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Social Acceptance for Energy Efficient Solutions in Renovation Processes †

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Abstract: The following paper shows the results of the ZenN European research project, in which the SSH-methodology has been implemented in order to collect information on user awareness, preferences, needs, behaviours and for energy efficient renovation solutions. Taking this into account, the barriers which limit opportunities for improvement of energy efficiency at the decision-making phase of regenerations and challenges encountered in practical parts of EE-renovation activities are characterized. The SSH analysis shows that the social barriers and challenges identified in the project were implied by insufficient knowledge or interest in the idea of energy-efficient buildings and high investment costs. Furthermore, several country-specific factors have been found, such as insufficient education and promotion activities, historical and cultural values of buildings which limit renovation opportunities etc.

Keywords: energy efficiency; Social Sciences and Humanities (SSH) analysis; EE-technologies; social acceptance

1. Introduction

Current economy is characterized by the transition to a low-carbon energy system and this trend can also be observed in the EU construction sector. It is clear that European countries offer good opportunities for implementing different renovation procedures [1]. Considering the age profile of buildings in the EU (35% of the EU's buildings are over 50 years old) and the slow replacement rates, the renovation potential of buildings in the EU is huge—up to 110 million buildings could be in need of renovation (based on the estimates that count 210 million buildings in the EU30) [2].

The low energy performance is easily visible in several European countries, among which Poland can be found [3]. Since most Polish dwellings were constructed before 1985, only very old energy performance requirements are met [4]. As the calculations prepared by National Energy Conservation Agency in Poland suggest, energy consumption can be reduced by 60% on average in multifamily buildings constructed before 1985 [5]. Although other examined countries (France, Spain, Sweden and Norway) have a greater capacity to meet criteria defined by the European Union, over 80% of the existing European building stock still has an Energy Performance Certificate rated C or worse [6–10] (all countries have been selected in accordance with the scope of ZenN project (Nearly Zero Energy Neighbourhoods funded by European Commission in the frame of Seventh Framework Programme, grant agreement No. 314363) which is a base for analysis presented in this article).

Although the number of advanced technological solutions aimed at improving energy efficiency in renovation processes increased in last years, energy consumption is often still above the targets stated in the EU documents [11]. One of the most important factors, which limit opportunities for popularizing the energy efficient solutions, is low social awareness and willingness to implement the new technologies in renovation processes [12,13]. It means that the transition to a low-carbon energy

system is not just a technical but also a societal problem, which is strongly connected with preferences of building owners and tenants. Bearing this fact in mind, it is necessary to highlight the importance of human factor in deep renovation processes in order to better understand customers' expectations, needs, habits and preferences [14–19]. On the other hand, introducing new products into the market requires an answer to the following questions (1) How to effectively deliver a solution to the customers taking into account the win-win approach in the value chain? (2) Are the end-users able to pay more for innovative green products and services?

To find the answers to these questions, a comprehensive and holistic Social Sciences and Humanities (SSH) analysis is needed [20]. The potential benefits of the SSH analysis are shown on the example of the ZenN project which takes social issues into account. This allows all interested parties to better plan and promote new innovative and sustainable solutions for more energy efficient renovations (EE-renovations), both in the frame of the project and in the domestic residential sectors.

2. Methodology

In general, three approaches are used for identification of barriers and opportunities related to solutions aimed at improvement of energy efficiency in buildings: technical viability, economic viability (i.e., rebound effect, mechanism designed to align investment incentives etc.) and social viability (i.e., behavioural economics, demography, social norms, reference bias). It is important to note, though, that aforementioned analytical approaches are not integrated with each other. As a result, many analytical tools consider technical and economic aspects but leave aside SSH aspects which are crucial for understanding the real opportunities for improvement of energy efficiency through implementing technological innovations. It leads to many paradoxes, which arise from low social awareness, exemplified by the fact that floor-based heating is more and more popular in passive houses while most households want to have carpets on the floors (which means that technology is not tailored to dominant social preferences and behaviours).

It means that social sciences can facilitate social learning process aimed at co-development of new technologies [22,23], including identification of the habitual, cultural or market barriers and opportunities. The core part of the SSH analysis is focused around the consumer rationality and aims at prediction of user preferences, needs and behaviours, social awareness and customer acceptance of EE-solutions planned for implementation during a renovation process.

The research activities can be implemented during the tests at pilot sites, as the best option is to base the SSH methodology on the real cases, providing manufacturers, building owners or tenants with detailed information on financial and environmental benefits resulting from a renovation process. As a result, social analysis can be carried out and specific recommendations in a realization phase can be formulated regarding the question: how the end users can exploit the new products or services? The research activities are also aimed at showing how the social awareness or readiness of people to invest money in EE-solutions can be improved. Thus, the SSH analysis can be used for finding the answer to the following question: how can we encourage people to be more energy efficient by means of project innovations?

The promising opportunities offered by the deep SSH analysis have been confirmed by research activities conducted in the frame of ZenN project in which social factors strictly related to the consumer rationality are perceived as crucial for successful promotion of EE-solutions and achieving market success in the EE-economy sector. The research steps have been implemented using qualitative research methods, such as workshops and semi-structured interviews with key stakeholders from Sweden, Spain, France, Poland and Norway [24]. This brought valuable results which were used not only for the purposes of the project. As the gathered data and detailed conclusions made are crucial for EE-renovations in general, they have been disseminated to the largest possible audience.

Key persons with a strong familiarity with the decision-making process or renovation process were identified in renovation projects and N = 35 in-depth qualitative interviews were conducted with them. Studies based on 2–8 non-nZEB renovation projects in each country (examined countries: France, Norway, Poland, Spain and Sweden) and on up to 5 nZEB renovation projects per country [24] (N-ZEB: Nearly Zero-Energy buildings: Renovation/construction that leads to a very high energy

performance of a given building. The nearly zero or very low amount of energy required should be covered to a very significant extent by energy from renewable energy sources (RES), including energy from RES produced on-site or nearby. It leads to more than 90% final energy saving, with an average total project cost of 580 euro/m^2 [25,26]).

3. Discussion and Results

The project addressed the problem in a broad sense, taking into account barriers at the decision-making phase of renovation that did not define high energy efficiency improvement goals, and challenges encountered in practical parts of renovations aimed at high energy efficiency ends [24]. With reference to the former, the social barriers identified were implied by insufficient knowledge or interest in the idea of energy-efficient buildings. It concerned both residents and building owners who often lack awareness and whose architectural aesthetics and culturally shaped values are not in line with energy-efficient solutions that have been proposed by different suppliers. High investment costs, too, are a very important barrier [24].

Concerning experimental and research results of the project, which are connected to challenges encountered when carrying out renovations with high energy-efficient goals, it is generally believed, that returns on investment from this kind of retrofitting are dubious [24]. This fact is problematic. On one hand it strongly influences people's attitudes towards the aforementioned processes, and on the other hand this problem is hardly vulnerable to incentives and not much dependent on culture. It can determine a behavioral component of an attitude which Eliot Aronson and others regard as the strongest one when it comes to influencing a person's behavior [21].

Nevertheless, regarding strictly societal aspects, it was concluded that one of the most important means to enhance residents' acceptance for advanced energy-efficient renovations is intensified communication and increased information about the renovations and their results. Importantly, these activities must be started at early stages of a process [24]. This is a sort of raising awareness, which is connected with a cognitive component of an attitude implied by what people know (or what they think they know) about a subject of their attitude [21]. This element can be addressed by awareness raising policies which might be a quite successful means of encouraging the society to the idea of energy efficiency.

ZenN project also examined country-specific societal challenges encountered when carrying out renovations with high goals referring to energy-efficient solutions in buildings. This analysis was based on the example of the selected European countries, namely, Sweden, Spain, France, Poland and Norway [24].

Swedish modernizations were hampered mainly by the fact that people treasure historical and cultural values of buildings [24] which is determined by a affective component of an attitude that referrers to emotions [21]. On the other hand, when tenants had to move to another place, deepen information and communication was recognized as crucial. However, in general, residents' concerns were identified at the initial phase of retrofitting and they were overcome by sufficient communication that was desired by residents. Also, a pilot project appeared to be a good idea in terms of promotion. Thus, the acceptance of the nZEB renovations by Swedes was very high. The project also concluded that especially those renovations, which did not need leaving apartments by tenants, required particularly deep consideration of impact on residents. The reason is the fact that enabling residents to stay at their places during renovations was identified as a very positive incentive [24]. In other words, it influenced a behavioral component of an attitude of the tenants which appeared to be decisive which is in accordance with the findings of Aronson and others [21]. On the other hand, it was recognized that some tenants did not return to the renovated dwellings because of variety of reasons, including an increased rent as well. However, it was not a common case due to the fact that increased rents are not a severe problem in Sweden, since Swedish law limits potential increases of rents. Furthermore, rents are often negotiated with help of Association for Tenants and justified increases are easy to accept for people [24].

Spanish case studies revealed that main social challenge is an engagement of building owners, i.e., main decision makers when it comes to starting particular energetic renovations. The reason is

the fact that the owners often do not believe in a success of energetic regenerations. Moreover, individual perspective on energy systems overweigh the communitarian one [24], which represents an affective component of an attitude. This barrier could be overcome by such measures as, for example, pointing out to other values held by an owner—moral, aesthetic, etc. However, it would require tailored approach in the shape of arguments presented by a professional counselor, rather than a top-down policy. ZenN also identified a need for relocation as an important potential barrier. In Spain, though, a main barrier was involvement of building owners and increasing their awareness. According to ZenN's conclusions, such education should also encompass presenting benefits from energy-efficient renovation to owners, using data on payback periods as well as on reduction of bills [24].

Now, French tended to be resistant to change, and their approach was not really friendly to energy-efficient housing. Therefore, in France a key challenge is to inform and educate tenants before as well as after renovations [24].

Similar problems were identified in Norway, where there is a need for more follow-up communication with residents in order to strengthen their cooperation. Norwegian residents had no sufficient knowledge and awareness either. What is more, technical systems available in Norway are too complicated to be employed individually, while some owners tend to wish to install them without a professional support in order to reduce the costs. Another barriers are connected with cultural values and treasuring a historical heritage [24].

In Poland, financial problems could be recognized as societal barriers hampering conducting renovations. Moreover, residents' awareness was identified as very low which resulted in lack of demand for energy-efficient solutions. Also, education and promotion of energy efficient solutions is lacking in Poland [24].

4. Conclusions

The presented research project shows that without understanding the SSH phenomena it is difficult to predict individual responses to public policy interventions and to design more cost-effective and mass-scalable behavioural solutions to encourage renewable and sustainable energy use among consumers. Although the research activities have been carried out in order to verify a potential for renovation in particular buildings, the SSH-methodology lead to more general conclusions which have proved to be very useful for identification of barriers and opportunities within a broader national framework. Thanks to that, the national potential for implementation of innovative and sustainable EE-solutions has been described in detail from the social perspective, providing stakeholders not necessarily involved in ZenN with interesting conclusions that are complemented with technical and economic analysis.

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