APPROACHES TOWARDS A SMART & SPEEDY IMPROVEMENT OF THE IN SERIES DEVELOPED POST WAR HOUSING STOCK

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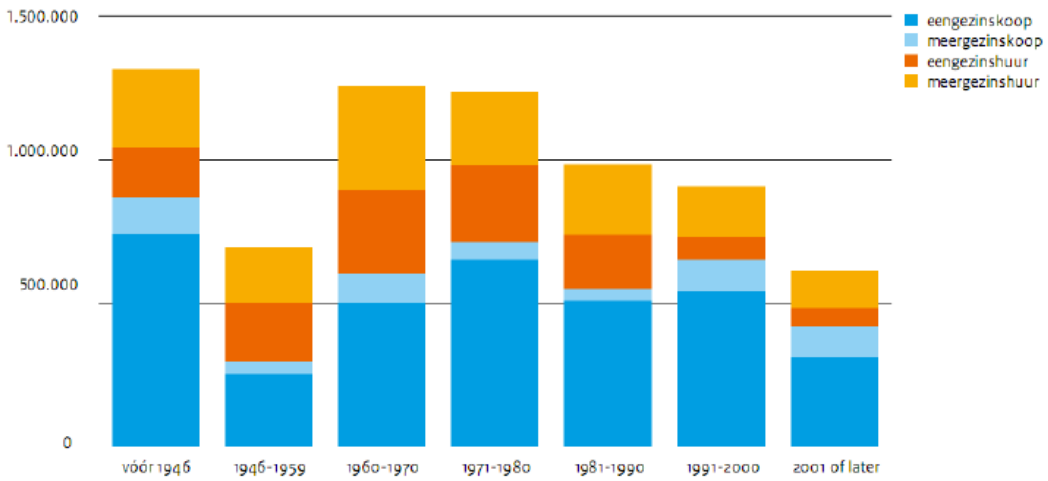
Abstract
One third of the current housing stock in The Netherlands dates from the sixties and seventies and a large part of these dwellings are fairly similar (because they were built in series). There is a high need for smart and speedy renovation methods, to improve technical, energy and cost efficiency of renovation projects as well as to limit inconveniences to residents. A considerable number of professionals in the Netherlands currently are making a combined effort to improve these methods and their implementation, in an initiative called Smart & Speedy ('Slim & Snel' in Dutch). This article describes this initiative, some results till now and an inspiring already realized renovation project that illustrates the goal of the Smart & Speedy approach.

The large part of all Dutch houses is built after World War II. Almost a third between 1960 and 1980 (VROM,2009b). The calculated economical lifespan of dwellings in the Netherlands is fifty years. However, in practice houses stand much longer. Even before the economic crisis in the Netherlands only 0,25% of existing homes were replaced every year. Based on this information existing houses are expected to last six to eight times their economic life span (Van Hal, 2008).

In general, the quality of these houses is very low as a result of the shortage of both building materials and experienced constructors in the years of their construction (Andeweg 2009). Also, due to the increase of welfare of the population and many technical developments the use of dwellings and the wishes regarding living quality have changed a lot (Vreeze, 2001). Improving these houses in a smart and speedy way to make them more attractive for today's residents, has already been an issue high on the agenda of the government, housing associations and other parties of the supply chain, for a long period of time.



Figuur 1: Samenstelling woningvoorraad (Blijie, 2009)

Figure 1: *Compilation of the housing stock (Blijie, 2009).*

THE IMPORTANCE OF A FOCUS ON ENERGY EFFICIENCY

In the Netherlands one third of the CO_2 emissions, amounting to over 60 million tons per year, is related to energy usage in buildings. 53% of this emission is caused by the housing stock (Ecofys 2005). The energy efficiency of homes built before 1975 is lower than realized in housing stock built more recently. To a large extent this is due to the fact that legislation on energy efficiency was only implemented after 1975. Before there were no norms that prescribed insulation and the installation of high yield condensation boilers. Due to the fact that many homes were built in the period between 1945 and 1970, a large part of the total housing stock has a relatively low quality in terms of energy efficiency.

For a long period of time most energy reducing initiatives were focused on new housing. However, as a result of the crisis of 2008-2011 in the Dutch construction industry the focus changed from new housing toward the existing housing stock. In a short time energy efficiency in the existing housing stock became a big issue (Nieboer, Van Hal , Dulski, 2011). Due to the rise of the energy prices the living costs of residents increase as well. Figure 2 shows that the energy costs have been doubled since 2000.

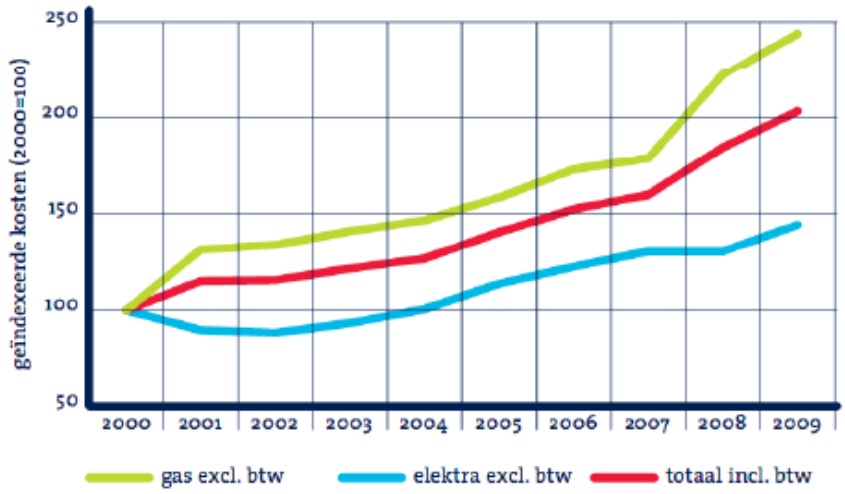


Figure 2: *Developments for energy costs of households since 2000 in the (Luijten, 2010).*

SOCIAL HOUSING

The Netherlands is unique because of the large percentage of social housing: 32 percent (between 2.2 and 2.3 million homes) of the total housing stock. With over 4.1 million homes the owner-occupied dwellings cover 55.9% of the total housing stock in the Netherlands (CBS, 2010). Over the past five years there has been a shift towards the owner-occupied market (CBS, 2010). Virtually all social housing (more than 99 percent) is procured and managed by social housing associations, which are private organizations operating under a range of public regulations that aim to ensure that a number of social tasks, such as housing lower-income households, are fulfilled. Large housing associations manage over 100,000 houses, whereas the majority of the housing associations manage less than 5,000, making the operational scope and influence of housing associations wide ranging. The remaining half percent of the social housing stock is owned by municipalities (Nieboer, Van Hal , Dulski, 2011).

Housing associations in the Netherlands are taking the energy challenge seriously. They signed an ambitious agreement with the government in which they promised to lower the energy use of their housing stock within a short period of time. The agreement was signed by the national association of housing associations AEDES.

It is the aim of the Smart & Speedy initiative to improve the large part of the housing stock built in series. To make an effective start on a broad scale the project is (at least initially) primarily focused on dwellings owned by housing associations.

THE CONCEPT OF THE SMART & SPEEDY PROJECT

Several parties have been approaching building and construction differently for quite some time. For these relatively small parties, it is difficult to really make a difference in the field. Housing associations, looking for suppliers and constructors, are cautious and often do not dare to opt for a new party on the market, especially not when that party operates differently to the usual. Often, after a long period of preparation and many meetings, they still chose a traditional party.

By joining forces and operating on a large scale, the project Smart & Speedy wants to bring movement to this static situation. The aim is to obtain concepts for serially built housing of the sixties and seventies that may reduce energy use by at least 45% at an affordable rate and without much hinder for the residents. One of the conditions is that the residents will not need to leave their house for longer than five days, whilst the preference goes to avoiding necessary vacation entirely.

The project consists of several elements that intertwine; a network, a field program and an extensive research program. Members from the construction chain that are involved with the sustainability of housing of the sixties and seventies, but also financial experts and parties from the energy field, work together in this network. Currently more than 20 companies are involved. The network members pay a fee per year for three years and thus create a joint capital that enables oriented research and the development of activities.

The network is involved on many fronts, for example as sounding board for the field segment of Smart & Speedy. This part is financed by the government and is part of the Energy Jump Program (EnergieSprong) of the SEV (Stuurgroep Experimenten Volkshuisvesting). Through field experiments the SEV aims to greatly increase energy reduction in the built environment. In the field program, Smart & Speedy realizes four projects, each with a minimum of 400 houses. These projects will start within a year and be completed within 3 years, but more importantly, will create concepts that may be repeatedly applied to comparable housing in other parts of the country.

The field program is experimental in the sense that in a totally new manner, consortia of rivaling market parties, in cooperation with the (coalition of) awarding corporations, develop supply ánd demand. Currently housing associations are approached and requested to take part and soon the search for supplying consortia will also start. They will be challenged so that they do not come forward with a solution that consists of piling measures such as double glazing and extra insulation, but with an integrated concept that may be applied to a large part of the housing of the sixties and seventies. The SEV provides an intensive process management to ensure these solutions become reality.

Of course, realizing these ambitions in the field is not just a technical issue. On the contrary. Besides the conservative reaction of awarding authorities already mentioned, there are more reasons that prevent ambitious plans from becoming reality. Therefore, preliminary to the field program, an extensive research was started with the aim to chart all possible opportunities and obstacles. Each opportunity and obstacle is displayed as a knob that may be turned, resulting in a concept with the working title ‘the control panel’. Who and when should turn which knob which way, differs per situation. These situations are charted as scenarios. During the program the results will be calibrated yearly.

Finally, three institutes of knowledge are connected to Smart & Speedy; Nyenrode Business University , Delft University of Technology (TUD) and Hogeschool Utrecht (University of applied sciences Utrecht). It is intended that a PhD candidate will monitor the whole project. Graduation students will focus on parts of the project.

BOTTLENECKS AND OPPORTUNITIES

The willingness of housing associations to invest in energy reduction used to be low. The interest among housing associations in the first years of the century was limited because of

low demand from residents and expected high costs of energy reducing measures. The introduction of the energy labels in 2008 may have changed the picture. Van Hal et al (2009) conducted an explorative study to see if this supposition is right. They made an inventory of the potential financial benefits of energy reducing investments, resulting or not in a higher energy label. They also conducted a survey of 15 housing associations to assess the impact of these benefits on the willingness of housing associations to invest in energy reduction.

The survey about the willingness of housing associations showed that they agree upon the urgency of the matter: energy reduction is necessary and is a task for housing associations. Compared with the first part of the decade the opinion of housing associations changed.

Van Hal et al conclude that housing associations are willing to invest in energy reduction. However, there are three obstacles for housing associations to do so:

- the 'split incentive' problem. When housing associations invest in energy reduction, they have to carry the load of the investment, the costs. The benefits - lower energy costs and more comfort - land with the residents. (When the majority of the residents do not agree with the investments they do not have to pay a higher rent (see below).) The split incentive problem is also related to the problem that the energy performance has a relatively small weight in the Dutch rent setting system.
- the diverging development of rents and energy costs. The energy costs are growing much faster than rents and are not leveled off by the housing allowance.
- the requirement that 70% of the tenants of an estate have to agree with investments and corresponding rent increase. If they do not agree the investments are possible but the increase in rent cannot be enforced.

Several housing associations tried, in creative ways, to avoid these obstacles. For example by starting an energy company, by investing in a long turn relationship with their tenants (tenants do support the initiatives of a housing association more easily if the relation is based on trust), by investing without a rent increase (in those cases the rent will only be raised after moving of the tenants) and several other initiatives. However; a definitive solution has not bene found yet. There are still a number of obstacles to remove to reach the goal of an energy efficient housing stock (Flier, v.d. and Van Hal, 2010).

Recent discussion amongst the members of the network Smart & Speedy show the same results. In this network one of the main concerns is related with the willingness of residents to cooperate and pay the raise of rent that goes with the energy efficient retrofitting. For years there have been attempts to get Dutch citizens enthusiastic to invest in improving the energy efficiency of their homes. Looking back, one can only conclude that the results are disappointing this far. A lot of money has been invested in information campaigns and specific motivational programs, but the overall results are minimal. Herein the Dutch are not unique. The American environmental psychologist Dough McKenzie-Mohr already stated in 1999 the example of an electricity company in California in his book 'Fostering Sustainable behavior'. This company had spent more money on advertising about the benefits of an energy-saving system in a specific type of dwelling, than the costs would have been had they implemented the system in the dwellings for free. In the Netherlands there are no official figures in this field, but it is not inconceivable that a comparable situation sometimes arises here.

An important cause seems the fact that too little is learned from earlier experiences. It is difficult to find projects whose effects have been analysed on the basis of a thorough benchmark and a final study. Developers of campaigns just do 'what seems sensible'. Partly due to this, project descriptions from years ago show strikingly few differences with descriptions of present projects, despite the fact that they were not successful. Another reason for the repeated mistakes seems to be the fact the main focus with the startup and realization of Dutch motivation campaigns often stays limited to the technique and financial consequences. Knowledge of the behavior of the target groups (fields of study such as psychology, sociology, behavior-economy and marketing) was usually not considered (Boerbooms, Diepenmaat, Van Hal, Kansrijke aanpakken, 2010).
The Smart & Speedy initiative shows the following elements to be of great importance too:

- The ratio of sold and rented houses
- The specific circumstances of the renovation project (kind of neighborhood, technical condition, etc..)
- Energy prices
- Public opinion regarding sustainability topics
- Policy of the national government
- European regulation
- Employment rate in the building industry
- Pull or Push market
- Market demand
- Vision of the construction industry on cooperation (willingness to cooperate)

Research carried out for the Smart & Speedy initiative has resulted in determining the following main focuses for action: cost reduction, meeting the needs of the residents, increasing the interests of housing associations, improvement of the position of the supply side, optimization of the effectiveness of governmental influences, development and optimization of effective technology, improvement of cooperation, a focus on the neighborhood scale too, and improvement of communication.

PROMISING APPROACH: THE CASE OF ROOSENDAAL

In neighborhood the Kroeven in Roosendaal 264 dwellings are being renovated in a way that can be described as smart and speedy. The project is realized according to the 'passive house' principle. This project is unique because in the Netherlands traditional rental terraced houses are never renovated to passive house level on this scale. Furthermore, besides the high energy ambition, the project is spectacular as the whole renovation is realized in occupied state, for which a relative fast realization and rigid planning are necessary.
In conjunction with the residents' committee, the choice was made to renovate to passive-house level as a response to the fast rising energy prices. Since the first plan to renovate these houses normal maintenance had been put off. Unfortunately, it had taken years before the project was started. This diminished the residents' trust in the housing association, making it difficult to get the required 70% approval. In the end, the necessary approval was obtained by a guarantee for the coming five years that the rent increase will be compensated by the decrease in energy costs.

In the passive-house concept, optimal insulation is used in combination with the sealing of chinks causing the dwelling to have a maximal heat demand of 25 kWh/m^2 (against 65 kWh/m^2 for a newly built dwelling). In this project, this leads to a decrease in average use of natural gas from 2500 m^3 to 700 m^3. The energy label of the houses improves from an F/G label to A++. Two approaches are used for the renovation of the houses. The first 110 dwellings are renovated in a more traditional way on the outside as well as on the inside. The installation systems needed for a passive house are installed separately. The other approach makes use of prefab elements and one integrated passive house heating and ventilation system.

The second approach, with prefab elements, leads to higher quality, shorter construction time, no delays and less complaints of inconvenience. In this renovation method the outer cavity wall is removed first. Next, the ground floor is insulated. On the fifth day the door frame, the window frames and the roof are removed and replaced with new prefab façade and roof elements. These elements are already provided with windows and a solar boiler. The total renovation takes no more than fifteen days. The tenants are given the option to include an internal renovation of their dwelling. If the kitchen or bathroom are old, they can be replaced during the renovation. Additionally, the residents can choose convenience improvements, like a larger bathroom or a luxurious kitchen, in exchange for a rent increase.

In spite of the improvement in quality and the short turnaround, the reactions of the residents are not always favorable. At the start of the project, some of the tenants are dissatisfied when they do not qualify for a free new kitchen or bathroom, when others do. During the renovation there are complaints about the workmen working inside the house, not tied to any specific job. The renovation is a large infringement of the residents' privacy.

However, there is a different between the two renovation approaches. The approach with the prefab elements takes no more than fifteen days. This seems to be the maximum amount of time people can bear with this inconvenience. The more traditional approach takes four to five weeks. This causes a lot more complaints about the duration of the renovation. When the renovation is done, the residents are not always satisfied with their 'new' dwelling. They have to get used to using new heating strategies and to the lingering warmth. Some complain that the dwelling is too warm and there is some distrust of the new (mechanical) ventilation system regarding the indoor air quality.

CONCLUSIONS

There is a great urgency to refurbish the existing serial built housing stock in a smart, speedy and energy efficient way. New approaches, strategies and more extensive implementation are necessary which ask for a combined effort of stakeholders. Bottlenecks to realize these renovation projects in practice have to be tackled. Apart from speeding up technical and process innovation (and sharing knowledge) expanding the possibilities for financing energy efficient renovations is crucial. One of the main issues is to address the split incentive phenomena. To be able to do so, in the Netherlands also cooperation of residents is of major concern. One of the main bottlenecks is the lack of enthusiasm amongst residents. Meeting the needs of residents should be the number one concern of all parties involved.

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