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TITLE
Chances and barriers for passive house renovations

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CHANCES AND BARRIERS FOR PASSIVE HOUSE RENOVATIONS

There is significant potential for carbon reduction and energy saving in residential buildings. Various market actors are looking for ways to increase the uptake of passive house renovation and its certification.
This study aimed specifically to draw lessons from research projects towards the volume uptake of such renovations in the Flemish Region in Belgium. The empirical part of the study focused primarily on structuring currently perceived supply and demand side barriers and opportunities for introducing nearly zero-energy renovations for single-family houses. As a reflection, the consequences for the market uptake of passive house renovations are discussed.
The demand of homeowners for passive house renovations is still very low and only a limited number of frontrunners has experience supplying such renovations. The top three problems for market uptake of such housing renovation were detected as lack of knowledge, inefficient planning and construction processes and lack of quality assurance. Due to their limited competencies, knowledge or resources small companies do not really have an alternative but to collaborate with other actors.

1 Introduction: Passive house renovations

Europe's buildings are a large energy user, comprising 40% of final energy use and 36% of CO2 emissions in the EU (EC, 2003; Itard et al., 2008). In the Netherlands, the built environment currently accounts for approximately a third of the total primary energy use. According to Statistics Netherlands (CBS), most of this energy (largely of natural gas and electricity) is used for providing a comfortable indoor temperature and climate (heating, cooling and ventilation), producing hot water and operating electrical appliances.

As space heating dominates energy use in homes located in most European regions, the passive house concept has become a European wide accepted solution to reach a significant energy demand reduction in the built environment (PEP, 2008). In the past few years, passive house principles and components have been successfully introduced in the retrofitting of existing buildings. Depending on the building type, energy savings vary between 80 to 95% (e-retrofit-kit, 2008). The specific heating demand is

typically reduced from values between 150 and 280 kWh/m²a to less than 30 kWh/m²a. In some cases, the passive house standard for new buildings of 15 kWh/m²a is reached. As pilot projects in different countries demonstrate, these passive house retrofits are economically feasible for a range of building types (e-retrofit-kit, 2008). Achieving the Passive House Standard in refurbishments of existing buildings is not always a realistic goal though, due in large part to unavoidable thermal bridges in the existing structures. Certified renovations according to Passive House principles are therefore usually referred to by retrofitting to the EnerPHit Standard (see www.europhit.eu).

The aim of this paper is to provide an overview of the chances and barriers perceived for the market uptake of passive house renovations in Flanders.

2 Experiences from research projects In Belgium

The 'One-stop-shop' (2012) project investigated opportunities and barriers related to the market development of nearly zero-energy building (nZEB) renovations. A questionnaire led to the identification of various issues that contractors consider important regarding the stimulation of the nZEB single-family home (SFH) market. They indicated strong preference towards awareness rising of customers and companies (see Figure 1).

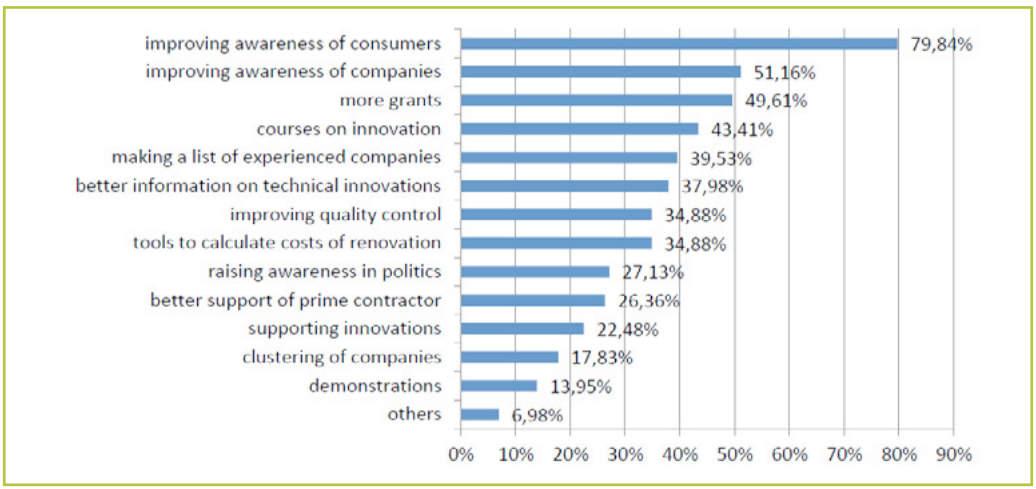

Figure 1: Answer to the question "What focus do you expect regarding the market development of integrated housing renovation?" (139 respondents/contractors; Belgium). Source: ERANET-ERACOBUILD One Stop Shop

The following issues were perceived as particularly problematic, requiring process solutions where better actor collaboration might play a role:

- Many traditional craftsmen are unfamiliar with the innovations
- Many craftsmen are not used to work together on whole building solutions
- Many craftsmen are involved, often resulting in problematic coordination on site which can result in lower quality
- Disturbance and required effort of the occupants and owners should be reduced

To overcome these barriers, an option was proposed to lift up the level of knowledge of the craftsmen. Also, the systemic use of innovative whole building concepts was found useful, since this can lead to well-coordinated renovation modules with fewer companies involved. A key observation in the project was that, in order to prepare for a growing market, companies must be aware that some customer segments expect one single point of contact to take responsibility, act as project manager, and ensure quality and efficient, rapid execution. Further results of this project can be found in Mlecnik (2012, 2013) and Mlecnik et al. (2012, 2013).

From 1 March 2014 the Flemish federation of architects (NAV), the Flemish contractor federations (VCB and Bouwunie) and the sector federation of consulting engineers (ORI) started a research project entitled 'Working in construction teams, an innovative process' (Werken in Bouwteams, een innovatief proces). This project is supported by the Flemish Agency for Innovation IWT and it aims to optimize construction processes by assembling various types of actors (clients, architects, engineers, key contractors) starting from the concept stage of a construction process. A stronger attention during the design phase is expected to streamline construction processes and to lead to reduced failure costs and better performance guarantees.

The 'construction team' concept is promoted in this project. The happy few who have experience with construction teams are enthusiastic about their own learning process and results. However, they also recognize that expectations from various types of actors can shift in such construction teams. For example, contractors need to do more than calculation and designers need to do more than design. Also, the juridical aspects of construction teams still need some development and construction teams for home renovation are still rare.

Various Belgian municipalities engage in offering advice on eco-construction to home-owners. For example, the city of Ghent introduced this in 2008 and was surprised by the interest in it: the local building sector could not respond to the demand, e.g. due to the lack of the required skills (EcoAP, 2012). The city of Antwerp does this as well and to cover the demand the city collaborates with two non-profit organisations, one specialized in ecological construction (VIBE vzw) and one in highly energy efficient construction (Passiefhuis-Platform vzw). Brussels Environment has developed a very successful programme for the promotion of sustainable construction in the Brussels Capital Region (Hermans et al., 2012). Architects collaborating in these projects assembled themselves in an informal structure to exchange experiences and knowledge. In the Flemish Region, Verdonck (2012) considered the main barrier to cooperation between firms and extra barriers were noted for small firms (Verdonck, 2012).

3 Further Research Results

3.1 Research approach

This study focused on structuring supply and demand side barriers and opportunities for introducing nearly zero-energy renovations for single-family houses. To understand the concerns of market actors main Flemish stakeholders from various disciplines were invited to discuss qualitative aspects in various working meetings, using focus groups and visual tools for developing businesses and quality assurance in the construction sector developed in the COHERENO project (www.cohereno.eu). These events were designed in such a way as to encourage input from all participants. The results were summarized by the moderators and reviewed by the participants.

3.2 First working meeting

A first international working meeting assembled general knowledge for the nZEB single-family owner-occupied housing renovation sector, which is characterized by small renovation works, laymen and micro, small and medium-sized enterprises.

The introducing presentations suggested that the marketing that works for social housing might not work for SFH and that both segments move at a different speed. It is still important in this phase to stick to 'fans' of nZEB renovation. Credible, tangible examples are still needed to convince home-owners. Quality assurance measures before and after renovation were considered important to gain customer confidence. Energy performance contracting was seen as a way forward.

During the discussions the attendees agreed that there is a need for independent parties (non-profit organizations, municipalities, and so on) in order to attract the home-owner to consider nZEB renovations. Plans are needed on a municipal level to work out concepts for the market. For example, in Antwerp, the municipality

offers home-owners free consultations with energy and sustainability advisors. Home-owners have to be facilitated to find the right companies.

Summarizing the results, the Flemish Building Confederation acknowledged that there are three important challenges: finance, quality and collaboration. The affordability of the renovation is a key issue that needs to be eliminated with good communication with banks, installing pay-back capacity and innovation financing. Considering quality issues, there are many labels which make the situation for the home-owner confusing. Regarding collaboration, clear plans are needed to share responsibilities and to determine financial liability of companies. It is important to involve frontrunners in a whole-system approach. The maintenance part is difficult to organize in the private sector.

Better quality assurance was acknowledged as a way to gain customer confidence. Peer-to-peer communication (for example Open House Days) and recommendation (for example a public list of 'recognized' professionals) between home-owners can be very helpful to develop processes for nZEB renovation.

3.3 Follow-up meetings

In the framework of the COHERENO project, a second (national) working meeting took place 6 February 2014 in Westerlo, Belgium. It was attended by about 20 people involved in construction works: contractors (majority of participants), researchers, architects. A third meeting was held with members of Passiefhuis-Platform (various types of companies) which took place 16 June 2014 in Mortsel and which focused on a detected key area of phased renovations.

The discussions went deeper into the topic of quality assurance and certification. Regarding the diagnosis/analysis phase of passive house renovations, the participants noticed that the most important barrier is the lack of sound independent energy advice as a starting point for planning renovation works. For the design/planning phase the participants were mainly concerned about flaws in the concept/plan of the architect and/or the plan. Targets were sometimes badly translated into technical specifications. Concerning execution of works, participants found important barriers to be inadequate product choice, not according to instructions or product guidelines, and lack of on-site coordination and cooperation between various parties involved. Regarding the specific topic of quality assurance, the participants were mainly keen to work in the future more on properly informing all actors in order to agree to deliver an aspired end result (on a trust/informal basis). Also the idea of a quality label for the advisor or the advice found resonance. Working according to codes for good practice was seen as important by the group. Yet, as one group member said, "codes are numerous, and professionals have to know them in the first place".

During these structured discussions similar concerns were expressed by various participants, although the main problem was considered to be insufficient knowledge

with the architect/advisors on practical issues. However, the feeling is that this is changing and that architects to date are navigating a transition phase (with respect to knowledge acquisition), attending courses and trainings. The knowledge of the actual contractor was also expressed to be a problem. For this problem education and training was agreed as the best and only solution by all group members. Knowledge has to be shared and spread, education has to encompass also learning about existing and new components in the market, and on-site experience – reckoned essential - has to be ensured for instance as part of training programs. Next to that, it appears working in teams or 'toolbox meetings' could enhance the learning effect. One participant added the possibility of developing and working according to checklists specific for renovation.
Also, concerns were expressed about how to inform home-owners and how to introduce energy monitoring. To solve this problem mandatory maintenance contracts and providing clients with maintenance protocols - so that they become involved - were discussed.
To address home-owners with financing difficulties, collaboration structures were proposed that address opportunities to show the costs and benefits of a step-by-step renovation and by offering administrative unburdening to apply for loans, grants and so on. In communication the added values (also non-energy benefits) and life cycle cost should be emphasized.

4 Discussion

The start-up of activities in nZEB SFH renovation is not always obvious for companies that don't have experience with passive houses. An important barrier on the supply side is that not many contractors have the proper knowledge to deliver such renovation or to guarantee profitable energy savings. These companies need to understand the necessity for collaboration, the customer values and the role of different actors in collaboration. Also, the companies need to develop their own good examples of demonstration projects to attract customers for nZEB SFH renovation. Collaboration with experienced professionals or consultants makes sense to attract the proper knowledge and to develop first projects. Collaboration between companies requires complementary service portfolios and compatible business cultures. Various types of professionals can collaborate in formal or informal structures: informing actors (for example non-profit organizations or municipalities), consulting actors (for example energy consultants, banks or insurance companies), contracting actors (these can be or not be executing actors), quality assuring actors (to gain customer confidence).

One actor has to take the lead and act as the 'reassuring' contact point for the home-owner, maintaining a permanent relationship. Stronger attention is needed in

order to attract customers, but at the same time advice and design is a service that somehow has to be paid for. From on-going developments, the importance of One Stop Shops and customer web portals, Open House Days and physical renovation stores, is expected to increase.

Similar barriers reappeared in all groups and were also related to construction phases. The top three problems for the market uptake of nZEB housing renovation relate to lack of knowledge, inefficient planning and construction processes and lack of quality assurance. Similar concerns were expressed, such as the lack of training and education of professionals, the attention needed in the design phase, and so on. Due to their limited competencies, knowledge or resources small companies do not really have an alternative but to collaborate with other actors.

It is important to gain customer confidence as an actor operating in the region of the home-owner and think in customer-oriented packages. The home-owner only tends to trust independent advice. Independent knowledge is needed which can be found by collaborating with competence networks and by involving independent/ experienced/certified advisers or offering labelled advice.

On the one hand, construction processes can be made more efficient by training all actors involved and regular checks. On the other hand, it is important to have a single trusted contact point for the home-owner; it can be recommended that this person fulfils specified goals (energy performance, timing, information transfer) and manages and coordinates the process. In each case, attention is needed for quality assurance and a performance-based approach, linked to sticks and carrots. The performances should be specified from the beginning and followed up with monitoring.

5 Conclusion

The research showed that – although frontrunners are capable to deliver quality assured passive house renovations – the market uptake for passive house renovation is hindered by various barriers. The supply side for passive house renovation is still suffering from a lack of knowledge, inefficient construction processes, insufficient quality assurance and communication difficulties with home-owners. While collaboration between supply-side actors is seen as a part of the solution to increase competitiveness, many SMEs are still largely unfamiliar with collaboration. The research showed that as the complexity of integrated renovation services increases, a shift in collaboration structures can be expected, likely towards quality assurance and performance contracting.

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