Politecnico di Milano ed.5

Introduzione

The case study is an historical building of the Leonardo Campus in Milano. It was built at the beginning of the XX Century and currently hosts one of the academic labs of the University. The PV system is integrated in the south-facing roof pitch of the building, which was previously covered with traditional tiles. The design process aimed at creating an homogeneous surface of PV tiles, harmonically integrated with the adjacent parts of the roof.

Approccio progettuale

The Politecnico di Milano has embraced an ambitious initiative to solarize its rooftop by installing a PVsystem in its buildings. In such framework, the installation of SOTTILE aligns with the university's commitment to sustainability and energy innovation, leveraging advanced renewable energy technologies to transform its urban campus into a model of ecological responsibility. By integrating a PV system into its rooftops, the Politecnico di Milano aims to significantly reduce its carbon footprint while enhancing the energy efficiency of its infrastructure. This initiative not only underscores the institution's dedication to environmental stewardship but also serves as a living laboratory for students and researchers, fostering innovation and hands-on learning in the field of renewable energy.

Integrazione estetica

The goal of the BIPV solution was to guarantee the perfect balance between integration and power density. In such respect, SOTTILE, characterized width equal to the row height of conventional roof tiles (typically 40 cm in standard roof tiling) but larger length, guarantees a perfect optical blending of the solar tiles with traditional clay tiles, creating a harmonious appearance that preserves the architectural identity of the roof, as well as high energy production and lower installation costs. The red colour option of SOTTILE module aligns with the characteristic hue of traditional Italian roof tiles, ensuring a flawless chromatic match.

Integrazione energetica

The energy produced by the PV system is entirely consumed on-site, directly powering the various energy-intensive loads of the campus, including research laboratories, teaching facilities, administrative offices, and common areas. By utilizing the generated energy in situ, the Politecnico di Milano not only reduces its reliance on external energy sources but also maximizes the efficiency and environmental benefits of the installation.

Integrazione tecnologica

SOTTILE has been selected since it is designed with a modular size compared to traditional standard tiles, split in two main elements: the PV laminate and the supporting frame. The latter represents the interface between the PV laminate and the building’s roof and therefore needs to perfectly match the traditional tiles in the middle of which it is inserted. In order to meet expected requirements in terms of flexibility and lightness but also to minimize the embodied carbon, it was decided to manufacture the supporting frame with a specific plastic blend made from up to 80% of recycled material, able to be UV-

resistant and self-extinguishing (classified as V2-UL 94). More specifically, it consists of a filled perimeter frame with intermediate stiffening, to make it light and resistant. This choice allows to contain cost, embodied energy and weight of the final product compared to existing market solutions. The connection and the overlapping among several supporting frames will guarantee the waterproofing.

The support system allows relative sliding with respect to the roof structure to make it possible to adjust the component in the three directions of space. To make this sliding action possible, the supporting frame combines elongated bolt holes and sliding grooves and tongues obtained with a formed (pressed) process.

Regarding the size, the system is characterized by the same width of traditional tiles (about 0.4 m) and a length of about 1.5 m. Such size allows to guarantee the best compromise between flexibility, handleability and cost. Nevertheless, the supporting frame of each PV laminate is manufactured with the same width of the laminate and 1/4 of its total length. This aims to facilitate the manufacturing phase of the component, made with formed process, allows a higher absorption of thermal expansion by means of special flexible joints and increases the modularity. A further issue that the PV tiles system has addressed is related to the potential irregularities and non-planarity of the roof substrate, typical of existing roofs, which can pose challenges into installation of traditional PV systems. In such respect, the modular and flexible mounting solutions as well as lightweight materials used in SOTTILE minimize the need for structural modifications, reducing installation costs and complexity.

Processo decisionale

The PV system was installed as a part of a wide solarization campaign of the Campus, within which all available surfaces were carefully analyzed. The specific pitch was considered usable only by adopting a technological solution that would guarantee minimum aesthetic impact in view of the building type and context. Therefore, this BIPV system was used as a case study to demonstrate the adequacy of the solution with respect to the requirements imposed by the Heritage Authority.

Lessons learnt

The installation of the system on historical building presents unique challenges for implementing innovative solutions such as photovoltaic systems. Specifically, the installation had to secure authorization from the local Heritage Authority, a step that entails a rigorous assessment of the project's aesthetic, cultural, and architectural impact on the building itself and the surrounding environment. This process necessitates meticulous planning and often the adoption of advanced technologies that harmonize with the historical and artistic characteristics of the structure.

The success achieved by such application represents a significant milestone, not only from a technical perspective but also from a regulatory and cultural standpoint. It demonstrates how technological innovation can be harmoniously combined with the preservation of historical heritage. This achievement can serve as a model for future installations in similar contexts, promoting a sustainable and respectful approach to the enhancement of cultural assets.

The installation of the PV system will contribute to the production of clean energy, reducing reliance on traditional fossil fuels and advancing the university's broader sustainability goals. This project highlights the critical role that academic institutions play in pioneering solutions for a greener future, setting an example for other organizations to follow.

DATI EDIFICIO

Tipologia progetto	riqualificazione
Destinazione d'uso	educazione
Vincolo	edificio vincolato
Indirizzo edificio	Via Celoria, Milano,Italien

Sistemi BIPV

DATI SISTEMA BIPV

Sistema architettonico	opakes Dach
Anno integrazione BIPV	2024
Active material	monokristallines Silizium
Trasparenza modulo	opaco
Tecnologia modulo	vetro-vetro, FV non riconoscibile, modulo standard
Potenza sistema [kWp]	12,8
Area sistema [m²]	110
Dimensioni modulo [mm]	1384 x 352
Orientamento moduli	Süden
Inclinazione moduli [°]	26
Produzione FV annuale [kWh]	14300

COSTI SISTEMA BIPV

Stakeholders

Progettista sistema BIPV

ZH Srl

Installatore sistema BIPV

Gianni Benvenuto Spa
Viale Giacomo Matteotti 39, 22012 Cernobbio (CO), Italien
giannibenvenuto@giannibenvenuto.it +39 031 511070
https://www.giannibenvenuto.it/

Produttore componenti BIPV

SOTTILE Solar Srl
Via Bergamo 19/21,20045 Lainate (MI), Italien
info@sottile.solar
https://www.sottile.solar/en/home-en/

Consulenti

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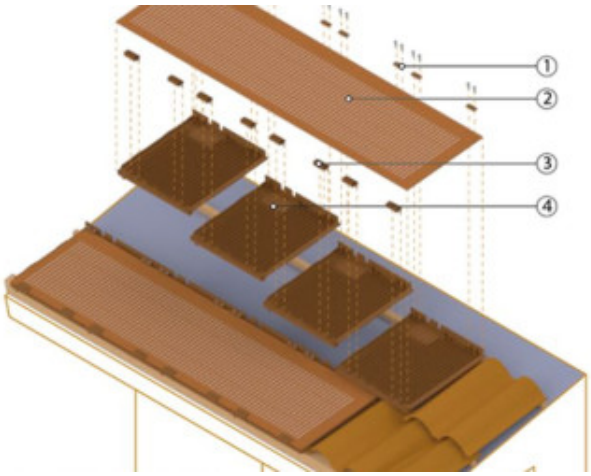
Direttore lavori

Area Tecnico Edilizia – Politecnico di Milano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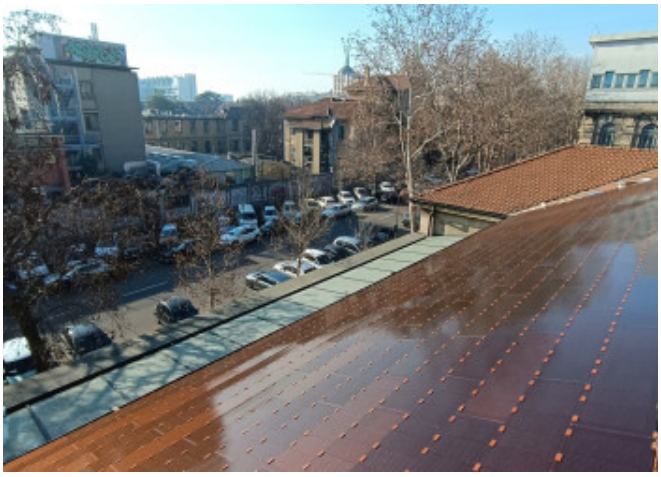

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