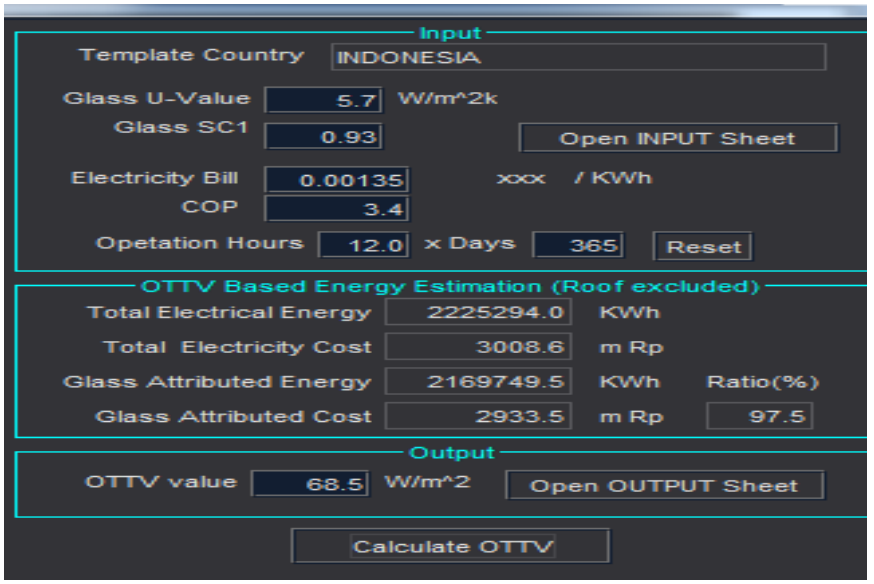
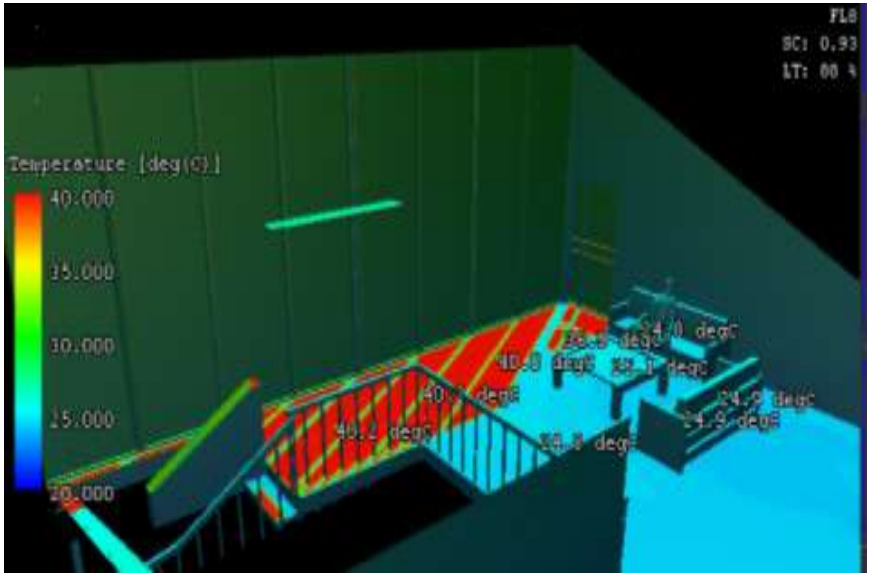
Energy Saving Simulation

Energy Saving Simulation







AGC Japan developing an energy saving software which enable the simulation of :

- ✓**Visual Image simulation of the building**
- ✓**Electricity usage & cost estimation**
- ✓**Solar heat reduction comparison by different glazing**
- ✓**OTTV estimation**

Energy Saving Simulation – Model Assumption

Simulation detail ;

- Glass vol. : ± 200 m^2
- WWR : 50%
- Spandrel : 30%
- Storeys : 30
- Planview : 9.0 x 9.0 x 16.0 m
- Floor to floor : 4 m
- Glass attributed energy : 365 days, 12hours/day
- Electiricity cost : IDR 1,350 /KWh

Energy Saving Simulation

Kind of Glass		LT (%)	SC	U-Val (W/m^2K)	OTTV (W/m^2)	Glass Attr.Energy (kWh/year)	Glass Attr.Cost (millionRp/year)
Ordinary Float	Clear 8mm	88	0.93	5.7	66.3	40,113.0	54.2
	Panasap Green 8mm	36	0.59	5.7	49.0	27,286.8	36.9
Pyrolitic Coating	New Stopsol SS Green 8mm#2	25	0.44	5.6	44.1	23,601.6	31.9
	Sunergy Sigma Green 8mm#2	21	0.38	4.3	34.9	16,788.1	22.7
Magnetron Coating	T Sunlux 208.8mm #2	9	0.22	4.3	32.3	14,895.3	20.1
	Stopray ACE 42T (6+12+6mm)	42	0.29	1.6	28.8	12,291.1	16.6

Simulation detail;

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Meet Jakarta OTTV regulation
$\leq$ 45 W/m^2

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Energy Saving Simulation - Appearance

Clear : 66.3 W/m²K

Panasap Green:
49.0 W/m²K

New SS Green:
44.1 W/m²K

Sunergy Sigma Green:
34.9 W/m²K

T-Sunlux 208 (On Green):
32.3 W/m²K

Stopray Ace:
28.8 W/m²K

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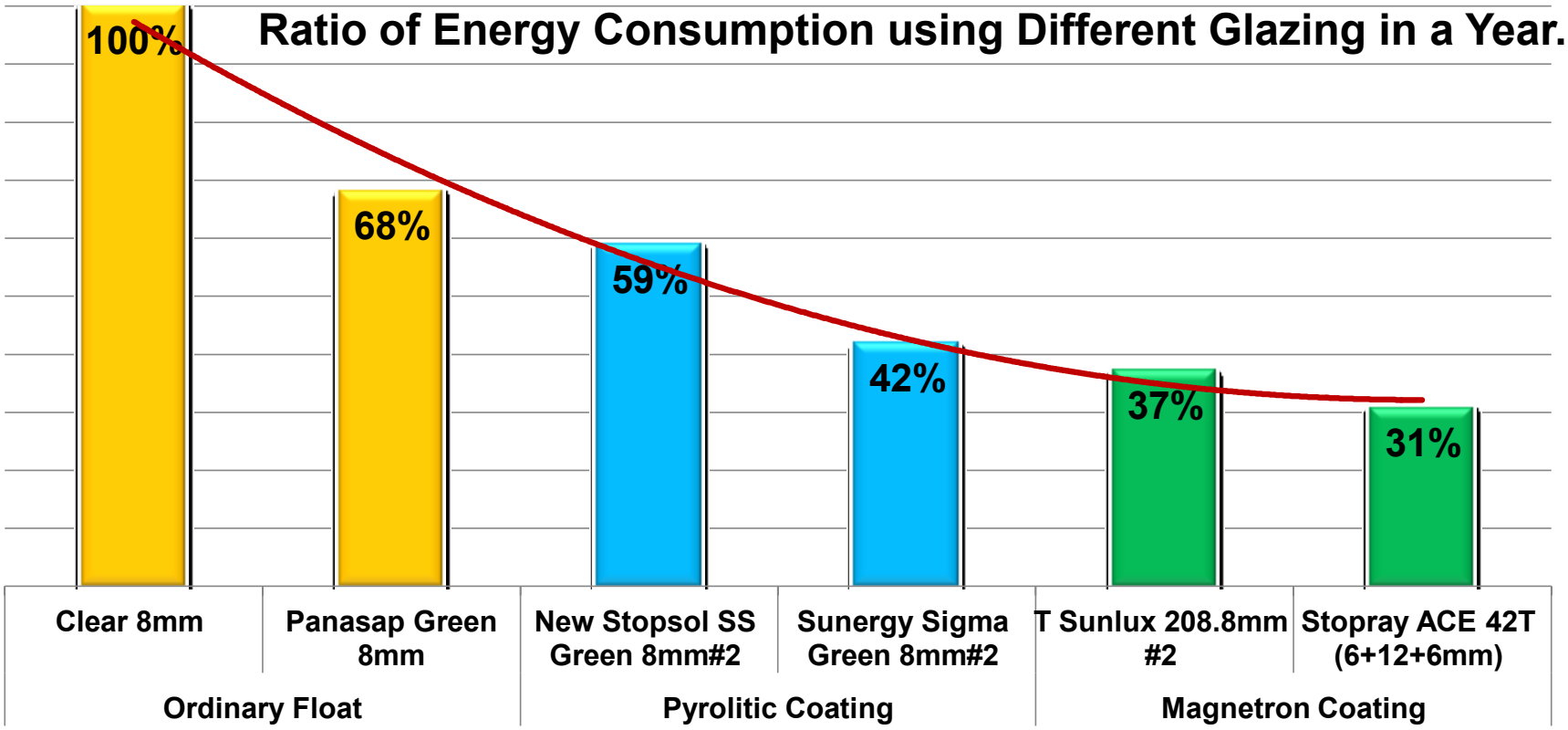
Energy Saving Simulation



Coating Glass helps reduce up to **69% cost** vs clear glass

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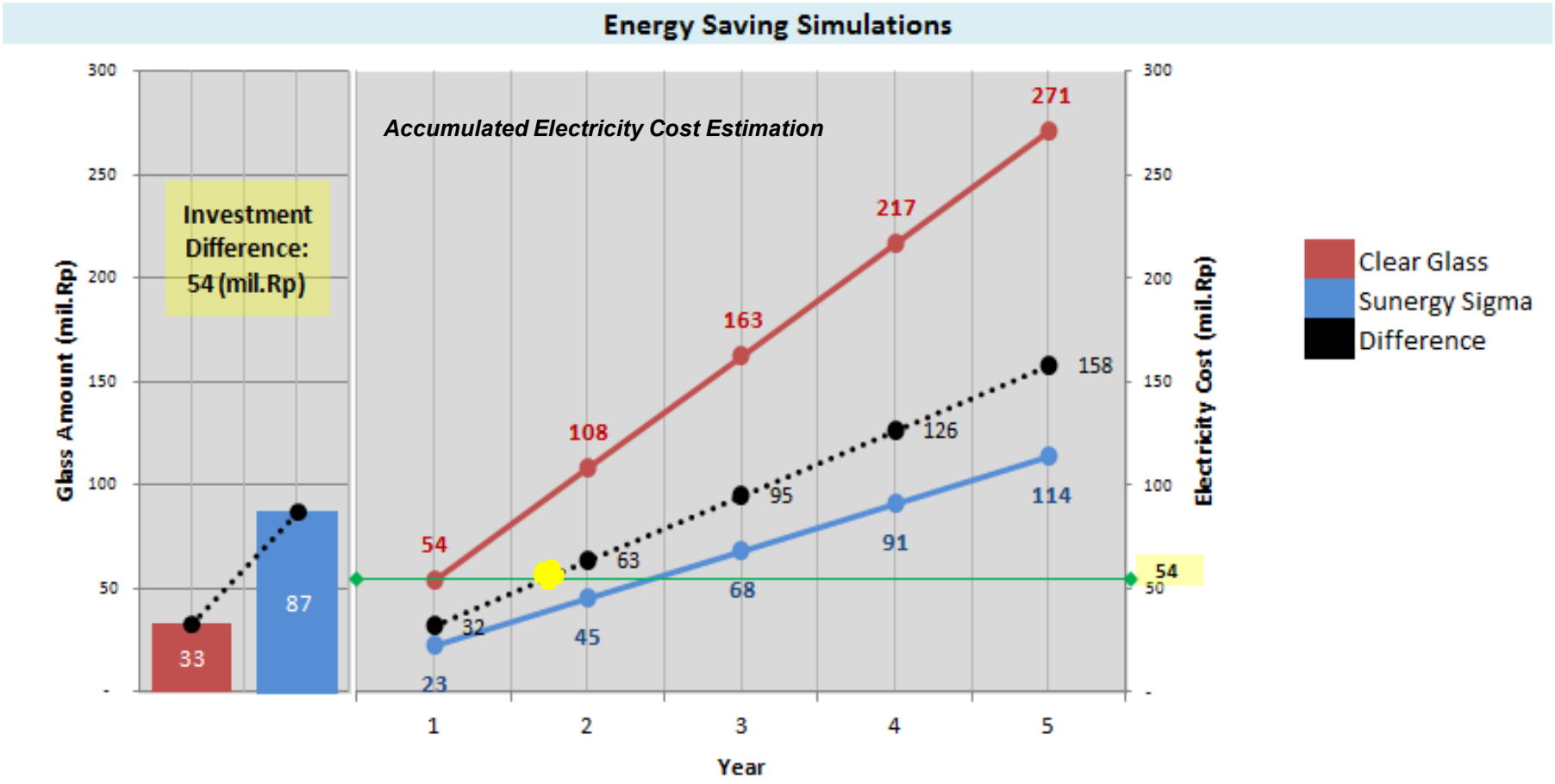
Energy Saving Simulation - ROI



By using Sunergy Sigma (vs Clear Glass), ROI will be ≤ **2 years**, and we will enjoy the energy efficiency afterward

Summary

Summary

- Green Building awareness in Indonesia is rapidly growing, thanks to GBCI and Government regulation.

- Glazing plays an important part in Green Building which key parameters, WWR & glazing performance (SC& U Value) provide significant contribution in OTTV calculation.
  - High WWR does not necessarily mean higher OTTV calculation, with current technology, better glazing selection could help to compensate high WWR and still achieve the mandatory OTTV.
  - Appropriate coated glass can help to reduce the energy consumption up to 69%** compare to normal clear glass

- As a Glass Pioneer in Indonesia & the region, Asahimas continue to develop the appropriate glazing products that can better suit the Green Building requirement and meet the Architects/Consultants expectation in Aesthetics.
  - Improved Online Coated Glass (New Stopsol, Sunergy Cool & Sigma)
  - Locally produced Offline Coated Glass (2H 2018)
    - T Sunlux & Stopray series

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amfg.marketing@agc.com

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Thank You !!