TOwards Integrated Design Strategies for Implementing BIPV Systems into urban renewal Processes: First Case Study in Neuchâtel (switzerland)

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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. 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 presents the first results of the first case study carried out in the city of Neuchâtel (Switzerland).

Research methodology

Phase 1
Identification of archetypes (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 Arch. 2 Arch. 3 Arch. 4 Arch. 5
A - Construction period
B - Urban context
Isolated building Isolated building Isolated building Isolated building Isolated building
C - Roof potential
Flat roof Sloped roof Flat roof Flattened roof Flat roof
D - Façade potential
1-4 floors 1-4 floors 1-4 floors 1-4 floors 7-8 floors
E - Architectural quality
Common Common Common Common Common
Level of protection
R B1

Categories of residential buildings

S0 - Baseline
Compliance with current legal requirements (which represents current practice)

S1 - BIPV conservation
Maintaining the expression of the building while improving the energy performances of the building (at least current legal requirements)

S2 - BIPV renovation
Maintaining the general expressive lines of the building while reaching high energy performances (at least Minergie standard)

S3 - BIPV transformation
Best energy performances and maximum electricity production possible with aesthetic and formal coherence of the whole building (at least 2050 Watt Society/ Energy strategy 2050)

Conclusion / Outlook
Based on the results of the evaluation, it seems clear that energy renovation projects without the integration of renewable energy in general and BIPV in particular are no longer an option if we want to achieve the objectives of the “Energy strategy 2050”. Today, renovation projects improving the building envelope with a very high level of thermal energy performance are necessary, but not sufficient. Compensating buildings’ energy consumption by producing electricity on site has become the number one priority. 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 strategies (passive, active and renewable-energy systems).

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