

Verosol

Report: Assessment of potential energy savings by using roller blinds with EnviroScreen 802 G3 Ultimate versus a non metallised screen in combination with two types of glazing by AGC/Interpane

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Assessment:

Assessment of potential energy savings when EnviroScreen 802 G3 Ultimate versus a non metallised screen with and openness factor of 5% in the colours Black and White in combination with two types of solar control glass: Ipasol 62/29 and Stopray Smart 30/20, both by Interpane / AGC, in Madrid

Boundaries:

Calculations are only regarding the energy flow through the fenestration. This means the energy flow due to Solar Heat Gain and Thermal heat gains. It does not consider user behaviour and the energy consumption due to the use of the building, like computers and electrical installations. In this calculation it is assumed that all solar energy which penetrates through the fenestration has to be cooled down, and all thermal heat losses has to be compensated.

Given facts and basic principles:

Properties for the glazing compositions are given in table below.

Glazing composition	U-value in W/m ² K	G-value	LT-value
1 8 _i -16Ar-8 Stopray Smart 30/20	1	0.21	30%
2 8 _i -16Ag-8 Ipasol 62/29	1	0.30	60%
3 8 _i -16Ar-44.2 Stopray Smart 30/20	1	0.21	29%
4 8 _i -16Ag-55.1 Ipasol 62/29	1	0.29	59%

Properties of shading fabric:

Properties	Solar irradiation		Licht transmission	Openness Factor
	Reflection	Transmission		
EnviroScreen 802 G3 Ultimate	74%	4%	4%	2%
Non metallised Screen, Black	5%	5%	5%	5%
Non metallised Screen, White	66%	20%	25%	5%

Calculation of fenestration performances.

Calculations are performed in WIS 3.0.1.SP2 in Compliance with EN 13363-2 and ISO 15099 using the reference climate conditions from EN 13363-2:

Fenestration 1	U-value in W/m ² K	G-value = SHGC	LT-value = VLT
Glass + EnviroScreen 802 G3	0.7	0.11 (or 11%)	1.5%
Glass + Screen 5%, Black	0.9	0.18 (or 18%)	1.5%
Glass + Screen 5%, White	0.9	0.14 (or 14%)	8.0%

Fenestration 2	U-value in W/m ² K	G-value = SHGC	LT-value = VLT
Glass + EnviroScreen 802 G3	0.7	0.12 (or 12%)	3%
Glass + Screen 5%, Black	0.9	0.26 (or 26%)	3%
Glass + Screen 5%, White	0.9	0.14 (or 14%)	15%

Fenestration 3	U-value in W/m ² K	G-value = SHGC	LT-value = VLT
Glass + EnviroScreen 802 G3	0.7	0.11 (or 11%)	1.4%
Glass + Screen 5%, Black	0.9	0.18 (or 18%)	1.3%
Glass + Screen 5%, White	0.9	0.14 (or 14%)	7.8%

Fenestration 4	U-value in W/m ² K	G-value = SHGC	LT-value = VLT
Glass + EnviroScreen 802 G3	0.7	0.12 (or 12%)	3%
Glass + Screen 5%, Black	0.9	0.26 (or 26%)	3%
Glass + Screen 5%, White	0.9	0.15 (or 15%)	14%

- The g-value reflects the shading property. This is the part of the solar radiation which enters through the fenestration. g-Value is also known as Solar Heat Gain Coefficient and Solar Factor.
- The U-value is the thermal insulation value and reflects the thermal heat gains and losses. The figure reflects the energy flow through the fenestration.
- The LT-value is the light transmission through the fenestration. This figure is needed when forecasting glare risks. On all sunlit elevations this shouldn't be higher than 5% to ensure visual comfort when working with computer screens. This means that a normal Screen fabric in a light colour will not be sufficient glare control

Based on the small difference between de laminated and 8 mm Inner Pane the savings calculation is performed for the 8 mm Inner Pane version. Furthermore, the Stopray Smart 30/20 has on itself a low g-value and of only applied for a small percentage. The potential saving calculation is only based on the Ipasol glazing.

Solar Irradiations

Climate data of Madrid

Elevation	Annual daily mean insolation in KWh/m ²
North	0.90
East	2.54
South	3.30
West	2.55
Average on all elevations	2.32

HVAC climate data for the area:
The Cooling degree days: 656
The Heating degree days: 1792

Total irradiated energy on the building

Elevation	Annual daily mean insolation in KWh/m ²	days	Total m ² of glass	totals
North	0.90	× 200	× 0	= 0KWh
East	2.54	× 200	× 1700	= 863600KWh
South	3.30	× 200	× 60	= 39600KWh
West	2.55	× 200	× 1700	= 867000KWh
Total annual insolation:				1770200KWh

Savings due to shading when COP of installation is 2,5:

Fenestration	insolation KWh		G-value or SHGC	=	Total solar heat gain KWh	:	Needed electricity for cooling in KWh	Cooling cost at an electricity rate of € 0.12/KWh
Glass only	1770200	×	30%	=	531060	:	212424	25491
Glass + EnviroScreen	1770200	×	12%	=	212424	:	84970	10196
Glass + Screen, Black	1770200	×	26%	=	460252	:	184101	22092
Glass + Screen, White	1770200	×	14%	=	247828	:	99131	11896
Potential cooling load savings with to the EnviroScreen shading:								€ 15295
Potential cooling load savings due to the Screen, Black shading:								€ 3399
Potential cooling load savings due to the Screen,White shading:								€ 13595

Thermal heat gain

For calculating the thermal heat gain through the fenestration:

- Calculation is based on the difference in U-value between the combinations glass and EnviroScreen and Glass + Screen which is 0.2 W/m²K.
- Calculations are based on the Cooling Degree Days figure given for the Madrid area. The Cooling Degree Days is an accumulation of average temperature differences (outside-inside) and days.

Savings on thermal heat gain by better insulation:

Cooling degree days	daily average hours of use of blinds ⁴⁾		total m ² glass in the building		difference in U-value in W/m ² K	=	total reduction of thermal heat gain / annum in KWh	savings on electricity for cooling in KWh ¹⁾	savings on cooling cost at electricity rate of € 0.12/KWh ²⁾	
676	×	18	×	3972	×	0.20	=	9666	3867	464

Savings on thermal heat loss by better insulation:

Cooling degree days	daily average hours of use of blinds ⁴⁾		total m ² glass in the building		difference in U-value in W/m ² K	=	total reduction of thermal heat gain / annum in KWh	savings on electricity for cooling in KWh ¹⁾	savings on cooling cost at electricity rate of € 0.12/KWh ²⁾	
2767	×	18	×	3972	×	0.20	=	39566	15826	1899

¹⁾ Calculation based on a coefficient of performance of 2.5 of cooling installation.

²⁾ Based on a given electricity rate of 0.12/ KWh

Total annual savings on cooling

Annual savings on cooling and heating when EnviroScreen is used insead of Screen, Black are in €:	11896+464+1899 = 14259
Annual savings on Electricity in KWh	118825
Annual savings of Carbon emissions in kg	73672

Annual savings on cooling and heating when EnviroScreen is used instead of Screen, White are in €:	1700+464+1899 = 4063
Annual savings on Electricity in KWh	33858
Annual savings of Carbon emissions in kg	20992

Conclusions:

- ◆ The Screen, White is not sufficient for glare control. It definitely will result in glare complaints.
- ◆ Both EnviroScreen 802 G3 and Screen, Black will good glare control.
- ◆ The total potential energy savings of EnviroScreen 802 compared to Screen Black is €14000 per annum, which means €70.000 in 5 years time.

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