Overview

In view of the importance of urban renewal processes, building-integrated photovoltaic (BIPV) systems can potentially provide a crucial response to the challenges of the energy turnaround. Functioning both as envelope material and electricity generator, they can simultaneously reduce the use of fossil fuels and greenhouse gases (GHG) emissions while providing savings in materials and electricity costs. In Switzerland, for instance, one way to achieve the objectives of the "Energy strategy 2050" is to install PV systems to cover 1/3 of the annual electricity demand. However, despite continuous technological and economic progress, the significant assets of BIPV remain broadly undervalued in the current practice. This project is focusing on the architectural design issues and it presents the first results of the first case study carried out in the city of Neuchâtel (Switzerland).

Research methodology

Phase 1: Identification of archetypal situations (residential buildings)

Phase 2: Detailed analysis of the case study

Phase 3: Design strategies with BIPV solutions

Phase 4: Multi-criteria assessment

Identification of archetypal situations

- Arch. 1: 1919-1945
- Arch. 2: 1946-1970
- Arch. 3: 1971-1985
- Arch. 4: 1986-2005
- Arch. 5: before 1919

Detailed analysis of the case study

- Isol / Adj. building
- Arch. 1
- Arch. 2
- Arch. 3
- Arch. 4
- Arch. 5

Phase 3: Design strategies with BIPV solutions

Phase 4: Multi-criteria assessment

S0 - Baseline

S1 - BIPV conservation

S2 - BIPV renovation

S3 - BIPV transformation

Conclusion / Outlook

Based on the results of the evaluation, it seems clear that energy renovation projects without the integration of BIPV remain broadly undervalued in the current practice. In this sense, by proposing new adapted BIPV solutions for urban renewal processes, the research contributes to advancing architectural and construction design practices in this direction. The results of this application case study highlight several interesting elements, such as the best cost-effectiveness of the BIPV scenario and that we can achieve more than 89% of total savings by introducing mixed energy performance.

Energy and emissions

Global Warming Potential (GWP)

Primary energy consumption (kWh/m²·year)

Global Primary Energy Demand (GPD)

Life Cycle Analysis

Photovoltaic installation

Indoor comfort

Global cost-effectiveness

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