This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 817991

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MULTIFUNCTIONAL BIPV FAÇADE CLADDING SYSTEM WITH INTEGRATED INSULATION. BIPVBOOST PROTOTYPES INSTALLATION ON DEMO SITE FAÇADE IN MORBEGNO (SO)

Technology description

The BIPV façade cladding system developed under the BIPVBOOST project was named ePIZ. It consists of a composite element, obtained by integrating PIZ cladding products with different photovoltaic (PV) technologies. The main concept of combining a PIZ product with a PV element was to have a BIPV cladding system that can offer energy production, a high level of thermal insulation and a good level of acoustic insulation within one product along with an easy installation process. In the BIPVBOOST project, PIZ rock metabio H89 was used to prepare ePIZ. It has an 80mm thick layer of wool rock insulation coupled with a 9mm thick layer of mortar.
The PIZ cladding product is CE certified and follows ETAG017. The thermal transmission rate is low and it has a very low water absorption capacity. It shows good resistance under the wind suction test, good resistance under the impact test and great resistance under the fire test. PIZ system is a breathable system with open joints so it has good water vapour permeability. It can be installed on the façade using a special aluminium mounting system. The lower and upper horizontal edges of the cement mortar are thickened and grooved to allow the insertion of continuous aluminium extruded rail. All the aluminium profiles are treated against atmospheric attack, the systems shall be secured to the existing sub-structure (iron frame, concrete wall, masonry wall) employing screws or expansion fixings.

BIPVBOOST prototypes installation on façade

Demosite building is a residential complex consisting of twin buildings separated from each other, both buildings have an identical cube-like shape. In the architectural BIPV design, the top three rows of the PIZ cladding panel were required to be replaced with the two rows of ePIZ glass-glass BIPV modules and two small rows of conventional PIZ H89 modules. ePIZ glass-glass BIPV modules are placed in between the two small rows of conventional PIZ H89 modules to avoid production losses due to the shadow of flashing elements in the top row.
In total, 178m2 of façade cladding was replaced with 110m2 of ePIZ BIPV cladding and 68m2 of PIZ H89 cladding. 204 standard ePIZ BIPV modules and 8 special ePIZ BIPV modules were required for this installation. All ePIZ BIPV modules had the same width and solar cells were evenly distributed in the

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individual BIPV module which gives a raster
image look overall. The approximate power of this PV installation is 9,8 kWp.
No modifications were made to the design during the installation process. The mounting system is made of horizontal H profiles in aluminium and vertical spacer profile in PVC. Additional aluminium safety clamps were used to provide extra protection for safety.

Preliminary steps

The existing facades of the demo site building were realized with the conventional PIZ H89 cladding system therefore before starting the installation of the newly developed ePIZ BIPV cladding system it was necessary to remove the top three rows of existing PIZ panels, these three rows of PIZ panels were replaced with 2 rows of ePIZ glass-glass BIPV panels and two rows of conventional PIZ H89 panels.
The façade of the building after the removal of the top three rows of the PIZ cladding panel can be seen in the figure below.

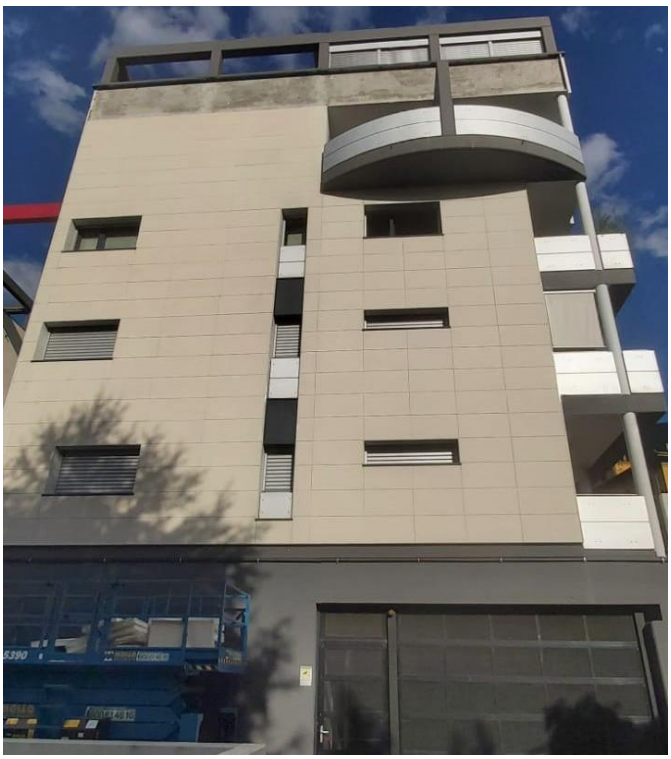

*Figure **Errore. Nel documento non esiste testo dello stile specificato.** Façade after the removal of the top three rows of conventional PIZ H89 panel*

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BIPV Structure Installation

ePIZ BIPV modules were installed using the same fastening and mounting system as traditional PIZ panels. The mounting system includes horizontal H profiles in aluminium and vertical T profiles in PVC. Horizontal H profiles were fixed to the walls using expansion plugs. The pitch between the expansion plugs was 45cm.

Additional aluminium safety clamps were used to provide extra protection for safety to the glass as seen in Figure (1-2) Safety clamps are recommended considering the behaviour of polymeric materials under high temperatures. In these modules, EVA encapsulant and silicone are polymeric materials. These materials could melt in case of fire and result in glass detachment therefore safety clamps can ensure protection in such a scenario.

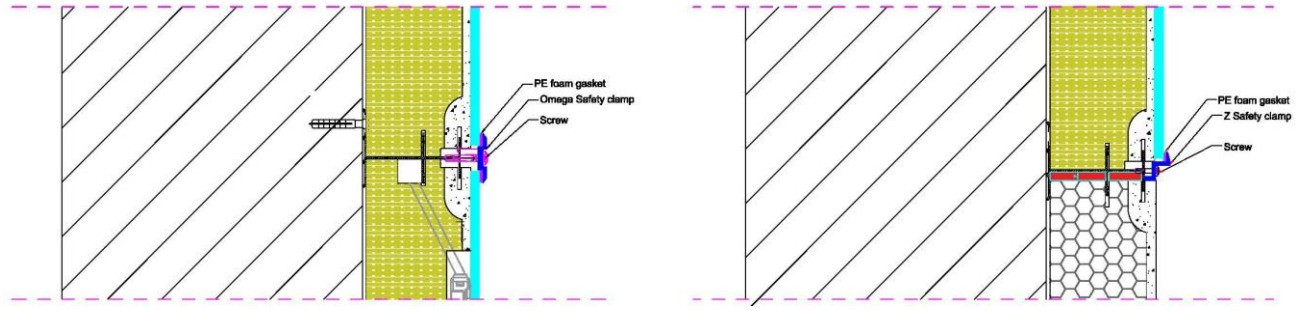

Figure 2 Additional aluminum safety clamps

Figure 3 Installation of Horizontal H profiles

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Figure 4 Aluminum safety clamps installed to provide extra safety

BIPV Modules Installation

The installation schedule was provided to residents of the building before the start of BIPV installation so that residents are aware that on which part of the building work will be carried out each day.
As per the design, It was required to install BIPV modules over the 8 facades of the two buildings. It was necessary to install scaffolding in the areas not accessible with the vertical platform.
The placement of ePIZ BIPV modules over the installed H profiles is quite simple, modules contain a continuous groove in the mortar surface over the horizontal edge, and this groove can be fixed over the installed horizontal aluminium H profiles and then vertical T spacer profiles in PVC were placed between the adjacent modules inside the groves prepared in wool rock insulation.
After the installation of the 1st row of BIPV modules, the same process is repeated for the next row of ePIZ BIPV modules and traditional PIZ H89 modules i.e. installation of horizontal aluminium H profiles and then placing the modules over the installed profiles.
The pictures of the building during and after installation are shown below.

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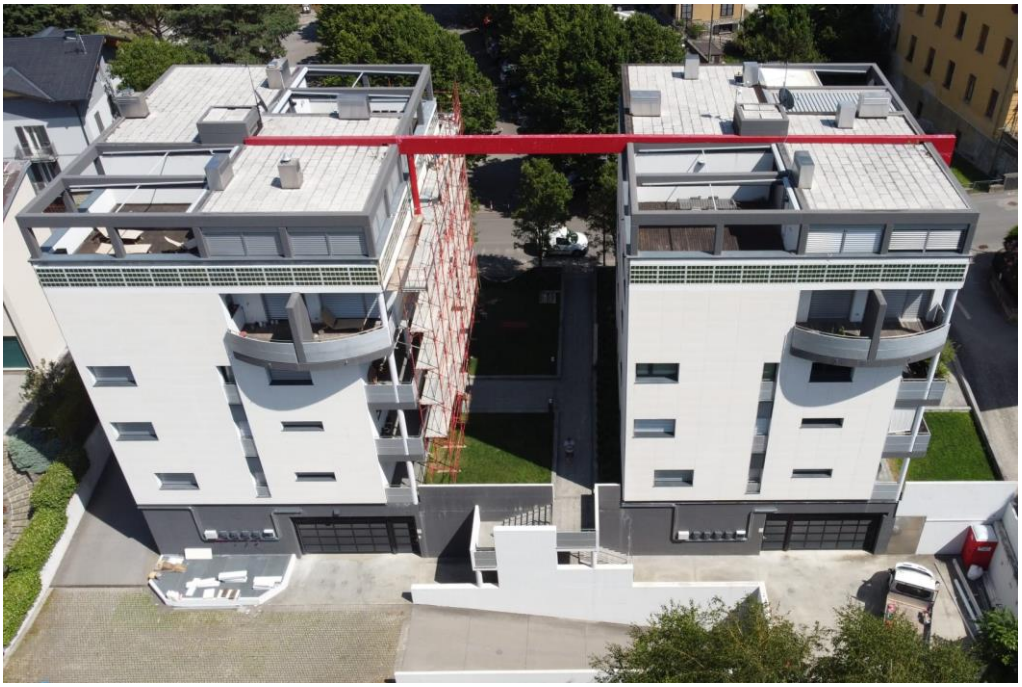

Figure 5 installations in progress

Figure 6 installations in progress

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Figure 7 Installation complete

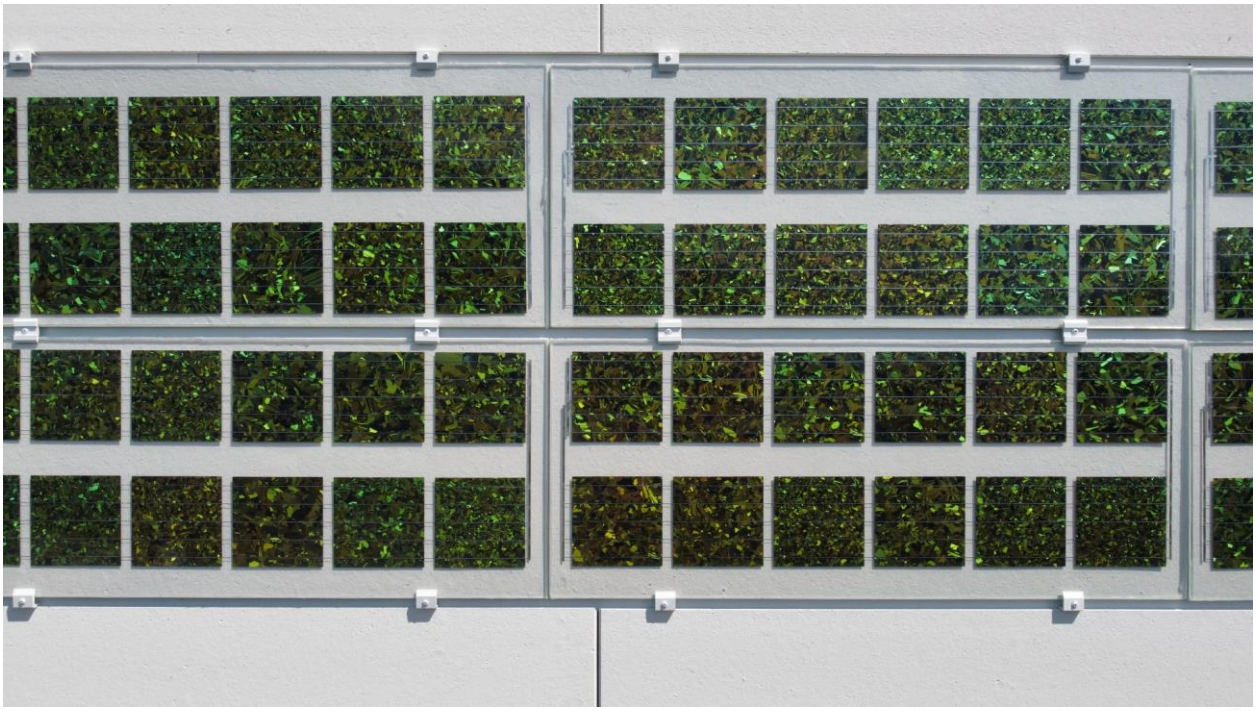

Figure 8 Installation complete

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BIPV electrical system installation

The electrical design of the system was studied in detail and all electrical components were selected accordingly. It was decided to realize the PV installation using a mono-phase inverter for every façade as each façade is oriented in a different direction and generates different power.
All electrical equipment installed outside has been placed in 2 custom-made steel cabinets for protection against bad weather.

Figure 9 Steel cabinet for electrical equipment

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The electrical installation was carried out as planned by providing, for each building, a single descent of the dc wires along a corner, which was suitable, and closed using pre-painted aluminium profiles.
After the delivery of the DC monitoring electrical cabinets, the electrical wires were connected to the cabinets and then switched to the connection of the inverters. (4 single-phase inverters for each building for 8 inverters installed). The AC wires outputs from the inverters single-phase have been combined to build a three-phase system (mode of supply from the network and used in the common services of the condominium) to balance the phases as much as possible.

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