



# European Union Energy Day

Clean energy solutions for the buildings  
of the future

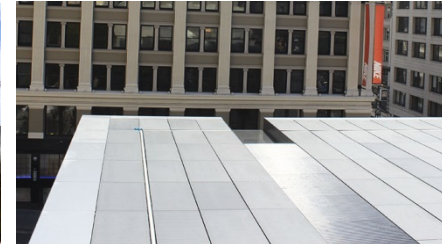
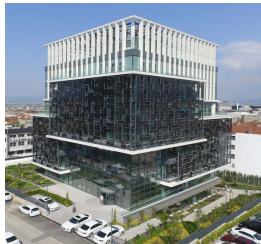
Astana EXPO, 24 July 2017

**#EUenergyday**



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# PV glass: The building material of the Future, Today

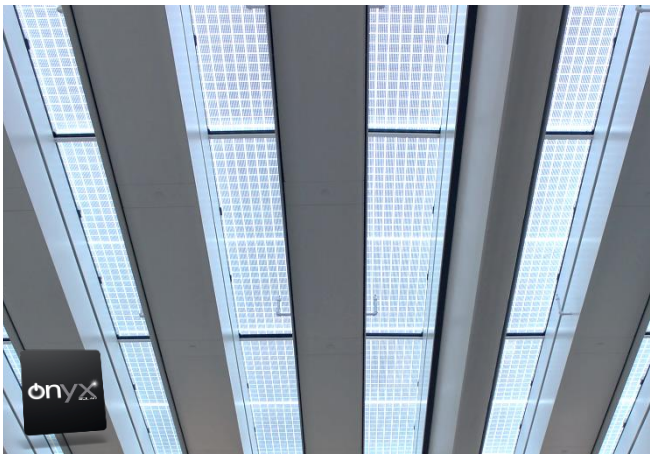


**Álvaro Valverde**  
Business Developer

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- 1 - WHAT IS A TRANSPARENT PHOTOVOLTAIC GLASS?
- 2 - WHAT IS THE PV GLASS MADE OF?
- 3 - SOLAR TECHNOLOGIES & CUSTOMIZATION
- 4 - R&D PROJECTS
- 5 - APPLICATIONS, REFERENCE PROJECTS
- 6 - EXPERIENCE & CERTIFICATIONS

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# ONYX SOLAR

THE GLOBAL LEADER IN PV GLASS FOR BUILDINGS



@onyxsolar

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## 35+ INTERNATIONAL AWARDS



## INTERNATIONAL QUALITY CERTIFICATIONS

UL 1703 &  
ULC/ORD-C1703



IEC 61215:2005  
IEC61730 2004:1&2



ISO 9001:2015  
Quality Management

ISO 14001:2015  
Environmental  
Management

UNE-EN 14449:2006  
UNE-EN 356:2001  
UNE-EN 12600:2003  
UNE-EN ISO 12543-4:2011

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# GREEN BUILDING

TOWARDS A NEW & MORE  
SUSTAINABLE ARCHITECTURE



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## PHOTOVOLTAIC GLASS

Architectural glass which besides providing the building with the same passive properties as a conventional glazing, it also **generates free electricity from the sun.**

It is therefore, the only building material available in the market that provides your building a **return on the investment.**

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## MULTIFUNCTIONAL PROPERTIES

1	ENERGY GENERATION		→	Decrease in O&M Costs
2	UV & IR FILTER		→	99% UV Up to 95% IR
3	THERMAL & ACOUSTIC INSULATION		→	As low as 0.76 W/m <sup>2</sup> K
4	NATURAL ILLUMINATION		→	VLT on demand
5	INNOVATION DESIGN		→	Energy efficiency + aesthetics

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## WHAT IS THE PV GLASS MADE OF?

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- Glass lites
- Solar cells
- Interlayers
- Junction box
- Add-ons

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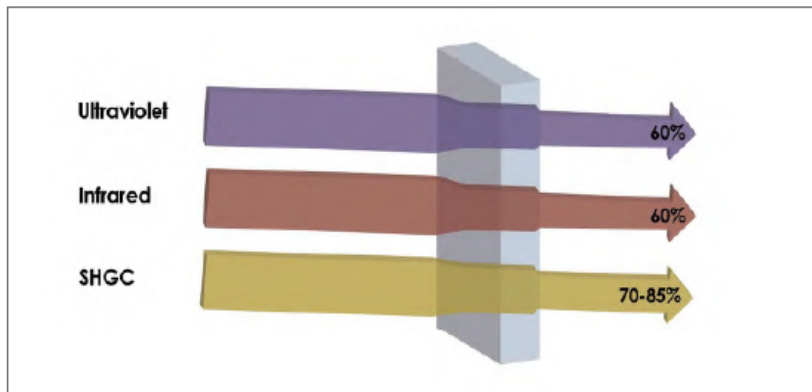
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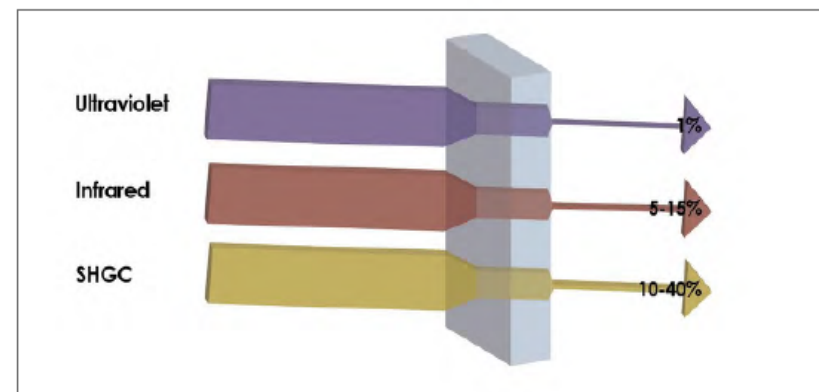
# SOLAR CELLS

Solar technology keeps evolving everyday, aiming to improve efficiencies, lifespan, and even the aesthetics of the technology. The following table shows several of the major solar technologies available in the market.

TYPE OF PV SOLAR CELL		PRIMARY MATERIALS	EFICIENCY (%)
Thin Film	A-Si	Silicon	5-10%
Crystalline Silicon	Monocrystalline		16-20%
	Polycrystalline		13-16%



**Conventional Glass:** Harmful radiation and solar heat passes through the glass for less favorable indoor condition.



**Thin Film (PV) Glass:** Harmful radiation and solar heat are significantly reduced, effectively enhancing the indoor comfort level. (99% UV and 85-95% IR radiations).



# JUNCTION BOX

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## SOLAR TECHNOLOGIES



# AMORPHOUS CRYSTALLINE

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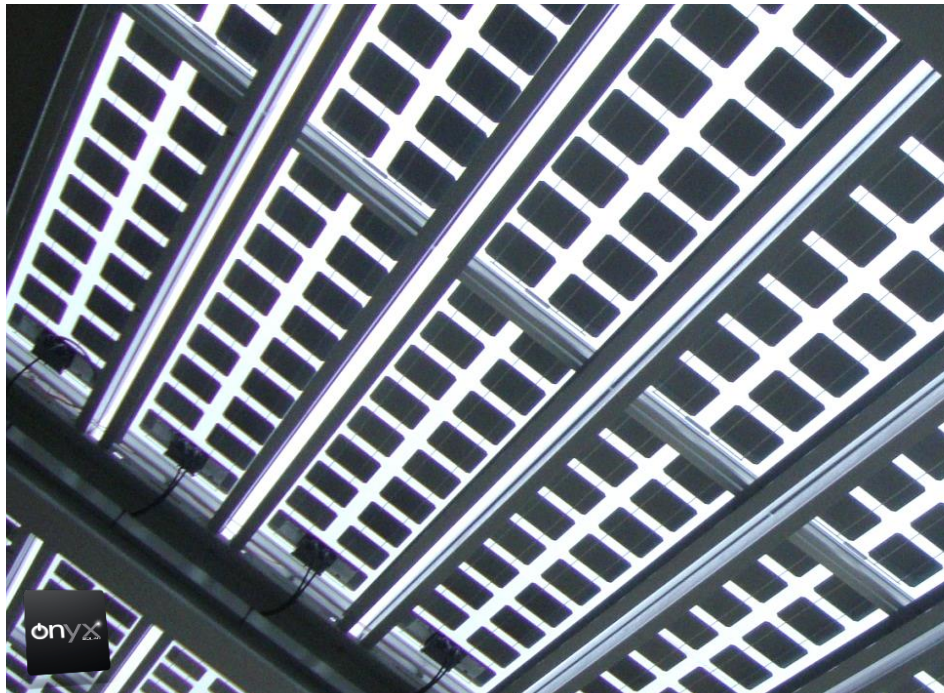
## AMORPHOUS

- Coating over a layer of flat glass (CVD)
- Visual Light Tr: Dark, 10, 20, 30%
- Efficiency 5% - 10%
- Greater energy production (kWh) at the same installed power (kWp)
- Better behavior under the presence of shadows / overcast (tilt, orientation)
- Low temperature coefficient – performs well under high temperature
- Unobstructed views
- Cheaper than crystalline-Si PV Glass

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## CRYSTALLINE

- Mono and Polycrystalline
- 12 or 15 cm. solid, square solar cells
- Efficiency 15% - 18%
- Higher kWp installed per Sqft
- Greater nominal power per square feet (Wp/ SqFt)
- Produces more electricity under direct sunlight
- Flexibility in functional design - trapezoids

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## SIZE, SHAPE AND COLORS

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# 100% PERSONALISED

Glass is personalized to the specific requirements of each project.

We manufacture the largest photovoltaic glass in the market (14' x 7').



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# RESEARCH & INNOVATION

Core to our business



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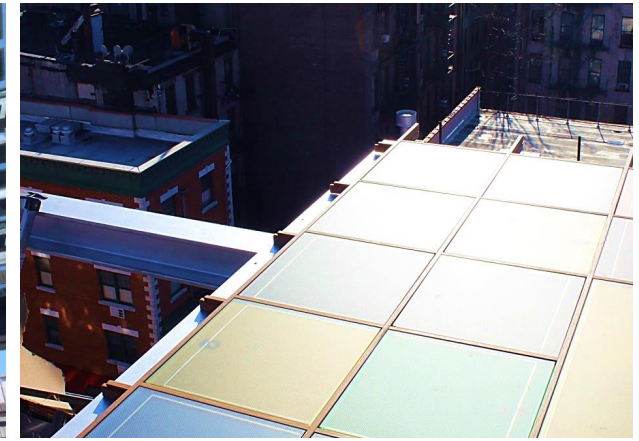
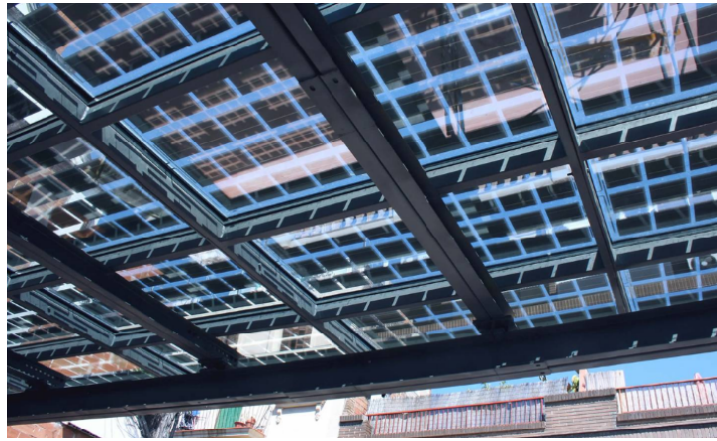
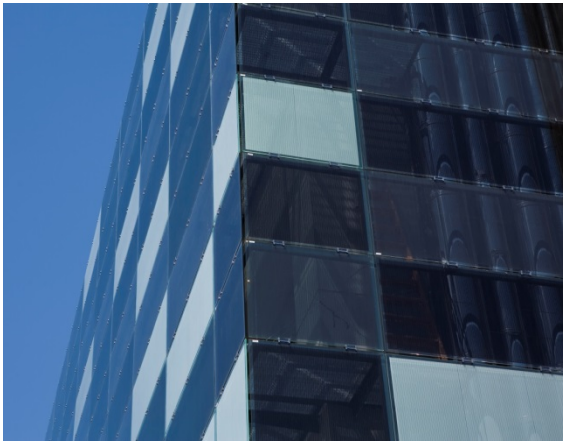






# APPLICATIONS

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# PHOTOVOLTAIC SKYLIGHT



Pic. Crystalline Silicon PV Skylight, 30% VTL. Novartis HQ, New Jersey



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295 kWp DC. Produces about 320,000 kWh/year. de 2.133 x 1.511 mm glass units



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# PHOTOVOLTAIC SKYLIGHT



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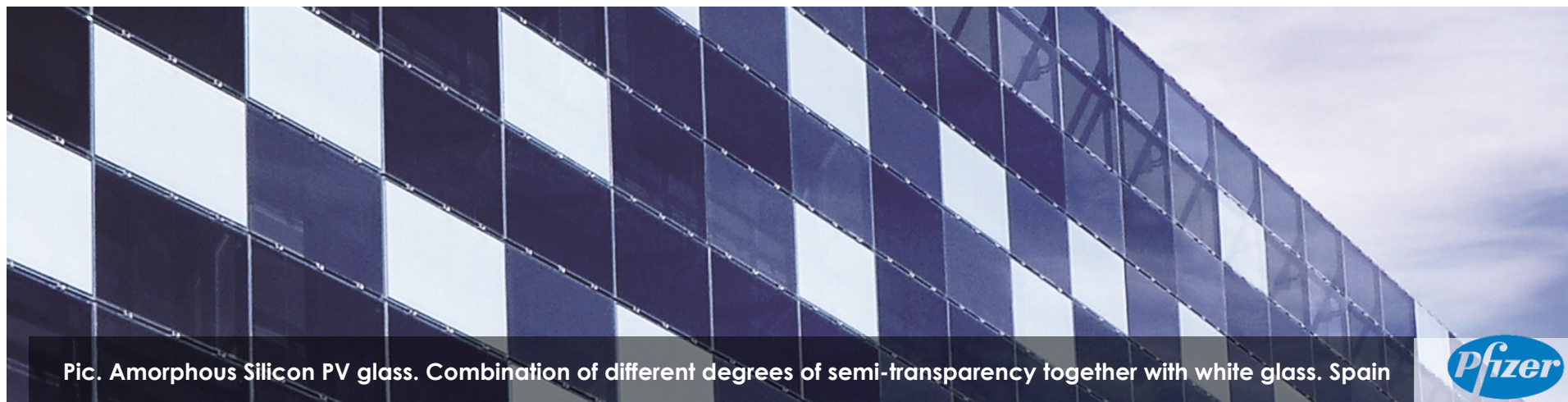
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# PHOTOVOLTAIC VENTILATED FAÇADE

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Pic. Amorphous Silicon PV glass. Combination of different degrees of semi-transparency together with white glass. Spain



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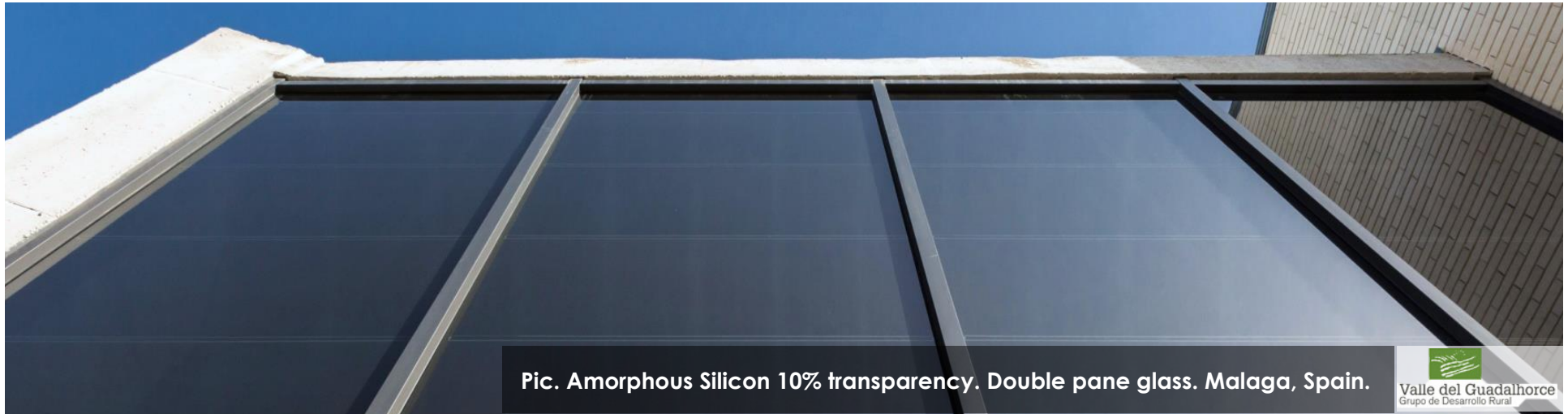
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# PHOTOVOLTAIC CURTAIN WALL



Pic. Amorphous Silicon 10% transparency. Double pane glass. Malaga, Spain.



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# PHOTOVOLTAIC SECOND SKIN



Pic. Amorphous Silicon PV glass, 20% transparency. Turkey



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10 PROJECTS & REFERENCES Dubai

# DUBAI FRAME

PHOTOVOLTAIC FACADE



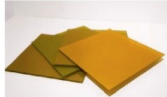
The **Dubai Frame** is an impressive rectangular picture-frame shaped building, **150 metres tall and 108 metres wide**, located in the Jumeirah Park in Dubai. Its strategic location provides over 2 million views with spectacular views of the city's other architectural jewels, framed on the horizon. It has therefore been considered one of the world's new attractions in 2014, and one of the most original skyscrapers.

Onyx Solar® has participated in this project with the integration in the facade of **1,200 m<sup>2</sup>** of amorphous silicon photovoltaic glass. Approximately 2,500 modules require **485 x 960 mm of a triple safety laminate** to have been manufactured in a yellow-gold colour with a **semi-transparent degree of 20% (1 visible)**. The total installed power capacity reaches 28 MWp and will enable the building to generate a large proportion of the energy it needs for its operation.

This multifunctional glass, besides contributing to the creation of a sustainable building fed for considerable extent by solar energy, provides the frame with undeniable aesthetic value due to its warm colour. It also filters out ultraviolet and infrared radiation, thus preventing the greenhouse effect so common in cities with tall structures and improving the comfort of its occupants. Thanks to the integration of Onyx Solar's photovoltaic glass in the envelope of the building, considerable energy savings may be achieved in the hands of the same.

“The choice of using photovoltaic glass, which produces clean energy from the sun, is witness to a change of attitude in the government and to Dubai's approach to sustainability”.

Abdullah Khalifa, Dubai government engineering and planning.



Onyx Solar® has developed a new generation of coloured semi-transparent photovoltaic glass, encompassing a wide spectrum of shades, while maintaining the same efficiency as colourless photovoltaic glass.

Dubai Frame - 1st prize, Thesis Award, Elevator Architecture Award 2010.

ONYX SOLAR®

10 PROJECTS & REFERENCES Dubai

10 REABILITY STUDY OF AMORPHOUS SILICON PHOTOVOLTAIC GLASS

**<0,01€**  
Per watt of  
**37%**  
Reduction in PVAC energy demand  
**22%**  
Fear of loss of return  
**<5 years**  
Payback

Download the complete study

“The Dubai Frame features a sustainable structure, simple to build and maintain, and with incomparable aesthetic value. Dubai is a city ripe with emblematic buildings, so instead of adding one more, we set ourselves the task of framing them”.

ONYX SOLAR® Dubai frame architect.

General Contractor: Alstom  
Architect: HOK  
First Class Winner

12 PROJECTS & REFERENCES Denver - Colorado

# SCIENCE PYRAMID

HEXAGONAL PHOTOVOLTAIC GLASS



The Science Pyramid, located in the Denver Botanic Gardens, is a pyramid-shaped building. Here, Onyx Solar® has integrated **hexagonal crystalline silicon photovoltaic glass modules with a 100% custom-made design**.

This pyramid shows visitors the principal ecosystems of Colorado and explores similar environments around the world. The illumination and vibrations within the pyramid are determined by the current weather conditions.



“It has been great to work with Onyx Solar®. It was the only company capable of making the hexagonal photovoltaic glass we needed and of helping us with the design”.

Adam Samoilien, Project Manager at GFI Group.

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ENR REGIONAL BEST 2015 PROJECTS

12 REABILITY STUDY OF CRYSTALLINE SILICON PHOTOVOLTAIC GLASS

**<0,01€**  
Per watt of  
**30%**  
Reduction in PVAC energy demand  
**66%**  
Fear of loss of return  
**<1 year**  
Payback

Download the complete study

Building awarded the title of Best Project in Colorado in 2015 by the most significant construction magazine worldwide, Engineering News-Record (ENR) of the McGraw Hill and Standard & Poor's group.

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# TANJONG PAGAR

PHOTOVOLTAIC CANOPY

Located in the midst of Singapore's financial centre, this 44-storey tower is the tallest building in the country. Designed by SOM, the New York-based architecture firm, its construction was led by the Korean multi-national company Samsung.

Onyx Solar® is taking part in this project with the integration of a large photovoltaic pergola of over 2,400 m<sup>2</sup> located at the entrance to the building, with an installed power capacity of 125 kWp. The pergola features 850 amorphous silicon photovoltaic glass modules measuring 2,456 x 1,245 mm, with a semi-transparency degree of 10% (M vision), which will enable the building to supply over 7,000 lights per day thanks to the sun (125,810 kWh per year).

This energetic efficiency measure contributes to the building obtaining the Greenmark and the Platinum LEED certification. Furthermore, the building has already been granted a 2015 WAN AWARD in the "Future Projects" category.



"At SOM we are committed to excellence, which translates to high-value innovative designs. We have the opportunity to influence positively the fundamental problems currently facing humanity: promoting renewable energy and increasing the levels of energetic efficiency. At SOM we are able to collaborate effectively with diverse solutions in the struggle against climate change".

"We believe that sustainability inspires great architectural works. New, spectacular designs are emerging which have a minimal impact on the environment".

ONYX SOLAR®

**SAMSUNG**

At Samsung, we undertake the responsibility of carrying out our activity with the aim of enriching our planet.

Our sustainability policy is based on the continued improvement of the environment throughout our activities, naturally including the efficient use of energy at our facilities".

Samsung sustainability report, 2015

2,424 M2  
125,810 kWh  
7,169 lighting points  
84,290 CO2  
76 Panels

>> FEASIBILITY STUDY OF AMORPHOUS SILICON SKYLIGHTS IN SINGAPORE

<0,01€ Energy cost

28% Reduction HVAC energy demand

86% Internal Rate of Return

<1 year Payback

Download the complete study paper

LEED Platinum

EUROPEAN PROPERTY AWARDS

WAN AWARDS



Best of What's New 2015

Onyx Solar®'s glass has been rewarded by the centenary scientific dissemination journal "Popular Science" as the most innovative product of the year, together with Tesla's Powerball batteries.

## SOM

SOM is the architecture firm entrusted with the design of the Tanjong Pagar.

Located in the midst of Wall Street, SOM has designed buildings as prominent as the **Burj Khalifa** in Dubai, which at 828 metres is currently the tallest building in the world, or the **One World Trade Center** in New York.

Over 15,000 buildings located in 50 countries bear witness to the awesome experience of this emblematic architecture studio.

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# PHOTOVOLTAIC CANOPY



Pic. Crystalline Silicon PV Skylight. Produces about 34,500kWh yearly. American Airlines Arena, Miami

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# PHOTOVOLTAIC CANOPY

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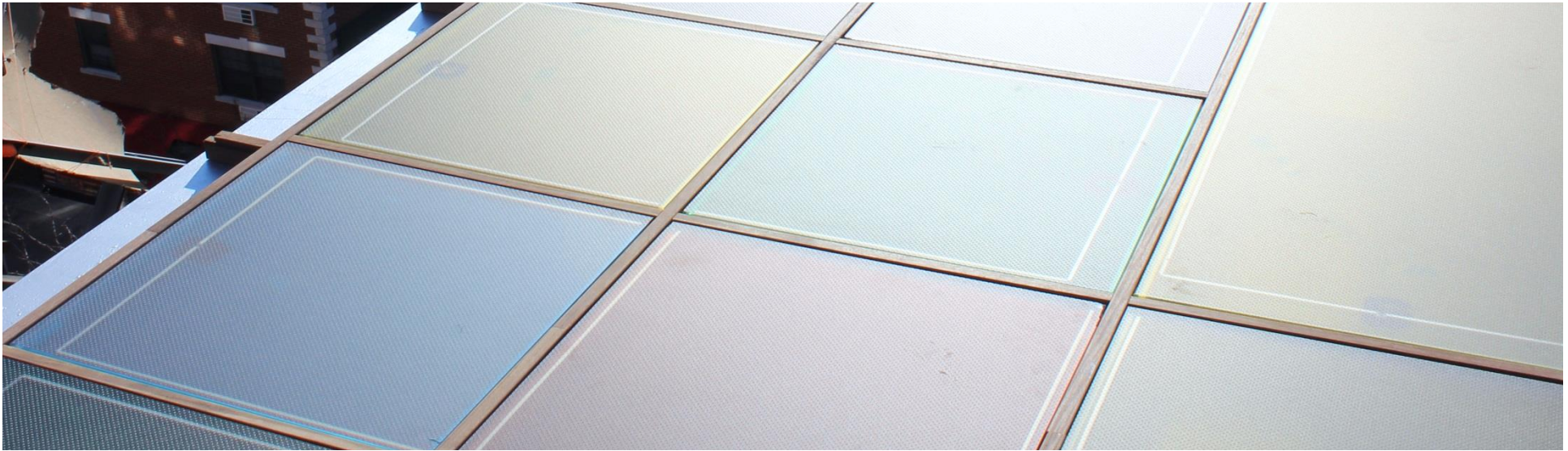
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# PHOTOVOLTAIC WALKABLE PV PAVERS

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# PHOTOVOLTAIC WALKABLE PV PAVERS



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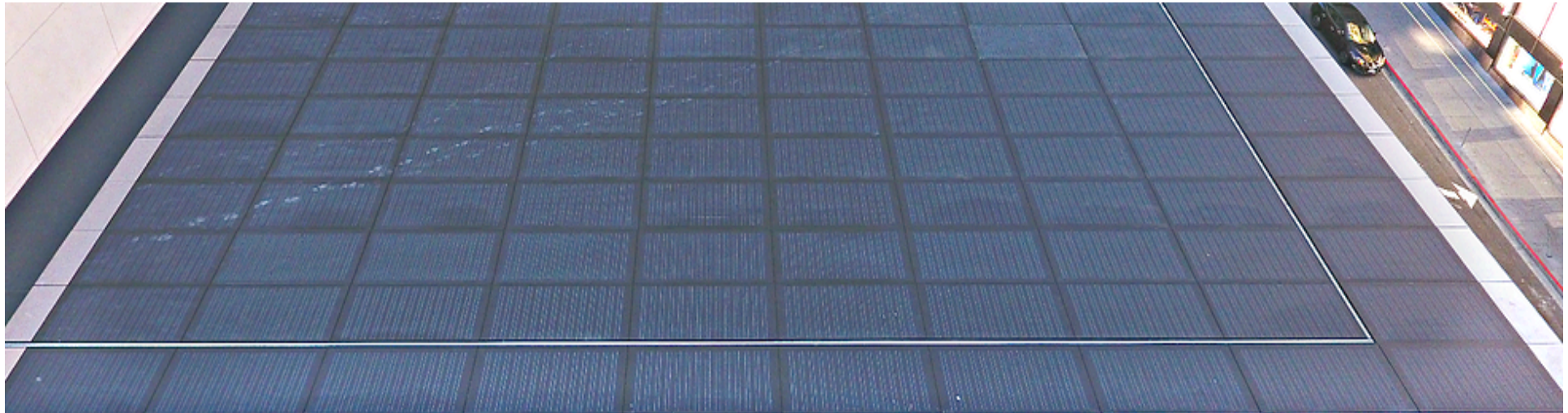
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# ANTI-SLIP ROOF RAINSCREEN

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## OTHER APPLICATIONS

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PV PARKING-LOT, SPANDREL,  
SHADOW BOX, GUARDRAILS,  
FINS AND LOUVERS,  
PV FURNITURE



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pays for itself



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## CASE STUDY PROJECT UNDER CONSTRUCTION: BELL WORKS

Former Bell Laboratories in Holmdel, New Jersey.  
200.000 m2 Building.

5.500 m2 20% LT amorphous Silicon  
photovoltaic glass.

Under construction and set to become largest PV  
skylight in the world.

Client: Somerset Development

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# THANK YOU

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