Building-integrated photovoltaics—aesthetic, efficient and widely accepted

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Renovation project with active terracotta tiles based on monocrystalline silicon cells. This farmhouse in Ecuvillens (canton of Fribourg) is situated in a conservation area in which roof-mounted photovoltaic modules are prohibited. Credit: Patrick Heinstein

Photovoltaic systems installed on roofs and façades could produce more than 50% of the present-day electricity demand. To accomplish this, however, use would also have to be made of existing buildings, especially residential dwellings in towns and cities. But some property owners and architects continue to doubt whether the integration of photovoltaic systems into buildings is economically viable and meets the aesthetic requirements of the surroundings.

These doubts are unfounded, however, as researchers at EPF Lausanne, the University of St Gallen, the Lucerne University of Applied Sciences and Arts and the School of Engineering and Architecture of Fribourg were able to demonstrate on the basis of a variety of case studies and a survey among property developers.

Photovoltaic modules as a new and versatile building material

"Thanks to new production processes, building-integrated photovoltaic systems have evolved into an innovative and attractive building material in both urban and rural areas. The enormous variety of colours, textures and formats that are now available means that photovoltaic modules can be flexibly integrated into roofs and façades. This applies to all types of buildings as well as to renovation projects, ranging from farmhouses to high rises and from minor maintenance measures through to complete renovation," explains Emmanuel Rey, head of the Laboratory of Architecture and Sustainable Technologies (LAST) at EPF Lausanne.

Economically viable as well as ecological

Although the initial investment in a renovation project with BIPV is higher than the cost of renovation without a PV system, this solution nonetheless yields significant benefits in terms of economic viability as well as energy efficiency. Investors can anticipate a satisfactory return, especially if building-integrated photovoltaics is considered early in the planning stage and is then optimised in accordance with various criteria. The amortization period for both non-renewable primary energy and greenhouse gas emissions is significantly shorter than the anticipated service life of a building-integrated photovoltaic system.

Depending on the type of building, the installation method and the

utilised energy storage system, it is possible for a renovated building with BIPV to achieve a self-sufficiency rate of up to 87%, if at the same time the fossil-fueled heating system is replaced by, for example, a heat pump.

Broad variety of options for owners and architects

PV modules integrated into roofs and façades are now more widely accepted than conventional roof-mounted systems, which is a significant factor in urban regeneration processes. A survey among house owners revealed a clear preference for modules that fit in with the architecture, are available in a choice of colours (particularly black and red) and wherever possible are produced in Switzerland or elsewhere in Europe. Thus the majority of them are prepared to pay more for BIPV systems than for non-integrated solutions.

"With these new technologies for integrating photovoltaic systems into buildings, developers and architects now have a broad range of options for combining architectonic quality with the necessity to generate energy in a sustainable manner," says Emmanuel Rey.

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