San Anton Market

IEA PVPS

Introduction

This project is part of the refurbishment of San Anton Market, located in the centre of Madrid, where a 168 m^2 skylight, comprised of transparent low-E photovoltaic glazing, has been completely integrated into the building.

Source: Successful Building Integration of Photovoltaics – A Collection of International Projects

Aesthetic integration

The solution chosen for the photovoltaic installation have a modern appearance similar to conventional glazing solutions which facilitate their integration in urban environments. In order to optimize the aesthetic of the final installation and reduce the visual impact of the electric elements, the junction boxes and wires are hidden inside the supporting structure.

Energy integration

This photovoltaic skylight generates over 7,700 kWh per year and prevents the emission of 5 tons of CO_2. For this reason, it has been selected as a sustainable project of reference by the European Commission. The system enables the generation of electricity in situ, while providing multifunctional bioclimatic properties such as the filtration of solar radiation (photovoltaic glass reduces the infrared, 90 %, and ultraviolet radiation, 99 %, compared to with conventional laminated glass), and at the same time enhancing interior light and providing thermal and acoustic insulation thanks to its double glazing.

Technology integration

The photovoltaic glazing employed is made of 54 amorphous silicon modules, with a semitransparency degree of 20 % (L vision). In addition to the low-E PV glass, a 12 mm air-filled cavity was chosen to increase the thermal and acoustic insulation of the system. The modules are installed with a small slope to facilitate water drainage.

Decision making

The photovoltaic glazing allows two functions to be combined: the possibility of illuminating an interior space, while having a solar installation. In this case, the skylight in which the installation was placed is the backbone of the project, so it was also wanted to add a pedagogical function, making the visitors ware of the need of using renewable energy. (Arch. Ana María Montiel Jiménez, estudio ATARIA)

Lessons learnt

The result is absolutely satisfying. The main objective of having a photovoltaic installation as a fully

integrated element in the building was an absolute success, as the qualities of double functionality sought were provided. Using renewable energy is a key objective in society in general, and architecture in particular, and photovoltaic glazing allows it to be incorporated in a natural way in necessary elements of the interior space. (Arch. Ana María Montiel Jiménez, estudio ATARIA)

The San Anton Market project was a technical challenge for Onyx Solar since it was the first one that they executed using photovoltaic glazing with an insulating gap between two panes (IGU, Insulated Glazing Unit). It created a twofold challenge as it was necessary to provide a solution to the exit of the wiring from the rear part of the photovoltaic glazing through the connection box and, at the same time, to find a technical solution to hide the wiring that interconnects the glazing units with each other and the strings that reach the inverters. The design of the skylight in a saw-tooth pattern was the most suitable solution to position the junction boxes on the photovoltaic glazing offsets. The work carried out by the architectural company's team, the construction company and Onyx Solar technical team was completely coordinated during the execution of the project, which allowed agile solution of any small setbacks that occurred during the different project stages. The final result of the skylight was satisfying. It was possible to achieve the goals of integrating 100 % photovoltaic glazing with an insulating air gap and allowing the light to pass into the building in a controlled manner. The integration with the building is so satisfactory that the employees and users of the Mercado de San Anton building are unable to perceive that part of the energy they consume is being produced cleanly "over their heads" thanks to the sun. (Arch. Ángel Gallego, Onyx Solar)

Although the initial cost of this skylight could be higher if it is compared to conventional solutions because of the photovoltaic and electrical components, economic viability is achieved due to the capacity of the PV glazing to generate free electricity from solar light and the passive properties that reduce climate control loads and HVAC demands. A feasibility analysis was done on the basis of total cost and an estimation of electricity generation per year of about 7,748 kWh. Under these conditions, the energy price was estimated to be about 0.02 €/kWh. Besides, the use of the BIPV solutions could lead to a reduction of 34 % in HVAC energy demands with 55 % as the internal rate of return and a payback less than 2 years.

Low-E photovoltaic glazing has a Solar Heat Gain Coefficient (SHGC) that is much lower than that of conventional laminated glazing. A low SHGC value is critical for thermal comfort, particularly for hot climates such as Madrid.

PROJECT DATA

Project type	renovation
Building use	commercial
Building address	Calle de Augusto Figueroa 24, Madrid, Spain

BIPV systems

BIPV SYSTEM DATA

Architectural system	skylight
Integration year	2010
Active material	amorphous silicon
Module transparency	transparent
Module technology	glass-glass, hidden PV, customized modules
System power [kWp]	6.5
System area [m²]	168
Module dimensions [mm]	2,536 x 1,147, 2,668 x 1,147
Modules orientation	South-West
Modules tilt [°]	10
Annual FV production [kWh]	7748

BIPV SYSTEM COSTS

Total cost [€]	77280
€/m²	460
€/kWp	11890

Stakeholders

Main building designer

Arch. estudio ATARIA

BIPV system designer

Onyx Solar

BIPV components producer

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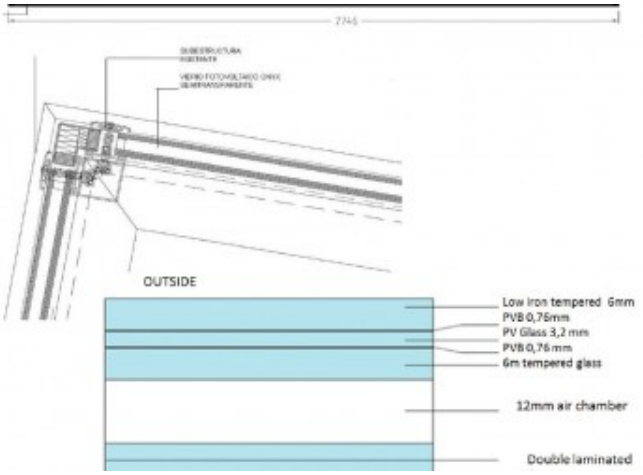
San Anton Market in the centre of Madrid © Onyx Solar

San Anton Market local meeting point, including a market of perishable goods, bars and restaurants © Onyx Solar

BIPV roof from the outside © Onyx Solar



Details of glass configuration and installation on the supporting structure © Onyx Solar

Sunlight effect of the BIPV modules © Onyx Solar

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