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Pending for renovations: Understanding the conditions of the multi-family housing stock from before 1945

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Abstract

The Swedish housing stock is once again in focus for national energy savings, as it was after the oil crises in the 1970s and 1980s. The contemporary debate has a one-sided focus on energy savings and barriers for implementation of existing energy efficient renovation measures but also on large stock of industrialized housing built after 1960. The need for renovation is equally urgent in older stocks of housing, also in those that already have been renovated but are in need for further interventions. In this paper we focus on multi-residential housing built before 1945 in Gothenburg, Sweden, representing cultural and historical heritage values. The opportunities to ensure high energy efficiency with new measures in a second renovation should aim to find a balance with heritage values, social values, function, aesthetics and management aspects. In order to get an understanding of the conditions of the stock in focus, we apply both a top-down and bottom-up approach. In the top-down approach, data are gathered from different sources such as energy performance certificates, the national property register, and geodata from the City of Gothenburg. By combining information from these databases, three data subsets have been defined for the bottom-up approach: non-renovated buildings, buildings renovated to a small extent and buildings renovated to a large extent. Three case study buildings were selected out of these data subsets. The choice of renovation strategy differs between the cases. Case study building 1 has been left virtually untouched while case study building 2 and 3 have been renovated to different extent. The next step in this research project is to identify suitable renovation alternatives for these building typologies.

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1. Introduction

The Swedish housing stock is once again in focus for national energy savings, as it was after the oil crises in the 1970s and 1980s. The contemporary debate has a one-sided focus on energy savings and barriers for implementation of existing energy efficient renovation measures but also on large stock of industrialized housing built after 1960. The need for renovation is equally urgent in older stocks of housing also those that already have been renovated but are in need for further interventions. In this project we focus on multi-residential housing built before 1945 in Gothenburg, Sweden representing cultural and historical heritage values. The national energy target to reach 50% energy reduction by 2050 (compared to 1995) represents major challenges for conservation of cultural heritage values.

The actual energy savings through renovation measures in housing over time are difficult to evaluate. In the aftermaths of the oil crisis in the 1970s, the Swedish government provided financial support for building owners that took measures to reduce the energy use. These measures involved insulating the exterior façade and exchanging windows, which in many cases resulted in losses of cultural values. The possible energy use reduction through renovation is also dependent on user habits as well as appropriate housing management. In the planning for new renovations it is therefore important to learn from past lessons of energy renovation but also to consider the involvement of the users and housing managers in order to reach the desired outcome. Furthermore, future technological opportunities for energy saving and possibilities for the restoration of cultural values lost in earlier renovations should be considered.

This paper reports from the first phase of a research project in which we aim to get an overview of the building stock, its current conditions in terms of energy use over time (purchased energy), technical status of the thermal envelope (U-values, thermal bridges, air tightness) in relation to cultural values. The aim of the overall project is to evaluate the long-term effects of energy-related renovations carried out during the period 1975 and onwards in the pre-1945 housing stock focusing on a selection of building typologies. This is made in order to map further needs for renovation and propose guidelines for the improved energy efficiency and thermal comfort that does not interfere with existing cultural values. When these buildings now stand for their second renovation, it is beneficial to utilize the experiences on energy performance and to decrease the risk for performance failures in regard of for instance moisture damages. The opportunities to ensure high energy efficiency with new measures in a second renovation should aim to find a balance with heritage values, social values, function, aesthetics and management aspects. To reach the aim we will study earlier renovations and assess the need for further renovations. The relevant research questions are: What information is available and accessible of the current status and earlier interventions of this stock? Is this information useful in order to define renovation strategies? The results from this first phase of the project will provide input for decision-support for continuous property management and the very early stages of renovation.

We apply both a top-down and bottom-up approach. In the top-down approach, data are gathered from different sources such as energy performance certificates (EPC), the national property register (PR), and geodata from the City of Gothenburg. Data from these sources are combined, analyzed and visualized in a Geographic Information System (GIS) using the software ArcGIS 10.2. The EPC provides data on measured energy use of individual buildings, type of energy sources, and year of construction. The PR contains, among others, building co-ordinates, ownership, year of construction, a so-called value year[†], and in some cases a year of renovation. For the top-down analysis, the housing stock is presented in age-type classes, i.e. classes that represent buildings properties related to the year of construction, type of building, attachment, number of stories, and number of staircases. The division is based on a building stock model developed for the whole multi-family housing stock of Gothenburg [2]. For our study, five classes are of interest: timber buildings, brick buildings, Landshövdingehus[‡], slab blocks, and tower blocks.

In the bottom-up approach we use a selection of case studies representing a few of the above mentioned typologies of housing from the studied period. At the moment we have included two types: brick buildings built ~1900-1930 and Landshövdingehus (a typical type of local housing with one level in brick and two plus an attic in wood) built ~1875-

[†] A value year is calculated based on the economic extent of refurbishment activities, improvement of standard, and related to the expected remaining life time of a building. Only costs for larger refurbishments or extensions of a building can result in a change of the 'value year' [1].

[‡] Landshövdingehus (lit: county governor's house) is a building type specific for Gothenburg.

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