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ScienceDirect

Energy Procedia 122 (2017) 109–114

Energy Procedia

www.elsevier.com/locate/procedia

CISBAT 2017 International Conference – Future Buildings & Districts – Energy Efficiency from Nano to Urban Scale, CISBAT 2017 6-8 September 2017, Lausanne, Switzerland

eREN Energetic refurbishment – a global approach for the building envelope

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Abstract

Buildings energetic retrofit is key to the Swiss « 2050 Energetic strategy », but the refurbishment rate is low. eREN [1] has analysed the 20th century multi-dwelling housing stock in Western Switzerland from a constructive point of view and developed refurbishment scenarios for the envelope of 10 buildings. The goal is to achieve balanced solutions between energy efficiency, constructive feasibility, building physics, cost, architecture and use value.
Our investigation shows that "wrapping" is not the only solution to meet the standard, whatever the solution it is technically complex, the cost are high but could be mitigated, projects must be led by qualified professionals and interdisciplinarity must be actively promoted.

Peer-review under responsibility of the scientific committee of the CISBAT 2017 International Conference – Future Buildings & Districts – Energy Efficiency from Nano to Urban Scale

Keywords: energetic retrofit, building envelope, global approach, contructive typologies

1. Context

With some 40% of the energy consumption and CO2 emissions, the building sector is a key issue to the "2050 Energetic strategy" of the Swiss government [2]. However, the refurbishment rate is today well below the 2% required to hit the target. Easy measures (replacement of single glazed windows by more performing frames and glazed units) have been carried out on many buildings and the next step will be technically more demanding and may create problems in building physics. Taking into account that financial motivation is too weak at today's energy price to decide owners to undertake energy refurbishment, public authorities develop subsidised incentive programs to switch to renewable energy for heat production and to improve the insulation of the existing buildings. This policy, relayed by insulation producers and energy consultants, has serious consequences. Most interventions consist in wrapping the building with perimeter insulation, with no global overview, bypassing architectural and constructive issues, putting building physics at risk, and slowly but surely changing the image of our urban environment.

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1876-6102
Peer-review under responsibility of the scientific committee of the CISBAT 2017 International Conference – Future Buildings & Districts – Energy Efficiency from Nano to Urban Scale
10.1016/j.egypro.2017.07.384

2- eREN origins

eREN is first of all an attempt by architects to regain control on a topic abandoned to energy engineers (many of them lacking of construction background and architectural sensitiveness) and for which insufficient effort has been made in the academic curriculum of architects' training. Our intention is to put back the architectural and social aspects of refurbishment at the centre of the concerns, not the sole energy issue. Building envelope retrofit is necessarily an interdisciplinary issue. It requires a synthetic vision that should be a responsibility taken by the architect. This synthetic vision should aim at weighting interests to find a well-balanced solution between energy savings, constructive and physical issues, architecture, cost, and use value.

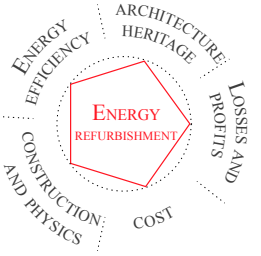

Fig. 1 : Energetic refurbishment criteria

eREN's goal is to search for answers to the four following questions:

- Can we reach the energetic standard (SIA 380/1) [3] without destroying the identity of the building?
- What is the method to achieve such a goal?
- At what cost?
- Is there a link between constructive typologies and refurbishment strategies?

3- Constructive typologies of the existing building stock

Properties with 3 flats and more and 3 levels and more, erected after 1900 and before the first energy standards of the 1980s form some 80% of the pre-1990 building stock in Western Switzerland [3], forming the sample with the highest potential for energy saving. An inventory of the most recurrent constructive typologies of this sample was done based on 193 buildings in Geneva, Vaud and Fribourg. This analysis was carried out on 8 key elements to establish the dominant constructive typologies across time:

1. Flooring against unheated spaces
2. Flooring between heated spaces
3. Façade walls
4. Roof
5. Windows
6. Window jambs
7. Solar protections
8. Balconies

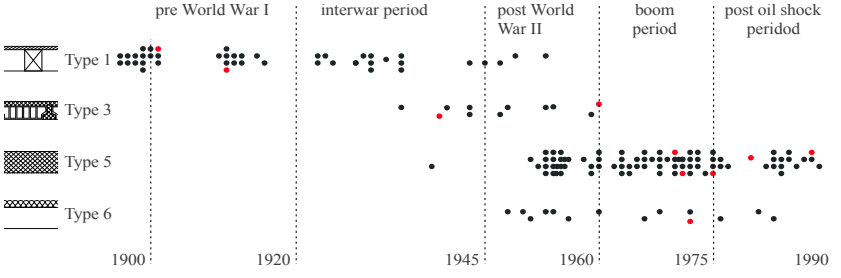

Fig. 2 : Building distribution : flooring between heated spaces (example)

Out of the analysis of the 193 buildings, 5 major periods (Pre-war : 1900 – 1920, Interwar . 1921 – 1945, Post-war : 1946 – 1960, Boom years :1960 – 1975, Post oil shock :1976 – 1990) and 15 constructive typologies have emerged.