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P Femenias[1, 2] **and K Granath**[1]

[1]Dep. of Architecture and Civil Engineering, Division of Building Desgin, Chalmers University of Technology, SE-412 96 Gothenburg, Sweden
[2]Author to whom any correspondence should be addressed: paula.femenias@chalmers.se

Abstract. The gap between energy policy and potential energy savings through renovation, and what is carried out in practice has been in focus of previous research. Various influencing factors such as economy, organisation, and social relations versus tenants has been studied to design guidelines to bridge this gap. There is a lack of empirical studies of how renovation is planned, and what factors will influence the renovation measures that are implemented. This paper takes the starting point in 42 on-going and planned housing renovation projects 2018 – 2021 carried out by three municipal housing companies in one major Swedish metropolitan area. Based on the character of these, three main types of housing renovation are defined. The most current type of renovation is bathroom and piping while climate envelope renovation and deep renovation are less common. Energy saving is decoupled from renovation activities which will have implications for implementation of policy for energy efficient renovation.

Keywords: renovation strategies, typology of renovations, multi-residential housing

1. Introduction

Housing renovation has large potential for energy saving and has been identified as a key area for action to reach European climate and energy goals. According to the European Directive 2010/31/EU on the energy performance of buildings [1], each member state should establish a long-term strategy to support renovation of residential and non-residential buildings in public and private ownership. In Sweden, a third edition of the National Plan for Energy Efficient Renovation was published in 2020 [2]. However, the implementation of energy efficient renovation has proven slower than expected [3], and in 2020, the European Commission launched the "Renovation wave" a strategy to address market barriers and speed up the rate of energy efficient renovation [4].

According to the Global Building Performance Network energy efficient renovation should be carried out as "Deep renovation" (DR) which fully captures the potential energy efficiency by combining several measures of the building envelope and installation systems into one integrated strategy [5]. Typically, DR should result in a yearly primary energy use of less than 60 kWh/m^2, but few renovation projects in Europe reaches these levels [3]. Renovating to levels below DR results represents lost opportunities as buildings will not be renovated for another 40-50 years [2].

Previous research has identified barriers to the implementation of energy efficient renovation, such as low energy prices, high costs of investments [6], lack of knowledge and organisational barriers [7]. The social implications of energy renovation with respect to higher rents that might lead to tenants being forced to leave their homes has also been highlighted [8]. The fact that the housing areas with the largest

needs of renovation and energy efficiency measures, correspond to the areas with the socio-economic most vulnerable residents makes the question precarious [6].

While considerable research has focused on finding optimal solutions for energy efficient renovation packages from environmental and economic perspectives to overcome the implementation gap, see for example [9]. There are still few studies that has empirically studied the renovation process, and how the planning and execution of renovation will affect the renovation measures that are implemented. The aim of this paper is to study typical housing renovation that are carried out in Sweden today and what factors that will influence the chosen renovation strategies. Based on 42 on-going or recently finalised renovations, a typology of levels of renovations are proposed and discussed in relation to earlier typologies of renovation and to current energy policy.

2. Previous research on renovation typologies

Earlier studies have shown that housing renovation is seldom motivated by energy savings but driven by urgent need for technical maintenance and high running costs [10, 11]. DR projects with high energy efficiency has been carried out in Sweden, however, there is currently a trend among public as well as private property owners to move from comprehensive all-at-once renovations towards stepwise renovation, where renovation actions are spread out over time [12]. The public debate about high rents and luxury renovations, with what tenants perceive as unnecessary standard improvements, have been identified as drivers of this trend along with economic barriers [13].

With respect to renovation typologies, earlier studies have focused on energy savings and costs of renovation. For example, renovation has been defined with respect to potential packages of renovation of the climate envelop, or renovation of installation systems [9, 11]. A Swedish study compares identified current renovation activities, with an energy efficient renovation, and DR concluding the potential for four levels of energy savings: 4, 15, 30, and 50 percent respectively [11]. A recent publication also highlights the need to consider the execution of the renovation, the potential disturbance for residents, and the costs as well as the organisation of an evacuation of residents if that is needed [14].

Value year, a tax instrument to indicate investments done through renovation, has been used to measure the remaining service life of the building [6] and to define renovation levels [15]. The value year of a property will increase if the cost of renovation exceeds 70% of the new building cost. In that case the value year is set to the renovation year. If the renovation costs are 20-70% of the new building cost, the value year is calculated based on the cost of the renovation compared with the cost of constructing a comparable new building. If the renovation cost is below 20%, there is no change in the value year. A shortcoming in this method of calculating service life is that buildings that have been renovated frequently but to a cost lower than 20% of the new building cost can mistakenly appear as in higher need of renovation. The Swedish National Board of Housing, Building and Planning have studied the social effect of forced relocation in extensive renovation using the value year to define levels of renovation [15]. In order to make a selection of renovation projects to include in their study, a value from the following formula was used: (value year – construction year)/(renovation year – construction year). All projects where the resulting value was above 0,25 were considered as extensive renovations.

3. Method and material

The paper is based on data from 42 renovation projects that were on-going, planned or recently finalised between September 2018 to Mars 2021 and represent all renovation projects carried out by three large municipal housing companies in a metropolitan area in Sweden during that period. The three companies belong to the same corporate municipal group and together they own and manage over 70.000 rental apartments in different age categories form the late 19th century to recently built. The 42 renovation projects involve 7000 apartments. Some of the renovation projects are phases of a renovation of one larger property, and in total 29 properties are concerned. The properties are spread out over the city and are mainly built post-war, with a few exceptions (for an overview, see Figure 3 in section 4.5).

In Sweden, public housing, owned by municipalities, are acting as commercial companies while still having social responsibilities. There are few subsidies available for energy retrofit.

Data about the renovation projects were retrieved from the housing companies and complemented with information from their websites and annual reports (for an overview see Figure 1). Data that was gathered regards: construction year; type of building; renovation measures; length of the renovation process; the organisation of the renovation with respect to tenants; the energy efficiency ambitions; the initial rent and the rent increases. Data of such varied character is not stored in one location and not (fully) digitalised, it is in the hand of different divisions and employees, something which has been a challenge in retrieving the data. To get all data several divisions were consulted: technical staff that plan and organise the renovation process; energy managers responsible for energy efficiency; and renovation coordinators that organise and plan for the consultation and communication with tenants. The process was iterative, and a compilation of the data were sent over to the three companies on several occasion for corrections. When all data was compiled, the research group made a draft that defined the 42 renovation projects in levels of renovations. This process was also iterative, and the draft was discussed with representatives from the companies and then altered in several loops.

In addition to the data retrieval, key employees at the housing companies (property managers, business managers and energy managers – depending on the internal sharing of responsibilities for renovation projects at each company) were interviewed on how they plan and organise renovation and energy efficiency projects. Due to the pandemic interviews were carried out digitally or over the phone, in some cases followed up by e-mail conversation. Finally, steering documents that describe owner's directives and political ambitions for the three municipal housing companies were studied.

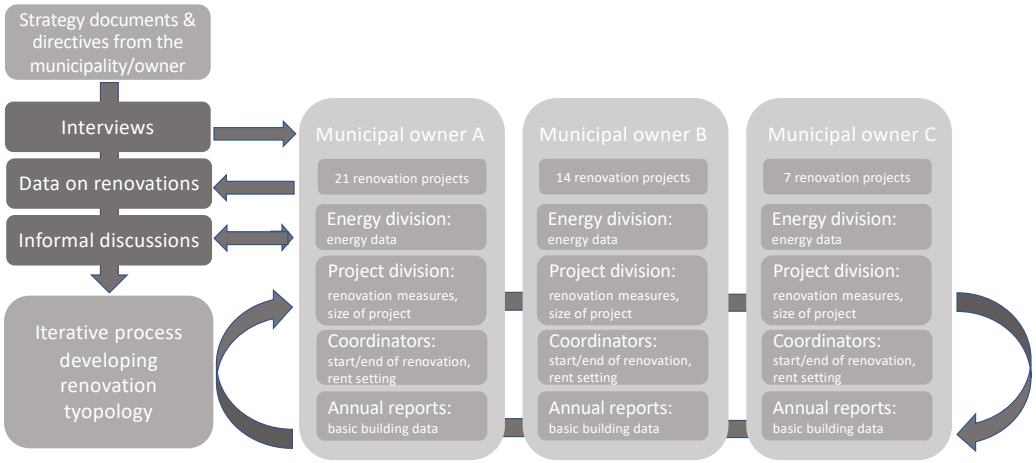

Figure 1: Schematic figure of the data sources and process for developing the renovation typology

4. Results

In the following short descriptions are given of influencing factors for the renovation strategies chosen by the studied property owners, followed by a typology of renovation using data from the 42 projects.

4.1. Political directives dictating careful renovation

The politically led corporate group, to which all three housing companies belong, have dictated a guideline called carful*"varsam"* renovation (updated in April 2022[16]. The guideline is based on owner's directives, steering documents, and business plans and highlights economic, environmental, and social dimensions. From an economic perspective the guideline should assure the long-term economic value of the property, and from an environmental perspective the reuse of materials instead of using new materials is highlighted. From the social perspective, the goal is that no tenant should have to relocate because of renovation.

According to the Swedish model, "bruksvärdesmetoden", rents are set in a negotiation between the Swedish Tenants' Association and the property owner, and in relation to the level of standard compared to similar apartments[17]. Rents can be raised if there is an improvement of the standard (e.g. replaced

bathroom or kitchens), while costs for normal maintenance (e.g. renovated/replaced plumbing or facade) cannot be transferred onto the rents. To reach social objectives, the guideline for careful renovation states that about 50% of the apartments should be renovated *"with a minimum improvement of the standard",* that will assure the long-term technical function of the building and the lowest possibly acceptable economic return of investment, at the same time as *"the rent is not altered more than necessary"*. The guideline does not dictate if the 50% should be achieved on a building, neighbourhood, or company level. A previous version of the guideline said that 20% of apartments were to be renovated with no raise of the standard, something which was found difficult to achieve technically and withstanding the economy of the renovations.

4.2. Renovation strategies

The three companies in the study have somewhat different ways of working with renovation, depending on their portfolio of buildings, previous experience of renovation and their economy. After some renovation waves in the 1970s until 1990s, related to the oil crises and governmental subsidies, there has been less activity and the companies now explore sustainable strategies for renovation.

The companies all have broad portfolios with housing but with varied profiles regarding age groups of stock. One of them, here called Company A, has a larger stock of housing from the 1950s. They are currently attending to plumbing in the 1950s areas and have the challenge ahead to renovate the large-scale housing areas from the 1960s and 70s. Company A have a philosophy of *"doing what we have to, not too much and not too little"*. Their strategy is to renovate stepwise and to avoid evacuation of tenants which is expensive. First, they do the plumbing and bathrooms, with the plan of doing climate envelope later, or the other way around depending on the urgency. Company A think that housing areas from the 1960s and 70s will need more extensive and comprehensive renovations than those from the 1950s.

Company B has a special stock of wooden structure working class housing from the late 19th and early 20th centuries, but also post-wars stocks. They have recently carried out a few extensive renovations in housing from both the 1950s and 1960s/70s. Their experience is that these have reached good results in terms of energy saving and prolonging the service life of the buildings but to very high costs. In on-going projects, they apply a step-wise approach where they separate external and internal renovation spread out over time, also with a focus on avoiding high rent increases.

Company C is the one of the three that has most experience of recent renovations. They have carried out some DR with high energy savings ten years ago. They previously advocated all-at-once renovation but has recently also adopted a stepwise approach. The business manager says: *"We now think that we will come back on several occasions".* In all-at-once renovations tenants need to be evacuated which is related to loss of rent income but also to the availability of temporal apartments for the tenants.

4.3. Energy efficiency and renovation

The companies have projects division for the planning of renovation and another for energy questions. Energy efficiency projects in existing housing is focused on *profitable* measures such as adjustments of existing heating and ventilation systems, installation of low-flushing shower and water taps, and the insulation of attics. In Sweden, most existing housing have hot-water and heating including in the rent. At present, individual metering systems (IM) are installed for tenants to pay for the use of hot water. For the mother company, profitable measures represented almost 10% of the energy efficiency for 2020.

Renovation projects can lead to energy efficiency even though this is not the main objective for most renovations. These energy savings are called *"even so"* measures. They will be a positive side effect of a renovation that needs to be done of other reasons. "Even so" measures are for example the replacement of windows, façade renovations, and the installation of heat recovery double flux ventilation. These measures represented about 7% of the total energy efficiency of the mother company 2020.

4.4. How tenants are handled

According to the Swedish Rent Act, each tenant needs to consent to standard improvements in their own apartment, and 50% of the tenants need to consent to improvements in common areas for the property

owners to be able to raise the rent. The Swedish Tenants' Association (STA) provides guidelines for the consultation process with tenants and together with the organisations The Swedish Property Owners, and Public Housing Sweden they have developed a common agreement template between owners and tenants. STA has pushed for a consultation process where the tenants are informed early on that a renovation is planned before details about the renovation measures have been defined.

To limit rent increases, the three municipal companies provide their tenants with a choice of level of internal renovation and standard improvements, called mini, midi, and maxi. Typically, the levels refer to a package of renovation or replacement of kitchen, and the use of PVC flooring instead of tiles in bathrooms. In more extensive renovations, it might be necessary to replace instead of renovating.

In the case of evacuation, the tenants are offered help to find a temporary dwellings and support to relocate. When an evacuation is not need, those who work shift, elderly and people with disabilities can still be offered help with a temporal relocation. If a tenant chose a maxi level of standard improvement a evacuation might be necessary as the kitchen and bathroom will be inaccessible for a longer period. In the case of bathroom renovation, temporal solutions are offered for WC and showers outside the apartment. For elderly, and others with disabilities, a compost toilet can also be installed in the dwelling. Reductions of the rent is usually provided for disturbances, temporary inaccessibility of parts of the home, and economic support for cost in relation to an evacuation.

If a renovation leads to higher rent increases, a step wise increase of the rent is usually employed for remaining tenants, while those who move in after the renovation must pay the new increased rent levels. The rent is typically increased during a period between four and up to eight years.

4.5. Defining three levels of renovation

A typology with three levels of renovation have been defined (Table 1). At an earlier stage of the research, the typology had five levels to distinguish smaller differences between level 2 and 3. In discussion with the housing companies the number of levels were reduced. There will always be differences between renovation projects also within the same level depending on for example previous renovations that can have been related to water leakages etc. Larger renovation projects are divided in phases, and the package of measure and even level of renovation can vary in the same project.

According to available data in official Energy Performance Certificates, EPC, the energy use in the studied properties is in average 140-145 kWh/m^2 and year for heated area, and in general energy class E to F. The lowest energy use pre-renovation lies at 90 kWh/m^2 and one projects reaches 321 kWh/m^2.

Table 1: Typology of levels of renovation based on the sample of 42 projects and 7000 apartments.

Level	Type of renovation	Typical measures	Example of tenant options	Evacuation of tenants	Disturbances for tenants	Rent increase	Energy savings
1	Climate envelope	Facade, windows, roof, balcony, at times outdoor environment	Glazed balconies	Tenants stay in apartment	1-2 days in apartment, scaffolding up to 1 year	Low: 1-20%	10-15% (only windows) up to 40% facade renovation
2	Bathroom/ plumbing	Bathroom, plumbing, at times electricity and/or ventilation system	New kitchen/ kitchen renovation	Generally tenants stay in apartment	6 to 12 weeks (ventilation 3 weeks)	Medium: ~12-30%	<1% low-flushing taps, IM ~2%, vent. ~1,5%
3	Renewal	Climate envelope, plumbing/bathroom, ventilation, outdoors, often combined with interior renovation	New kitchen/ kitchen renovation	Temporal relocation/ evacuation	Up to 12 months	High: 20-50%	40-50%

Level 1 in the typology is an exterior climate envelope renovation, normally window replacement that can be combined with façade renovation with additional insulation. There are potentials for medium to high energy savings. Other measures in this level can be the renewal of the outdoor areas and/or common facilities such as washing facilities or digital locking systems. The disturbance for tenants in the

apartment is limited to workers entering to seal windows, but scaffolding can be up for a long time. The rent increase is low and relates to improved comfort from draft and standard of common facilities.

Level 2 is the replacement of plumbing which often implies reconstruction of the bathroom. The disturbance for tenants is higher, and parts of the apartment can be disabled for up to three months. Measures are limited to interior renovation such as new electricity or ventilation. The energy savings are small, and rent increases are medium range depending on the standard level of the new bathroom, and tenants' option for example regarding the kitchen. Evacuation of tenants is avoided but can be necessary if for example infrastructure in the building, for example the electricity system, is connected between staircases and apartments, and consequently can't be switched of for individual apartments.

Level 3 is a comprehensive or deep renovation with both external and internal measures. In this case tenants needs to be evacuated for up to 12 months (Figure 2). The rents increase is high and so are the potential energy savings. One of the level 3 renovation where a new EPC has been carried out, reaches 74 kWh/m2 and year after renovation which is a reduction of about 50% to pre-renovation levels.

Figure 2a-c: Photos of Level 3 renovation, a) exterior and b) interior, kitchen pre renovation and c) during renovation. (Photos P. Femenias)

Figure 3 shows the number of apartments in the sample divided regarding year of construction and level of renovation. The largest number of apartments in the sample are renovated to level 2 (64%), followed by level 3 (16%). Level 1 (10%), climate envelope, are the smallest category. Two of the pre-war properties, 19th century buildings, were not possible to fit into typology. One of these is a basement reinforcement of an inner-city brick building, where also windows and the electric systems were replaced. The other is a wooden construction where some, but not all, apartments had fungus and had to be completely renovated. For one area built in the 1970s, the level of renovation is not decided as an agreement has not been reached with the tenants.

Finally, a calculation was made using the method employed by the study by a Swedish authority [15] mentioned in the section on previous research (see section 2.2) that identifies deep renovation as projects with a calculated value exceeding a reference set to 0,25. Only ten out of the 42 renovation projects have a value year different from the year of construction, which indicates that an investment, usually through a renovation has taken place. Some of these investments relates to previous renovations, and the value years is not a reliable indicator for detecting influence from a new renovation. New renovation might not be reflected in the value year due to delays in reporting.

Based on seven updated value years, which seems to be reliable with respect to the new intervention, it can be stated that Level 3 projects (four of these seven projects) have a value year equal to the renovation year (thus this indicates an investment above 70% investment of the investment in a comparable new building) and a calculated value of 1 according to the method used in the governmental

report. Three Level 2 renovations in the sample have the three different calculated values 0,37, 0,46 and 1 respectively even though they have seemingly similar renovation measures. Finally, one Level 1 renovation has the calculated value 0,8.

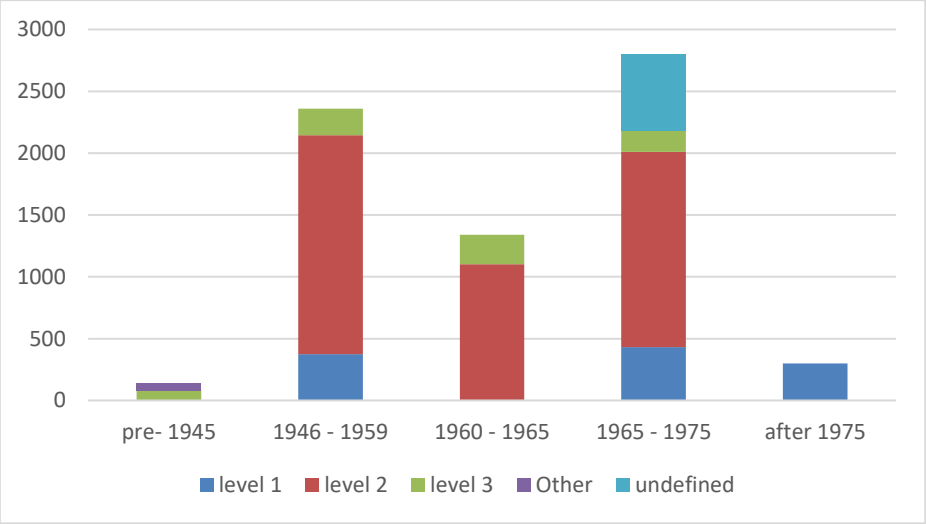

Figure 3: Number of apartments in the 42 renovation projects according to year of construction and defined level of renovation. Age groups distinguish pre-industrialised (~pre 1965) from industrialised (~after 1965). and high-rise large estates (~after 1960) compared to small scale areas of the 1950s.

5. Discussion and Conclusions

This paper provides insights in contemporary renovation strategies for multi-residential buildings used by three large municipal housing companies in one large Swedish metropolitan area. Together they own 92% of the public housing and 44% of the rental apartments in the city. The results of this paper might not be applicable to all regions and property owners; however, earlier research have shown tendencies of alignment regarding renovation strategies in different areas in Sweden as well as between public and private property owners [12, 13].

Findings confirm a previous observed trend among owners of multi-residential housing to move towards stepwise renovation over time instead of all-at once and DR solutions [12, 13]. What this study contributes with, in relation to earlier studies, is details on what is a typical housing renovation at present and the factors that influence the renovation strategies chosen by owners of multi-residential housing.

The studied companies' motivations for over time renovation, are to comply with local political directives (which is their owners' directives) to carry out *"careful renovation"* and avoid high rent increases. At the same time costly evacuations are avoided as well as the large investments related to DR. The local political ambition for careful renovation also encourages the reuse of existing material and consequently pushes for less extensive interventions.

The most common type of renovation found in this study, is plumbing and bathroom renovation which results in limited energy savings, and that can be understood as being motivated by technical needs in the housing stock. Another explanation could be that bathroom renovation lead to standard improvement and thus rent increases that provide income. Climate envelope renovation leads to less standard improvements, and consequently also costs that can be pushed over to the tenants through rents. With respect to social effects of renovation, over-time renovation results in lower rent increases than DR. However, rents will eventually raise when new renovations are carried out as part of the strategy.

As highlighted in earlier studies, energy savings is not a motivation for housing renovation [10, 11]. For the companies in this study, energy efficiency is decoupled from renovation and considered merely as a positive side effect (*"even so"*) from renovation, which is driven by other factors. This result

overturns the basis of earlier typologies of renovation, which take a starting point in the motivation for energy efficiency. The lack of motivation for energy efficiency in the renovation of multi-residential buildings will challenge national and European goals for energy efficient renovation. With respect to motivation for energy savings, the current energy crises might provoke a change but has not been captured in this study where data was collected in the summer and autumn of 2021.

Finally, there is a lack of correlation between the here proposed typology of housing renovations and previous studies that uses value year, an indicator for monetary investments, as a measure to define renovation. When using the value of 0,25 to define comprehensive or DR based on the value year, there is practically no difference between level 1, climate envelop renovation, level 2, plumbing and bathroom, and level 3, DR in the studied examples. This should be subject for further studies.

References

[1] 2010/31/EU. Directive 2010/31/EU of the European parliament and of the council of 19 May 2010 on the energy performance of buildings (recast). *Official Journal of the European Union*.
[2] Regeringen. Sveriges tredje nationella strategi för energieffektiviserande renovering, https://www.regeringen.se/495d4b/contentassets/b6499271ac374526b9aa6f5e944b0472/sveriges-tredje-nationella-strategi-for-energieffektiviserande-renovering.pdf (2020).
[3] Artola I, Rademaekers K, Williams R, et al. Boosting building renovation: What potential and value for Europe. *Study for the iTRE Committee, Commissioned by DG for Internal Policies Policy Department A* 2016; 72.
[4] EC. *A Renovation Wave for Europe - greening our buildings, creating jobs, improving lives COM/2020/662 final*. Brussels, 2020.
[5] Shnapp S, Sitjà R, Laustsen J. *What is Deep Renovation*. Technical Report, Global Building Performance Network, GBPN, 2013.
[6] Mangold M, Österbring M, Wallbaum H, et al. Socio-economic impact of renovation and energy retrofitting of the Gothenburg building stock. *Energy and Buildings* 2016; 123: 41–49.
[7] Jensen PA, Thuvander L, Femenías P, et al. Sustainable Building Renovation – Strategies and processes. *Construction Management and Economics*; Forthcomin.
[8] Bouzarovski S, Frankowski J, Tirado Herrero S. Low-Carbon Gentrification: When Climate Change Encounters Residential Displacement. *International Journal of Urban and Regional Research* 2018; 42: 845–863.
[9] Galimshina A, Moustapha M, Hollberg A, et al. What is the optimal robust environmental and cost-effective solution for building renovation? Not the usual one. *Energy and Buildings* 2021; 251: 111329.
[10] Thuvander L, Femenías P, Mjörnell K, et al. Unveiling the Process of Sustainable Renovation. *Sustainability*; 4. Epub ahead of print 2012. DOI: 10.3390/su4061188.
[11] Wahlström Å. GK. Not even close to the goals - A “snapshot” of Swedish property owners’ energy renovation plans. 588.
[12] Femenías P, Mjörnell K, Thuvander L. Rethinking deep renovation: The perspective of rental housing in Sweden. *Journal of Cleaner Production*; 195. Epub ahead of print 2018. DOI: 10.1016/j.jclepro.2017.12.282.
[13] Mjörnell K, Femenías P, Annadotter K. Renovation Strategies for Multi-Residential Buildings from the Record Years in Sweden—Profit-Driven or Socioeconomically Responsible? *Sustainability* 2019; 11: 6988.
[14] Serrano-Jiménez A, Femenías P, Thuvander L, et al. A multi-criteria decision support method towards selecting feasible and sustainable housing renovation strategies. *Journal of Cleaner Production* 2021; 278: 123588.
[15] Boverket. *Flyttmönster till följd av omfattande renoveringar*. Karlskrona, 2014.
[16] Framtiden. Revidering av riktlinje för varsam renovering.
[17] Lind H. The Effect of Rent Regulations and Contract Structure on Renovation: A Theoretical Analysis of the Swedish System. *Housing, Theory and Society* 2015; 32: 389–406.