The financial barrier to climate and comfort renovations

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ABSTRACT

Due to financial constraints, part of the homeowners cannot finance (major) renovations. Empirical analyses show that most owners finance renovation projects with their own resources and carry them out step by step or distributed over time. Climate renovations are found not to be a priority for all owners; many owners want to upgrade their house primarily in terms of comfort, utilisation and subsequent resale value. In practice, energy renovations are often the result of non-energy related investments.

Based on these observations, we attempt to quantify the importance of the financial barrier to renovation policy on the basis of a synthetic database in which we assemble relevant characteristics of owners and houses in a representative manner. Our analysis shows that 40 to 51% of the current owners are not able to finance the climate renovations they are striving for. When comfort renovations are added to the climate renovations, 47 to 59% of the owners cannot finance this total renovation. Offering limited renovation subsidies will make little difference as a large part of these owners are more than € 50,000 short. The analysis shows that only households with an equivalent monthly income of € 3 000 or more can finance all necessary renovation costs.

A large proportion of the current owners have already invested in energy-saving measures such as roof insulation in the past. Many owners believe that their house is quite energy efficient or even future-proof. Regardless of their financing capacity, a large proportion of these owners have absolutely no desire to carry out renovation works with a very long payback period. Nevertheless, the success of renovation policy will depend on the decisions that millions of owners - with very different characteristics and preferences - will take in the coming years.

INTRODUCTION

Buildings in the EU are responsible for about 40% of energy consumption and 36% of CO2 emissions[1]. According to the European Commission, 75% of the building stock is energy inefficient, indicating a huge CO2 reduction potential. On the other hand, the Building Energy Performance Institute Europe states that 97% of the building stock is in need of renovation[2]. In addition, 75% of the current building stock is expected to continue to be used in 2050. An ambitious and pragmatic renovation strategy is essential to accelerate the transformation to a low carbon building stock.

This transformation is accompanied by various challenges. We do not know what combination of policy instruments can effectively provoke this radical transformation. What is the total social cost of this transformation and will the invoice be distributed in an acceptable way? In addition, each EU Member State has its own dynamics in terms of housing, construction and renovation, so that customisation is essential. But even optimal policy schemes can continue to face important barriers, such as financial constraints on (future) owners, excessively long payback periods for renovation investments, heterogeneous preferences and all kinds of information problems that prevent owners from renovating or aspiring to renovate.

Today, these barriers certainly have an impact on the degree of renovation, but by 2050 a large proportion of the houses will be sold to new owners, offering opportunities for transformation. In essence, the rate of income growth between today and 2050, as well as the evolution of policies on housing, spatial planning, urban transformation and (semi-) public infrastructure, will be particularly important to accelerate the rate of renovation.

The purpose of this publication is to explain the financial barriers to major renovation works from a perspective that takes into account analyses of the behaviour, preferences and strategy of current owners. We want to offer a pragmatic answer to the question of what proportion of the owners can finance a (major) renovation with their own savings and/or external capital (e.g. commercial loans). This share may be influenced in the future by all kinds of policy measures such as targeted subsidies. A brief overview of historical energy efficiency policies in the European Union shows that their impact has been rather limited so far.

A good renovation strategy takes into account the main barriers but also the macro-economic effects of the policy objectives. Economic analyses of renovation challenges pay a lot of attention to the renovation costs but often ignore their allocative impact at the macro level. If we are really going to thoroughly renovate a large proportion of our houses by 2050 - including the poorly located houses that cause high emissions through transportation - we will not be able to invest these resources in other economic sectors and activities with a high added value[3]. If investing in real estate makes a limited contribution to our economic productivity while other investments lead to higher productivity gains, the renovation policy may have a significant opportunity cost. A country's income level depends on economic productivity, so from a welfare point of view it is necessary to ensure an efficient allocation of investment resources[4]. From an economic point of view, there are strong indications that real estate bubbles lead to a misallocation of resources with a negative impact on overall productivity, partly because banks prefer simple mortgage loans to loans to innovative companies and start-ups. Innovative companies find it more difficult to find capital, which reduces their growth potential[5]. Countries differ, of course, and moreover, renovation policy can be used to tackle current market distortions. In case as a result of renovation policy the number of high-quality houses in the private rental market increases sharply in the long term, for example, this could increase the mobility of employees, generating significant economic benefits.

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[1] See (COM(2016) 0860)

[2] https://www.bpie.eu/publication/97-of-buildings-in-the-eu-need-to-be-upgraded/

[3] In De Tijd of 12/09/2020 the Dutchman Jitse Groen van Just Eat noted the following statement: 'Belgen bouwen huizen, Nederlanders starten een bedrijf'. Investing in real estate ensures economic growth and jobs for construction companies and their suppliers. Investing in new companies is risky. Many new companies go bankrupt, but every year a few new growth companies provide a huge social return..

[4] Restuccia, D. and Rogerson, R. (2017). The causes and costs of misallocations, Journal of Economic Perspectives 31(3), 151-174

[5] hakraborty, I. et al. (2018). Housing price booms and crowding-out effects in bank lending, Review of Financial Studies 31(7), 2806-2853

1/ POLICIES WORK BUT THEIR IMPACT REMAINS LIMITED

We know from analyses of historical energy efficiency policies in the EU that their short- and long-term impact, while positive, is rather limited. The sharp rise in oil prices prior to the 1973 price shock forced European countries to reflect on their external energy dependence. The European MURE database[6] classifies in detail about 2 000 energy saving measures taken by European Member States since 1970. Most of the measures focused on households: EU Member States introduced an average of 18 measures to reduce household energy consumption between 1975 and 2013. In a recent article in Energy Policy , Bertoldi and Mosconi pose the question whether all these energy-saving measures have also resulted in energy savings. Their dynamic panel model allows us to conclude that energy consumption in Europe will fall by 12% in 2013 as a result of all the measures taken since 1990[7]. In other words, without the measures, Europe's energy consumption would be have been 12% higher in 2013. This reduction does not imply a reduction in energy consumption in absolute terms; after all, the economy grew substantially after 1990 and the reduction ambitions of the efficiency policy are expressed in relation to the expected energy consumption in a reference scenario (e.g. based on the PRIMES model).

For Belgium, Bertoldi and Mosconi conclude that households consumed 6.2% less energy in 2013 thanks to the measures taken since 1990. The energy savings for the total Belgian economy in 2013 would be equal to 7.6%. On average taking a single energy saving measure resulted in a total energy saving of 0.17% in the short term and a saving of 0.35% in the long term. According to Bertoldi and Mosconi, three measures are needed to reduce energy consumption by 1%.

After 2013, the European Union tightened up its efficiency policy, but it is clear that the objectives can never be achieved by 2050 with the measures that had a rather limited impact in the past. This immediately raises the question of whether the measures taken are too weak in themselves or whether the existing barriers preventing renovations are far too strong. It is also possible that the majority of the measures taken will only have a noticeable impact over time.

The European Union has placed energy efficiency at the heart of European climate policy, especially after 2005. Nevertheless, the recent study by Ipsos Belgium and Navigant for the European Commission - *Comprehensive study of energy renovation activities and the uptake of nearly zero-energy buildings in the EU*[8] - concludes that the renovation rate in almost all EU Member States will continue to fluctuate around an insufficient 1% of the building stock after 2012. The more recent and ambitious European directives have not yet led to a break with the trend in renovation activity. The Energy Services Directive (ESD - 2006/32/EC[9]) introduced efficiency improvement targets of at least 9% by 2016 and led to national energy efficiency plans from 2008 onwards. The 2012 Energy Efficiency Directive (Directive 2012/27/EU[10]) introduced, among other things, access to energy audits, regulation to incite and reward energy efficiency, the target of energy renovation of 3% of the public buildings annually, information tools and the preparation of an ambitious long-term national renovation strategy. The latter was the predictable implementation of the decisions of the European Council in March 2007 to reduce the EU's primary energy consumption by 20% by 2020. In short, Europe has invested heavily in the development of policy, but the impact is taking longer than expected.

As the 2050 ambitions for the building stock are very challenging, it is useful to know which type of measures are proving most effective for the time being. From the MURE database Broin *et al* selected 250 energy efficiency measures aimed at private houses in 14 EU Member States for the period of 1990 to 2010. They distinguish between financial, regulatory and informative measures. Their analysis shows that technical regulation in particular[11] has a relatively predictable and positive impact in the 14 EU Member States. The impact of financial incentives and information tools appears to be smaller. The limited impact of historical policy could partly be explained by the choice for information and financial measures such as subsidies (rather than technical regulation).

In the case of technical regulation, however, we must take into account the so-called *energy performance gap* (EPG) or the difference between the actual and modelled consumption of a house. This difference arises from a complex and interacting mix of technical and behavioural differences between model and reality. From a technical point of view, for example, certain heating technologies are modelled in a highly simplified way and the entire house is seen as a single uniform heating zone. At the same time, an average consumer is assumed, while occupants of A and G houses each have different socio-economic characteristics and associated consumption patterns. Based on detailed data for 50,000 houses in Switzerland, Cozza et al obtained a median value of -11% for the EPG. The large group of houses with the B label turned out to consume 12% more than expected in practice (EPG +12%). For 'bad' G-labelled houses, on the other hand, the EPG is -40%. Houses with the worst labels turn out to consume much less than expected. Renovating these houses can lead to energy savings that are much lower than the modelled energy savings.

In practice, the total Swiss building stock appears to consume 6% less than predicted on the basis of technical modelling. The authors also include their findings in a review of Switzerland's climate ambitions by 2050 and conclude that very ambitious policies could increase the renovation rate to 2.2% per year, but that even then the actual energy consumption would be 7% higher than the modelled consumption of the future more efficient building stock. A greater focus on CO2 intensity per kWh of energy consumption may be part of the solution as houses with labels A and B in Switzerland have relatively low carbon heating compared to houses with worse labels. Houses with label B consume more energy than expected, however low-carbon additional consumption is highly preferable to high-carbon additional consumption.

These results for Switzerland are comparable to studies for countries such as the Netherlands and the United Kingdom. The quantified size of the EPG can also show that the methodology used to estimate energy consumption is not yet finalised. It is logical that this methodology should be systematically adapted and improved. However, we must bear in mind that the impact of implemented renovation efforts on the final energy consumption will always deviate from the modelled consumption. Especially the assumption that consumer behaviour would remain constant after a renovation is difficult because of the well-known rebound effects.

[6] https://www.odyssee-mure.eu/

[7] Bertoldi, P. and Mosconi, R. (2020). Do energy efficiency policies save energy? A new approach based on energy policy indicators (in the EU Member States), Energy Policy 139 (2020) 111320

[8] European Commission (2019). Comprehensive study of energy renovation activities and the uptake of nearly zero-energy buildings in the EU, https://ec.europa.eu/energy/sites/ener/files/documents/1_final_report.pdf

[9] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=-CELEX:32006L0032&from=EN

[10] https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32012L0027&from=EN

[11] For example, the E-peil and S-peil in the Belgian context.

2/ THE FIELD OF TENSION FOLLOWING THE FIRST RENOVATION WAVE

Although the impact of the current policies is lower than expected, we cannot conclude that we still have to start investing in energy saving measures. For example, the vast majority of Flemish houses already have insulating glass and roof or attic insulation today (see Table 1). Only 4.3% of houses in Flanders do not have insulating glass for their windows and doors. In only 13.6% of the houses, the roof or attic have not yet been insulated. These types of insulation are relatively easy to install. About half of the houses have some type of wall insulation and about one third have floor insulation.

We can expect additional but rather limited energy savings if the remaining houses (14 to 24%) are also provided with insulating glass and an insulated roof. Installing floor insulation, on the other hand, is very drastic and is only tackled in practice in the case of major energy renovations.

Table 1 - Insulation efforts in Flemish houses

	(ALMOST) EVERYWHERE	PARTIAL PRESENCE	ABSENT
INSULATING GLASS	86,2%	9,5%	4,3%
ROOF/LOFT INSULATION	76,5%	8%	13,6%
WALL INSULATION	49,3%	14,9%	35,9%
FLOOR INSULATION	33,4%	13,9%	52,7%

Source; VEA (2019). Verhogen van de renovatiegraad van bestaande woningen. Werkdocument 2019: Renovatiepact 2.0, September 2019, https://www.energiesparen.be/sites/default/files/atoms/files/Werkdocument%202019%20Renovatiepact%202.0.pdf

Despite the high percentages in Table 1, the scores of the Energy Performance Certificates (EPCs) show that today barely 5% of Flemish houses obtain the future-proof A label. The Flemish Energy Agency (VEA) therefore concludes that 95% of Flemish houses do not meet the 2050 objectives. In addition, only 7% of the existing houses receive a B label. Moreover, more than one third of existing houses built before the introduction of minimum energy performance requirements in 2006 still obtain the (very weak) F-label[12].

This overview indicates a large field of tension. Due to the great emphasis in the media on roof or attic insulation and insulating glass - supported by all kinds of (temporary) subsidies and tax incentives - a large proportion of current owners think that their house is already relatively energy-efficient or even future-proof . This is understandable because these owners have invested in the recent past and many have received subsidies for it. And yet 95% of houses - including just about all those that already have roof insulation and insulating glass, for example - still require considerable additional effort. A radical effort is certainly required for part of the building stock.

Moreover, this tension is fed by the law of diminishing returns. Table 1 shows that it is mainly the relatively inexpensive and less drastic renovation efforts that have already been made, as a result of which owners will be confronted with less attractive cost-effectiveness ratios and long payback periods in subsequent renovation phases. The recent SERV advice 'Elementen voor een gesublimeerd klimaat- en energiebeleid 2019-2024' concludes that an in-depth renovation of an average house pays back only in 38 to 64 years, depending on the evolution of CO_2 and energy prices[13]. When, in a terraced house with optimal façade and roof insulation as well as super-insulating glass, the owner decides to break out the floor to provide floor insulation, this results in limited additional energy savings with a very high reduction cost and an extremely long payback period. This last investment should not be made unless the floor was of course in need of replacement. There are therefore authors who fear that the law of decreasing returns could lead to a decrease in the renovation rate rather than an increase in the long term[14].

[12] https://www.axabank.be/nl/blog/vlaanderen-energiezuinig-bouwen-renoveren

[13] https://www.vlaanderen.be/publicaties/elementen-voor-een-gesublimeerd-klimaat-en-energiebeleid-2019-2024-advies-serv-met-achtergrondrapport

[14] European Commission (2019). Comprehensive study of energy renovation activities and the uptake of nearly zero-energy buildings in the EU, https://ec.europa.eu/energy/sites/ener/files/documents/1.final_report.pdf

3/ WHY AND WHEN DO HOMEOWNERS INVEST?

But what do owners themselves think of retrofitting, renovating or upgrading their property? The above-mentioned Comprehensive study of energy renovation activities and the uptake of nearly zero-energy buildings in the EU for the European Commission pays great attention to the decision-making process of homeowners who have carried out energy renovations in the recent past. To this end, the researchers contacted 30 118 owners, 18 302 of whom invested in an energy renovation. In addition, 1 581 architects and 2 009 construction companies were surveyed. The analysis shows that owners do not or hardly make their renovation decision dependent on energy scores or energy labels. Renovations are carried out in function of whether maintenance work is necessary, desired comfort improvements and, above all, as a result of the release of the necessary budgets. It also appears that 90% of the energetic renovations coincide with other works without any energetic finality. When a small old house is extended today, the client naturally opts for an energy-efficient extension.

The analysis in the same study of the triggers that have prompted Belgian households to undertake energy renovations - often in combination with non-energy renovations - shows that the release of the necessary budget is the most important factor. 21.1% of households claim that access to budget (savings, inheritance,...) led to the renovation. In practice, this means that many owners save specifically and often for quite a long time in order to be able to carry out a long-planned renovation. Owners who do not yet invest in an (energy) renovation, are saving in the meantime, but do not yet have the sufficient resources to start their intended projects. Another important trigger is the purchase of a new house: 14.8% of Belgian owners renovate immediately after purchasing a new house. These are owners who, after the purchase, have sufficient budget to start the renovation works. Another important trigger for rather small-scale renovations is the necessary maintenance of the house. Only 2.8% of investors started renovating because of poor energy performance (EPC)[15].

When energy renovations are often a side effect of other renovations or works on the house, the high payback time of individual renovation efforts suddenly becomes less problematic. After all, the owner invests to increase the comfort and utilisation of his or her house. As long as owners want to radically transform their house, they will automatically invest in energy renovations (regardless of the payback period).

The same study for the European Commission[16] also looks at the barriers faced by owners. 65% of owners feel that it is too difficult to quantify the costs and benefits of renovations. 78% said they did not want to take out a loan for the renovations, while 74% felt that the renovations were too expensive. 61% feel that the payback period - which is difficult to determine - may be too long. 65% state that the current regulations requires more than the owner himself deems appropriate. Of those who have carried out renovations, 72% appear to have self-financed these with their savings. Only 18% took out a commercial loan and 8% borrowed from family or friends.

The same study also shows that the European renovation market is strongly dominated by so-called step-by-step renovations in which - spread over time - limited energy savings are achieved in each renovation phase. The far-reaching or major 'one-off' energy renovations in which energy savings of up to 60% or more can be achieved through a single major investment represent only 0.2 - 0.3% of the built-up area each year. In Belgium, between 2012 and 2016, a total of 15.6% of the built-up area was renovated: for 7.8% of the area, the energy savings were negligible, while only in 0.2% of the cases an energy saving of more than 60% was achieved[17].

[15] [16] European Commission (2019). Comprehensive study of energy renovation activities and the uptake of nearly zero-energy buildings in the EU, https://ec.europa.eu/energy/sites/ener/files/documents/1_final_report.pdf

[17] For 6.5% of the renovated area the energy savings amounted to 3 to 30% and for 1% of the area the energy savings amounted to more than 30 but less than 60% (source: European Commission (2019)).

4/ READILY INVESTMENT IN EXTRA M²

In order to stimulate the renovation appetite, policymakers are thinking of combinations of information tools, subsidies, taxes and regulation (such as the renovation obligation when buying or selling an existing house). These instruments can certainly have an impact - in addition to a budgetary invoice - but part of the current renovation activity involves a particular dynamic that may even increase energy consumption in the long term. When determining policy objectives, the energy savings achieved are calculated on the basis of *static building* stock models, which assume that an existing house does not structurally change during the renovation process. This is a pragmatic assumption that is certainly relevant for relatively recent houses. If you buy a very good house, you will not immediately start to renovate it structurally.

Another story can be found in the most inefficient houses. In practice, these are relatively old and, above all, relatively small. In 1948, the average surface area of Belgian houses was 59 m². Thereafter, the average surface area increased significantly to 81 m² in 2001 and to around 130 m² today[18]. These figures should not be confused with the average surface area of newly built houses, which has been declining for a number of years due to the sharp rise in land prices. The above mentioned numbers measure the available surface area in the main building as included in the land register, excluding the infamous Flemish boroughs or extensions (whether or not placed with a permit). Anyone who today moves into a house built in 1948 will undoubtedly have much more than 59 m² of available space. According to Eurostat[19], Belgians live in a very large area (130 m²) compared to other Europeans. The average house in our country is about 30 m² larger than in the Eurozone countries. The average house in the Netherlands has 106 m² and French families live on average on 94 m². Belgian houses are both energy consuming and under-utilised.

Due to demographic dynamics, many relatively old and small houses are offered for sale. In combination with the preference for relatively large houses, small houses often undergo a transformation after purchase. The new owner of a small terraced house built in 1955, for example, merges a few small rooms on the ground floor into one large living space and invests in an extension of 35 m² for a spacious kitchen and convenient storage space. This extension typically replaces a series of existing extensions in different building styles and will be carried out today with great attention to energy efficiency. The construction increases the total surface area that is used and heated daily. This can increase the total energy consumption, even when the construction itself is very energy efficient[20]. There is still a clear positive relationship between surface area and energy consumption.

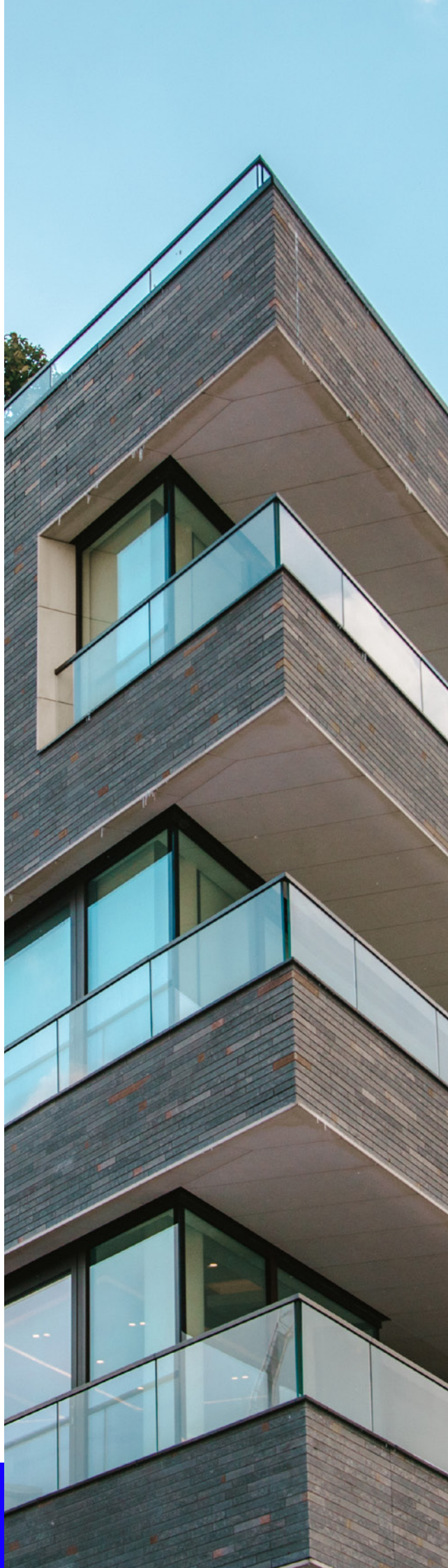
Figures on the number of houses whose surface area increases after renovation due to an extension or superstructure are not available. However, the increase in average surface area over time indicates a structural trend. According to some experts, 75% of the small, old houses is expected to also be extended during a major renovation. Incidentally, this is a very profitable investment for those with the necessary budget. The larger house offers more comfort and practical possibilities while also increasing the market value through efficient expansion. If the market value increases proportionally to the cost of the expansion, only the financing capacity counts; the construction is immediately recouped. The contrast with the efficiency of pure energy renovations is very high.

[18] SERV (2019). Climate and Energy Policy 2019-2024. Van Alfa tot Omega. Background report 24 June 2019

https://www.serv.be/sites/default/files/documenten/SERV_Raad_20190624_energierapport_alfa_omega_RAP.pdf

[19] https://ec.europa.eu/eurostat/statistics-explained/pdfscache/41898.pdf

[20] If the owner has a limited budget, it is quite possible that only investments will be made in the construction, while in the meantime the non-insulated facade and single glazing on the north side will not be tackled. Also the heating system from 1996 - on fuel oil - is not yet replaced because it still works well.



5/ HOW DO WE FIND OUT WHO CAN RENOVATE?

Upgrading 95% of the houses is only possible if all owners want to renovate and can also finance this work. It is very difficult, if not impossible, to identify the real intentions of all owners. In addition to the above-mentioned barriers in terms of complexity and payback times, many owners, for example, look up to the practical complications of a renovation. In the further analysis, we therefore assume that all owners wish to renovate and turn our attention to the question of what percentage of the current owners can finance the optimal renovation. In doing so, we must take into account the behavioural insights from the above-mentioned studies. In practice, for example, many owners seem to opt for a step-by-step approach in which the renovation work is spread over time according to the available budgets. In addition, many owners invest in non-energy renovations to increase comfort, utilisation or the overall quality of life. These renovations are not a side-effect of energy renovations, but just the opposite; many energy renovations are the result of non-energy investments.

Financing renovations with own resources requires a good insight into the distribution of assets and the capacity to save in the period to come. A radical transformation of the building park is theoretically feasible if the owners of the worst houses have sufficient financial resources – own savings and debt - so that comfort enhancing and major (energy) renovations can be carried out at the same time. In practice, the lesser performing houses are often bought by households with relatively low incomes that have little or no financial resources left after the purchase.

The observation that many owners do not currently finance the renovation work with commercial loans does not of course exclude that this will change in the future, for example in the event of a further fall in interest rates. For this reason, in what follows, we look at the capacity for renovation in the case of financing on the basis of savings but also on the basis of financing with savings and loans.

There are excellent publications on the estimated renovation costs for the Flemish building stock, on the segments within the housing market (with characteristics of both owners and houses), on the distribution of assets and on the behaviour of owners who have recently renovated. However, there is no single overarching study that compiles all the information for a large number of owners and houses in a single database. There is no database for property X that compares the necessary renovation costs to make it *future-proof* with the available financial assets, income and borrowing capacity of the current owner. If this database does exist, we simply selected all properties with a renovation cost lower than the available financial capital - possibly supplemented with commercial loans - of the owner. In this way, we know what proportion of owners can already renovate energetically today and contribute to the climate objectives by 2050. If this database also contains information about the owners' capacity to save in order to finance a renovation in the future, we can estimate per time period what proportion of owners will be able to renovate.

But there's no such database. That is why we make our own synthetic database based on the insights from the existing studies. In this database we combine realistic parameter values for fictitious but representative owners and houses. Using simulation tools, we sketch an image based on this database that should in principle be representative. This approach makes it possible, for example, to combine owner data from one study with asset data from another study. The wealth study of the European Central Bank (ECB 'HFCS III dataset'[21]) questions other households than those surveyed in, for example, *Wonen in Vlaanderen 2018* of the Policy Research Centre Housing[22].

If in the wealth study a household values its own house at €400,000, it does not mean that this house corresponds to the typical profile of a comparable house in other studies. By creating our own synthetic database on the basis of various studies, we are able to draw a plausible picture by means of many simulation runs based on the distributions of important parameters in the studies used. Each run combines different parameter values where the combinations must be consistent with the conclusions from existing studies or with the correlations we find in available (partial) databases.

Working with synthetic datasets has advantages and disadvantages. But studies based on roughly 2 000 households also have their limitations. Flanders has about 2.8 million households of which about 2 million own a house. Also, empirical analyses do not always check to what extent respondents' answers are correct. We also know that higher incomes are often under-represented in asset analyses or are not willing to provide all information.

[21] See https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html

[22] https://steunpuntwonen.be/Documenten_2016-2020/Onderzoek_Werkpakketten/WP_1_Nieuwe_woonsurvey_en_woningschouwing/WP1-2_TOELICHTING

6/ APPROACH AND ASSUMPTIONS

The renovation capacity for each property depends on the difference between the owner's available budget and the estimated necessary renovation budget to make it *future-proof*. The available budget consists of the current financial capital, possibly supplemented with commercial loans. In the synthetic database we collect technical parameters per house (age of the house, number of m², state of the house,...) and information on the owners (age, income, family situation, assets, mortgage debts,...). We extract this information from existing publications and databases, but the most important parameters such as renovation cost and financing capacity are not derived directly from external sources, but are rather endogenously calculated and allocated to households.

6.1 Renovation cost

Fortunately, there are excellent studies that make it possible to estimate renovation costs for each household in our synthetic dataset. The report *'Inschatting van de renovatiekosten om het Vlaamse woningpatrimonium aan te passen aan de woningkwaliteits- en energetische vereisten'*[23] of the Policy Research Centre Housing (2019) examines the cost price of adapting Flemish housing heritage to both the minimum requirements of the Flemish Housing Code and the 2050 energy objectives of the Renovation Pact. The defects are estimated on the basis of the internal screening of 5,000 Flemish houses in the Groot Woononderzoek 2013. The cost price of the partial renovations is based on approved quotations from renovation dossiers for social housing projects collected by the VMSW and is expressed, among other things, in surface area dependent m² prices over the various building sections. This approach has advantages but we have to take into account that for many houses the actual renovation invoice may differ from the invoice for the renovation of more large-scale social housing projects.

The analysis of the Policy Research Centre Housing shows that 57% of the houses need repairs, renovations or a total renovation in order to meet the minimum Flemish housing quality requirements. The average estimated renovation cost for these houses with defects is € 22,000 per house. As already mentioned, almost 95% of Flemish houses have to be renovated in order to meet the energy objectives of the Renovation Pact 2050. The average cost per house can be estimated at € 40,000 to € 43,000. Policy Research Centre Housing estimates the average renovation cost for both the housing quality and energy requirements at € 52,000 to € 55,000 per house, which represents a total investment cost of € 137 to € 145 billion.

Table 2 links the average renovation cost to the living area per decile. This shows that the average total renovation cost rises sharply for the larger houses. On the other hand, the cost of renovations for elimination of the housing quality defects only is fairly flat. This table can be used to predict the total renovation cost of a particular house with a living area of 150 m². But there are other options to predict the renovation cost. The study by Policy Research Centre Housing provides an overview of the renovation costs according to the socio-economic background of the residents, taking into account ownership status, household type, income and age. In addition, the renovation costs are broken down according to housing and spatial characteristics (construction period, type of housing and location). Other studies link the renovation cost to the 'condition of a house' and state that a renovation budget of € 200,000 should be provided for houses in 'very poor condition'.

Table 2 - Living space and average renovation cost

LIVING AREA DECILE	AVERAGE LIVING SURFACE (M²)	AVERAGE RENOVATION COST HOUSING QUALITY DEFECTS (€)	AVERAGE TOTAL RENOVATION COST (€)
1	81	21.000	35.000
2	107	21.000	40.000
3	125	18.000	44.000
4	143	19.000	48.000
5	159	22.000	52.000
6	175	20.000	50.000
7	194	18.000	54.000
8	219	18.000	58.000
9	251	22.000	62.000
10	336	31.000	81.000

source: Policy Research Centre Housing (2019) Inschatting van de renovatiekosten om het Vlaamse woningpatrimonium aan te passen aan de woningkwaliteits- en energetische vereisten, p.45

[23] https://steunpuntwonen.be/Documenten_2016-2020/Onderzoek_Ad_hoc_opdrachten/Ad_hoc_12_Inschatting_van_de_renovatiekosten/Ad_hoc_12_TOELICHTING

In the synthetic database we bundle information about owners, such as income, and housing characteristics, such as living space. We can estimate the renovation cost on the basis of m² (see Table 2), income, year of construction and the condition of the house. The results of these estimates based on the four dimensions may differ. To include representative renovation costs in the database, we opted to determine the renovation cost per household as the average value of the four predicted renovation costs (in the four dimensions). Suppose that the database combines the following characteristics of one household and one house;

- Surface decile: 8 -> renovation cost € 58,000 (see Table 2)
- Income decile: 6 -> renovation cost € 55,000
- Year of construction: 1991 - 2000 -> renovation cost € 46.000
- Condition of the house: Good -> renovation cost € 40.000

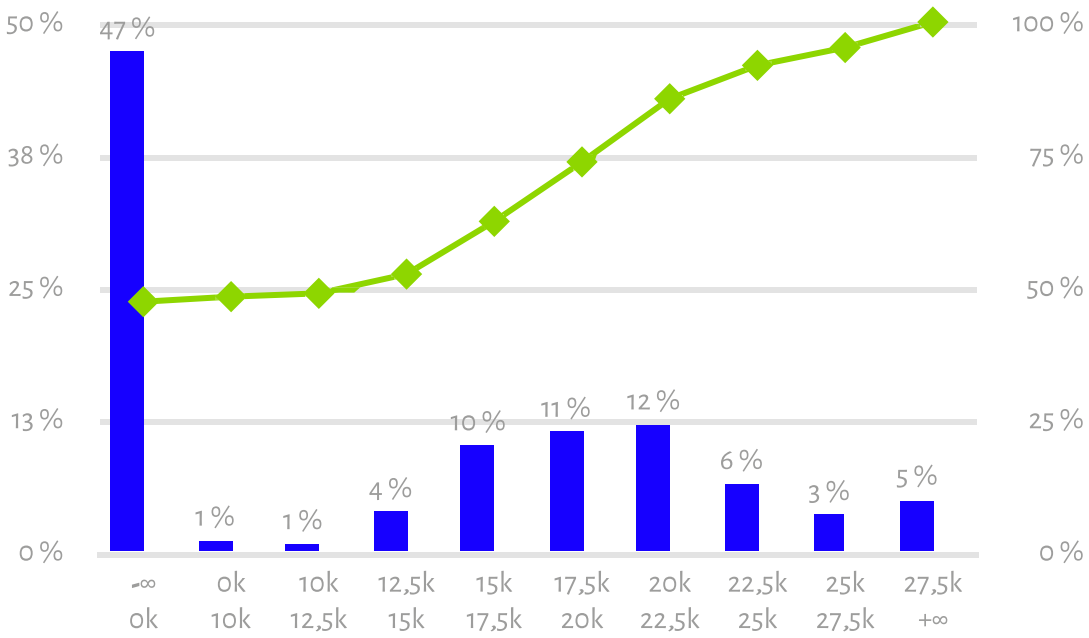
In this case we determine the total renovation cost of this house as the average of the four predicted renovation costs, i.e. € 49,750. This exercise has to be corrected for the houses that are already fully compliant today and therefore have no need to be renovated. 43% of the houses fully comply with the housing code and about 5% of the houses meet the 2050 climate ambitions. For some of the more recent houses occupied by relatively high incomes, we set the renovation cost in the synthetic database to zero. In this pragmatic way, we guarantee that the percentage of houses in the database that do not require renovation corresponds to the percentages from the Policy Research Centre Housing.

Based on this approach, we will have the model generate 10,000 synthetic households. For each household, we look at the four different predictions for renovation costs (each based on a different variable), and then take the average of these predictions. Figures 1a and 1b show respectively the renovation costs obtained to comply with the housing code and the 2050 climate ambitions. This shows that 47% of households have a renovation cost of € 0 for housing code renovations, which is in line with the conclusions of Policy Research Centre Housing (i.e. they do not have to carry out any renovation to fully comply with the housing code).

We also see that 8% of the owners are facing a renovation cost of € 0 for climate renovations. The deviation from the 5% of houses in the total population that no longer require any renovation to meet the 2050 climate standards is due to the omission of the oldest age category (+ 65 years) in our approach (see 6.2[24]).

When a house is renovated to bring it into line with the 2050 climate ambitions, all possible defects are simultaneously tackled during this energetic renovation so that the house also complies with the requirements of the housing code afterwards. From a regulatory perspective, this house is completely in order after renovation. After all, it would be odd to invest in a major (energy) renovation and not to tackle the known technical defects. In practice, the owner can always opt for additional works, even if the property complies with the housing code and climate ambitions (see below).

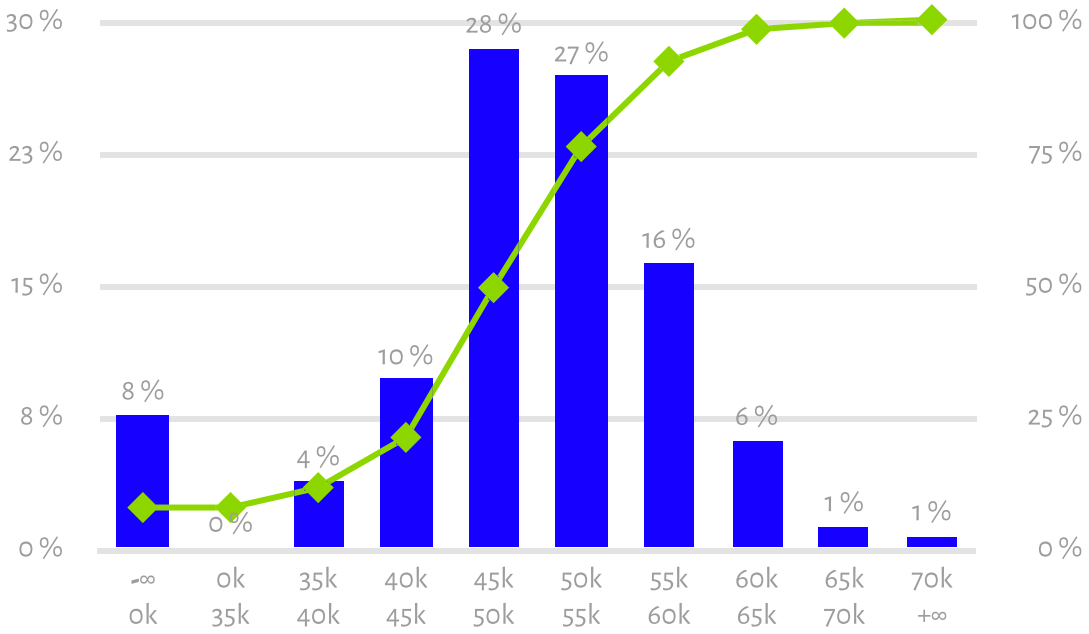
Figure 1a - Simulation of the distribution of renovation costs 'housing code'



[24] When this group is included in the analysis, 5% of all households have a '2050 renovation cost' equal to € 0.

Figure 1b shows that in our synthetic database about 55% of the owners are confronted with energy renovation costs ranging from € 45,000 to € 55,000. These values correspond well with the quoted average values from the renovation publication of the Policy Research Centre Housing. For about a quarter of the owners, the energy renovation cost exceeds € 55,000.

Figure 1b - Simulation of the distribution of renovation costs '2050 climate ambitions'



In the further results, we will first examine what proportion of the owners can finance these housing code and climate renovations. We then check whether these renovations do paint a complete picture of a more complex renovation reality. After all, most studies on renovation costs use a static perspective in which the house does not structurally change, expand or shrink as a result of the renovation. During some of the renovations, the house will be extended in practice. This is certainly the case for the relatively small and old houses that do not offer the comfort that is generally expected today. For the new owners of these small, old houses, an extension only offers advantages; the level of comfort, the functionality and the market price of the house increase.

Empirical work shows that in practice energy renovations are the result of other renovations. It is important that these other renovations such as an extension, an extension on the first floor or a spacious dormer window often have priority for the owner. In addition, many owners opt for pure comfort enhancements such as the installation of a new kitchen, bathroom, dressing room, new lighting technology and so on. These investments are often not the result of, for example, technical defects in the existing kitchen. The new owners may judge that the very outdated kitchen strongly detracts from their new living concept. This can be a sufficient reason for a replacement investment if the budget allows it. Other popular comfort investments are the placement of screens, blinds, curtains, etc. Finally, there is a large residual category of investments that may be important for owners but which in themselves have a limited impact on the comfort level. Typical examples are painting works and the construction of driveways and garden terraces. Anyone who beautifies a detached old house very neatly and makes it climate-neutral may also find it important that the broken driveway full of holes or the knocked down garden terrace at the back are also quickly future-proofed. For some of the owners, the 'total picture' must also be correct in due course. For obvious reasons, the invoice for a new driveway, for example, is not included in estimates of the renovation cost of the house, but can be very relevant for the owner. For this reason, we also include this type of investment under the so-called 'comfort investments[25]'.

Since the structural expansions of the house also provide more comfort, we use the term 'comfort investments' for all renovation efforts on top of the housing code obligations and climate ambitions. For a large proportion of the houses in the database, the average predicted renovation cost - previously limited to housing code and climate renovations - must be increased by the cost of these additional comfort renovations or comfort investments. In practice, there may be an important overlap between the housing code, climate and comfort renovations. A typical example of this is the replacement of an outdated and tiny bathroom with a larger wellness bathroom that is part of a very energy efficient extension.

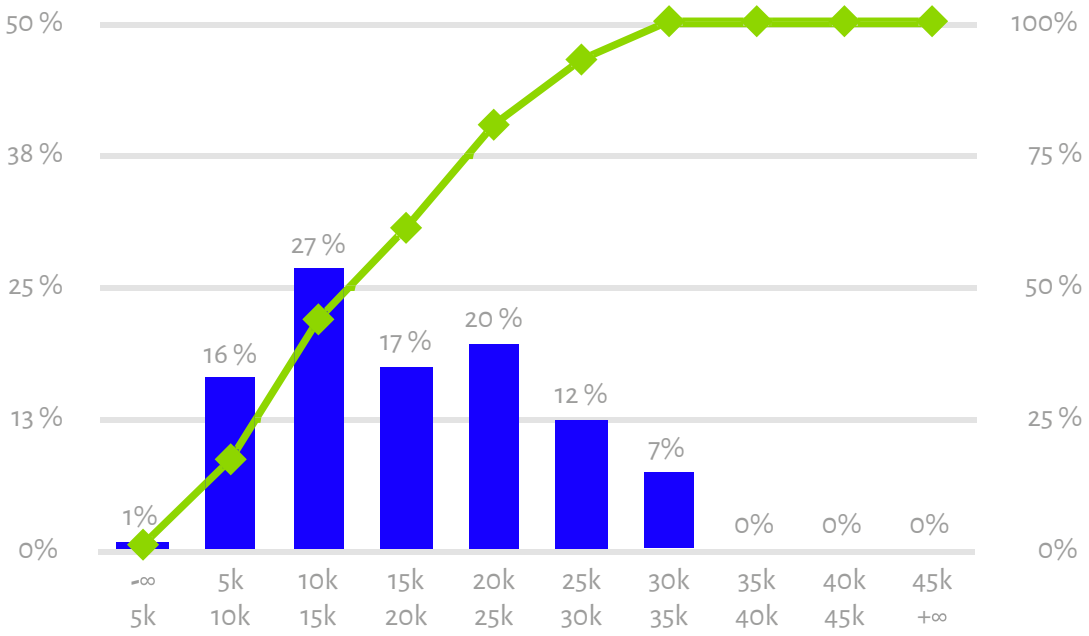
The comfort renovation may be a priority for a part of the owners, but in practice the invoice will be limited by the financial possibilities. Therefore we have to take into account the income situation and the financial assets of the owner. Furthermore, it is strongly recommended to take into account the year of construction of the house and the number of m². The chance is very slim that the new owner of a very recent, spacious and comfortable house wants to extend it. If, on the other hand, you buy a very small and outdated house at a low price, you may want to extend it. But in that case it may not be realistic to provide a large budget for this. Those with a large budget will in practice opt for a better house with a much lower 'renovation load'. We therefore assume that the bill for the comfort renovation depends on the year of construction and is highest for houses built between 1946 and 1960. For these houses we provide a budget for comfort renovation from € 15,000 to a maximum of € 30,000. For houses built between 1981 and 1990 this budget varies between € 9,000 and € 21,000. In addition, we apply a correction in function of the habitable surface.

[25] By this we mean that the budget for comfort investments could also be used for the construction of a driveway, installing screens or carrying out painting work. We therefore do not allocate a separate budget to each house to be renovated, for example for a new driveway or painting work.

For the smallest houses - first decile in the distribution of living space in the database - we limit the budget for structural renovations from € 5,000 to € 15,000. For houses in the third decile of the residential area distribution this budget amounts to a maximum of € 19,500. The database takes both criteria into account when drawing up the structural renovation budget.

Figure 2 shows the distribution of the bill for the so-called comfort investments across the houses in the synthetic database. For 27% of the houses we provide comfort investments of € 10,000 to € 15,000. For 12% of the houses, the comfort bill amounts to €25,000 to €30,000. This invoice is a maximum of € 10,000 for 17% of the houses. Anyone who has had comfort-enhancing renovation works carried out in the recent past may think that these amounts are completely insufficient for a beautiful extension containing a state-of-the-art kitchen. In practice, many owners opt for very limited comfort renovations.

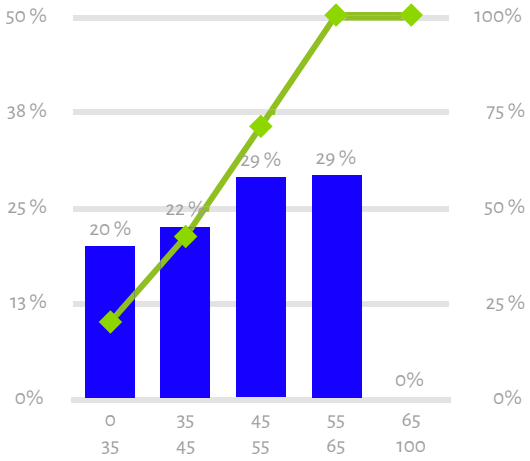
Figure 2 - Distribution of the cost of comfort renovations in the synthetic database



6.2 Owners and budget: one-off or immediate and step-by-step renovation approach

In studies on ownership and housing in Flanders, a large proportion of respondents - typically 30 to 35% - are over 65 years of age. It is quite possible that a small part of these owners will still proceed to a thorough renovation. In the analysis that follows, however, we only consider owners with a maximum age up to 65 years. Our analysis examines, among other things, the capacity to renovate provided through access to commercial loans. In order to approach this from a model perspective, it is advisable to exclude unlikely financing possibilities. For example, it would be somewhat bizarre for an owner of 88 years to take out a substantial renovation loan with a term of 15 years. Our analysis and database is limited to the group of owners between 18 and 65 years of age whose relative distribution by age group can be seen in Figure 3. About 40% of the owners are younger than or close to 45 years of age, while about 60% of the owners are in the group of 45 to 65 years of age.

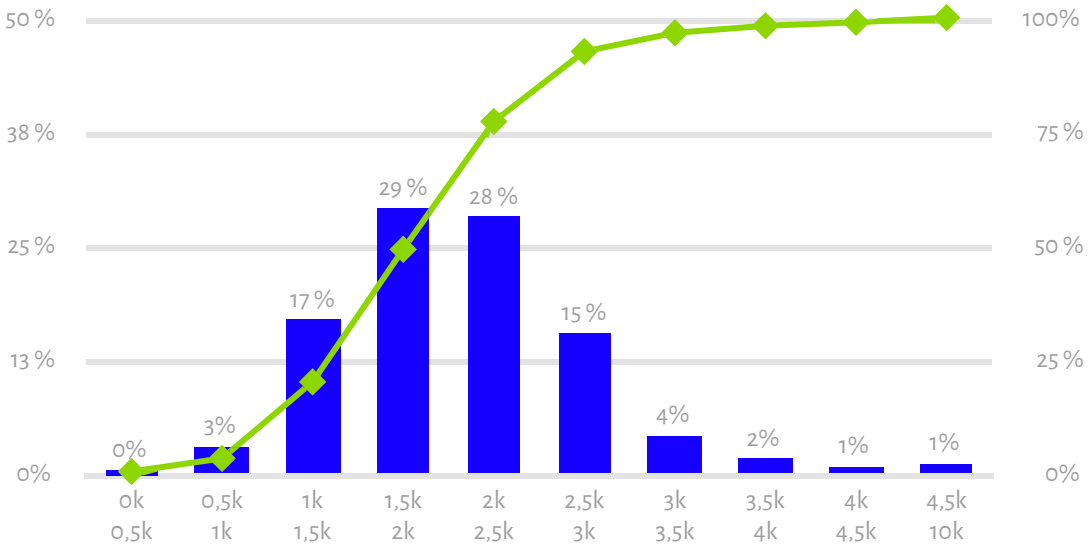
Figure 3 - Breakdown of owners by age



For these owners up to the age of 65, Figure 4 shows the distribution of equivalent incomes. Equivalent income is a measure of household income that takes account of the differences in the size and composition of a household. Within the households we simply find singles and large families with one or two earners. In order to compare the spending possibilities of the same income in a representative way for different types of households, the equivalent income is made to represent all household sizes and compositions[26]. Figure 4 shows that almost 50% of owners up to the age of 65 have a monthly equivalent income of up to € 2 000. 43% of owners have a monthly equivalent income of between €2,000 and €3,000. Less than 10% of the owners have an equivalent income higher than € 3 000.

The current equivalent income is important for those who want to renovate very substantially today and who want to enquire about the conditions for renovation loans with their pay slips at the bank. The current income can be translated into the maximum borrowing capacity that we then have to add to the current available financial capacity - see below - to determine the maximum borrowing capacity or the maximum renovation budget.

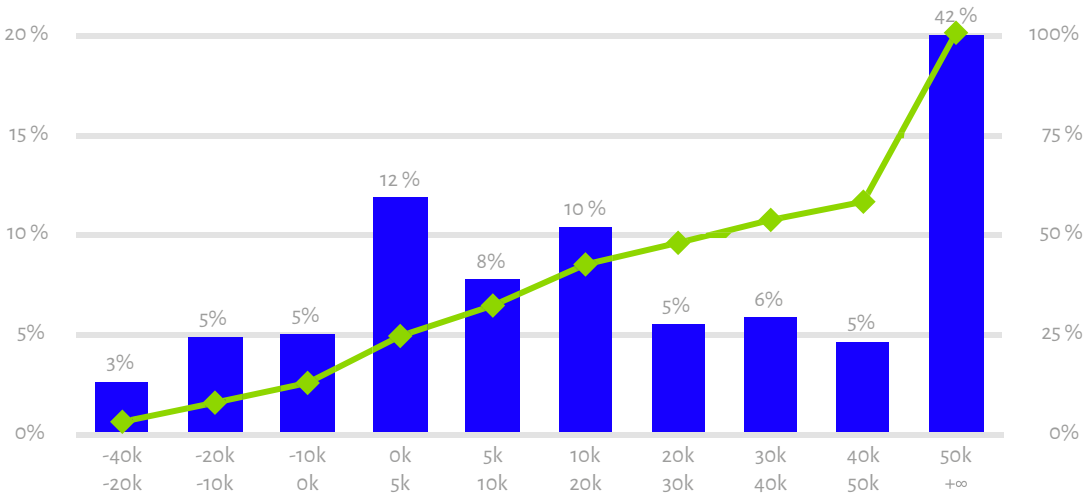
Figure 4 - Distribution of the monthly equivalent income (income and cumulative)



In practice, most owners opt for a step-by-step renovation strategy in which they periodically renovate according to the available budget. For these owners, the current equivalent income is also important, but what counts above all is the growth of this income. The current equivalent income will increase in the future as a result of economic growth and the income (re)distribution policy pursued. 2020 is a special year with unprecedented uncertainties.

For simplicity, we assume that the equivalent income for all owners will increase by 1.5% per year between today and 2050. By opting for a lower or higher growth rate, the total renovation budget to be spent up to the age of 65 will be lower or higher.

Figure 5 - Distribution of financial assets



[26] Equivalent income is calculated by dividing the total household income from all sources by the equivalent household size (c.f. the OECD equivalence scale which gives weight to all household members): 1.0 for the first adult; 0.5 for the second and every subsequent person aged 14 and over; 0.3 for every child under 14). The equivalent size is the sum of the weights of all members of a given household. See; https://statbel.fgov.be/nl/themas/huishoudens/armoede-en-levensomstandigheden/plus

Figure 5 shows the distribution of financial assets of homeowners up to the age of 65 based on the ECB surveys. Financial assets are the sum of deposits, shares, bonds and investments in investment funds from which we deduct non-mortgage debt (such as credit card debt or consumer loans). This financial capacity refers to a readily available capacity to finance renovation investments (which makes mortgage debts irrelevant). For example, a homeowner can have an outstanding mortgage debt of € 150,000 but can also own shares and bonds for € 60,000. The owner can liquidate these investments tomorrow to finance a renovation project.

Figure 5 shows that 13% of owners looks at negative financial assets. Approximately 30% of the owners have financial assets between € 0 and € 20,000. 20% have financial assets of more than €50,000. The latter group forms a residual category with a capital of € 50,000 to € 1,000,000. The non-inclusion of owners over 65s means that considerably large capacities are not included in Figure 5.

6.2.1 One-off or immediate financing capacity

We use the income and wealth information to get a picture of one-off or immediate financing capacity (IFC) of the current owners. Here we ask the question what the current owners can finance at this moment to start renovation works immediately. Later, we will compare this financing capacity with the estimated renovation cost in order to answer the question of what proportion of owners can effectively renovate today.

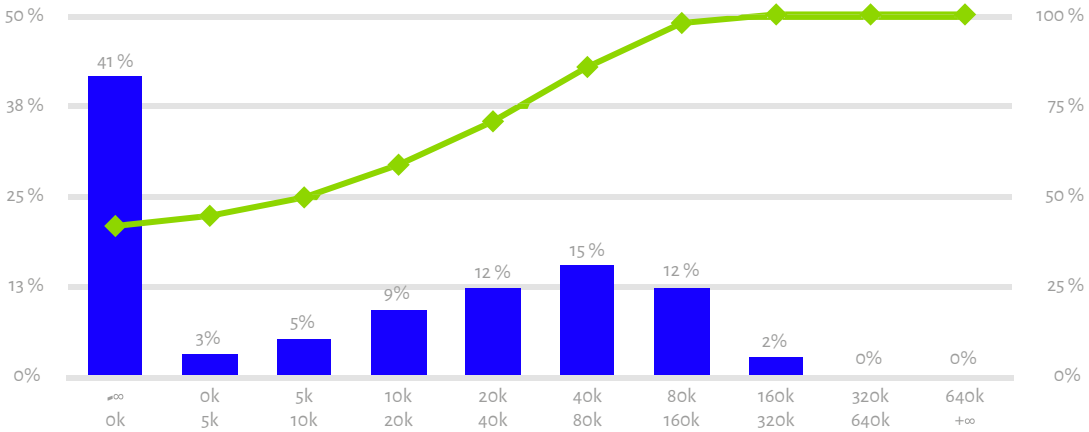
We first quantify this one-off or immediate financing capacity on the assumption that the owners not only raise their own funds but also want to take out a commercial loan[27] to finance the renovation invoice. When determining the maximum amount to be borrowed for renovation works, we must take account of current loans, in particular mortgage loans. Approximately 61% of the Flemish owners currently have an ongoing mortgage on their house. 39% has completed their repayments or have never had a mortgage loan. Those who no longer have repayments, can reserve a large part of the equivalent income for the future instalment of a new renovation loan. Anyone with ongoing mortgage payments will have to weigh the options for any additional loans thoroughly. When granting a renovation loan, financial institutions will also take into account current mortgage repayments.

In our analysis, we assume that new loans must always be repaid before the owner of the property reaches the age of 65. Those who are 50 years old can therefore take out a loan with a maximum term of 15 years. This is an important restriction, but our country pays out relatively low pensions (except to civil servants). Furthermore, our analysis uses a housing ratio of 30%, which implies that the total repayment - possibly the combination of a current mortgage loan and a new renovation loan - can claim up to 30% of the equivalent income. Since 39% of households no longer have a mortgage, this group can spend 30% of the equivalent income on paying off a new renovation loan. In addition, 40% of current owners already spend 30% of their equivalent income to pay off a mortgage loan. These households can no longer borrow to finance renovations.

In practice, the housing ratio for higher incomes can be significantly higher than 30%. In any case, higher incomes have more resources to finance a renovation so that working with an income-dependent housing ratio does not drastically change the results.

Figure 6 shows the distribution of the amounts still to be borrowed. Of course, 40% of families with high repayments cannot finance an additional loan: the amount to be borrowed in these cases equals zero. Approximately 9% of households do borrow something but not more than € 10,000. 27% can borrow between €20,000 and €80,000 to finance renovation projects.

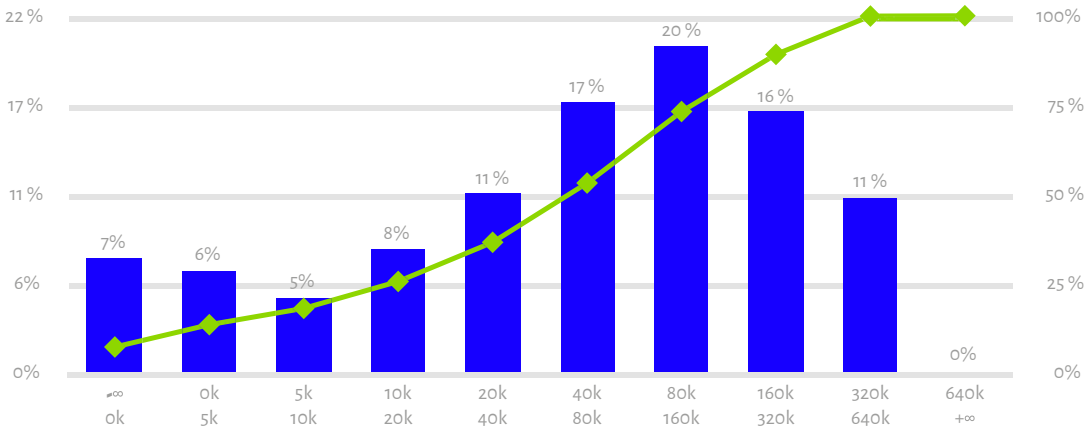
Figure 6 - Maximum amount to be borrowed for renovation projects



[27] In practice, owners with an outstanding mortgage can 'borrow' within this loan and do not enter into a new renovation loan.

Figure 7 shows the distribution of the total one-off financing capacity (IFC) of the current owners as the sum of the available financial assets and the additional amount to be borrowed. Approximately 35% of the owners have a total financing capacity of up to € 40,000. Approximately 25% of the owners have less than € 20,000 at their disposal. Approximately 37% of the owners currently have between €40,000 and €160,000 at their disposal to finance renovation projects. It also appears that 7% of the owners have a negative one-off financing capacity. These are owners with negative financial capital and no access to additional commercial loans.

Figure 7 - Distribution of total one-off financing capacity (IFC): own savings + loan



6.2.2 Step-by-step financing capacity (SFC)

Many owners renovate periodically or step-by-step according to the evolution of savings. Step-by-step' renovation is done according to the owner's priorities. Four years after the purchase of an old house, they can first invest in a small extension on the south side, three years after that the facade and the windows on the north side will be taken care of and another five years later the floors will be replaced and the very old fuel oil boiler will finally be replaced by a heat pump.

The total step-by-step financing capacity (SFC) depends on the current equivalent income, the growth rate of the equivalent income (+ 1.5% per year), the number of months remaining between the current age and the age of 65 or the remaining period in which savings can be made, the share of the monthly equivalent income that the owner wishes to reserve for renovations, the current financial capacity and the current repayment of mortgage loans. At SFC, the owner does not look for borrowed capital; he saves as an alternative to the use of borrowed capital.

The proportion of the monthly equivalent income set aside for renovations indicates a mental distribution of savings among resources for renovations to the house in addition to resources for other purposes (travel, other investments, leisure, etc.). Since people do not live and work to inject maximum resources into their own houses throughout their lives, it is unrealistic to assume that all owners, for example, would want to set aside 25% of the total equivalent income each month for future renovation projects. Many owners have already made a great financial effort to become owners and repaid mortgage loans for 20 years or more.

As a frame of reference, the savings ratio or the ratio of savings to households' disposable income[28] can be referred to. The savings ratio of Flemish households fell from 22.1% in 2009 to 13.9% in 2016 and continued to drop thereafter. Families save for a variety of purposes. Many also have a mental list of priorities, for example to first save a few years to modernise the house and later to save for other purposes. Many older owners are mentally unprepared for a new round of renovation to adapt the house to the recent 2050 climate ambitions.

In the analysis, we choose to reserve a maximum of 10% of the equivalent income for future renovation objectives. This assumption is particularly relevant for owners without a mortgage loan. Anyone who already spends 30% of the equivalent income on paying off their mortgage loan will leave it at this and is not able to save an additional 10% of the equivalent income for renovation investments. The selected 10% is an average value. In practice, an owner who wants to complete the most important renovation works as quickly as possible will be willing to save as much as possible for a few years. There are families who live very sparingly for a few years - and never travel - to improve the house as quickly as possible.

In the case of step-by-step financing, the proportion of equivalent income spent each month on the combination of repaying the existing mortgage and saving funds for future step-by-step renovation never exceeds the 30% housing rate. Suppose that an owner-occupied household with an age of 40 has a mortgage that still has to be repaid for 12 years. Until the age of 52, the owner will spend a substantial proportion of the equivalent income - which increases by 1.5% each year - on mortgage repayments. With a housing quota of 30%, this owner can only set aside limited savings for future renovations in the first 12 years. After the age of 52, the mortgage repayment expires and the owner can save much more money for later renovations (up to 10% of the equivalent income).

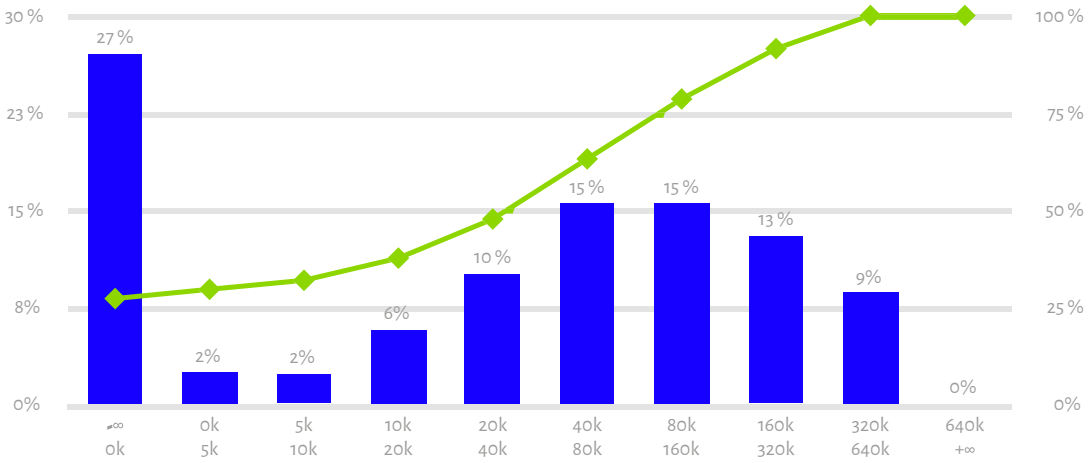
Based on available information on equivalent incomes, outstanding mortgages and monthly repayments, we calculate the step-by-step financing capacity (SFC) for each owner in the database. Those who can never save and currently do not have necessary financial capacity, will not be able to build up the financing capacity in the future. In addition, there are also households with strong negative assets. Those who have to repay outstanding non-mortgage debts[29] can not necessarily save even if the mortgage repayment is less than 30% of the equivalent income.

[28] The savings ratio is expressed in terms of nominal income and not in terms of equivalised income

[29] In practice, an owner could build up a 'temporary renovation budget' by taking out as many consumer credits and other debts as possible. There are families that take out loans to finance expensive trips, household appliances and electronics. Obviously, this is not a sustainable solution to the renovation challenge..

Figure 8 shows the distribution of the step-by-step financing capacity among the current owners. The amounts on the horizontal axes are budgets that owners can collect before their 65th birthday if the equivalent income increases annually by 1.5%[30]. The owners save a maximum of 10% of the growing equivalent income for renovation projects and never spend more than 30% of the equivalent income on the addition of the mortgage repayment and reservation for future renovations. It is immediately apparent that 27% of the owners are unable to set aside funds for future renovations. These households need the growth of equivalent incomes in order to pay off current debt - mortgage and other debt. In this group we mainly find households with low equivalent incomes. In addition, approximately 20% can save up to €40,000 in the long term for renovation projects. In time, 22% of the owners can release more than € 160,000 for renovation projects.

Figure 8 - Distribution of step-by-step financing capacity (SFC)



[30] Obviously, this does not mean that these owners will wait until their 65th birthday to start the renovation work.

7/ RESULTS

In this section, we look at the results of the simulations based on the synthetic database in order to estimate the proportion of owners with sufficient resources to renovate. In 7.1 we first make a distinction between only the housing code renovations and the broader climate renovations. This analysis therefore does not take into account the so-called comfort renovations as explained above. Only in 7.2 do we add comfort renovations to the housing code and climate renovations. In 7.2 we examine which part of the owners can finance both housing code and comfort renovations and which part can finance climate and comfort renovations. When carrying out the wider climate renovations, the owner will always address any 'housing code defects' so that after the renovation the house complies with the housing code.

7.1 Housing code and climate ambitions

For each owner/household, we compare the financing capacity or the available renovation budget with the retained renovation cost. In the analysis, we distinguish between the one-off or immediate financing capacity (IFC) based on savings and loans, and the so-called step-by-step financing capacity (SFC) where the owner saves a period of time to finance periodic renovations. This is how we obtain the financing gap or FGAP;

FGAP = renovation budget (IFC or SFC) - renovation cost

7.1.1 Housing code renovations: IFC and SFC

Figure 9 shows the financing gap (FGAP) for the housing code renovations based on the one-off or immediate financing (IFC). For 19% of the owners it is negative, which means that their available budget is insufficient to finance the housing code renovations. These are mainly owners without access to commercial loans because their current mortgage repayments and other debts weigh heavily. As expected, a large proportion of the owners have more than sufficient resources to tackle the housing code renovations. 38% of the owners have a budget surplus of more than € 100,000 after implementing the housing code renovations.

Figure 9 - Housing code renovations; FGAP at IFC

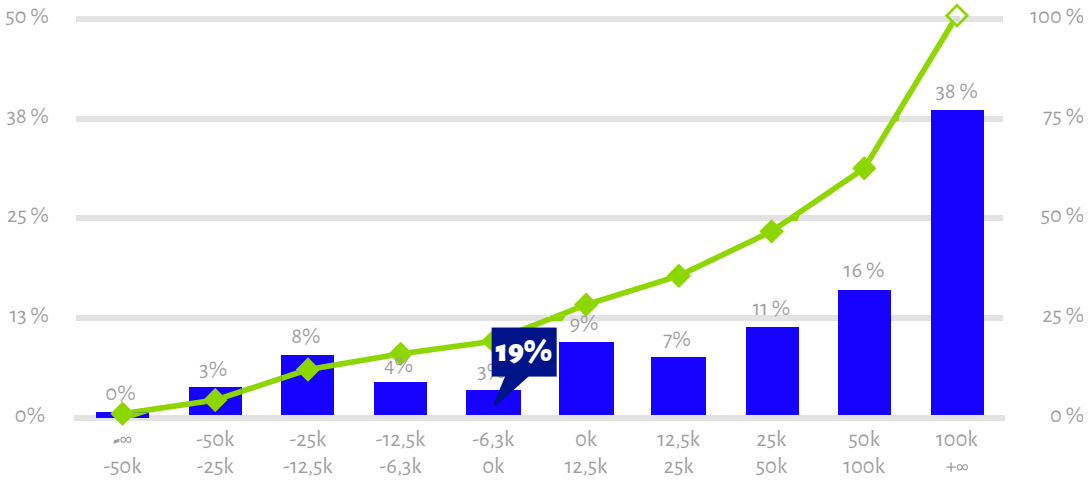
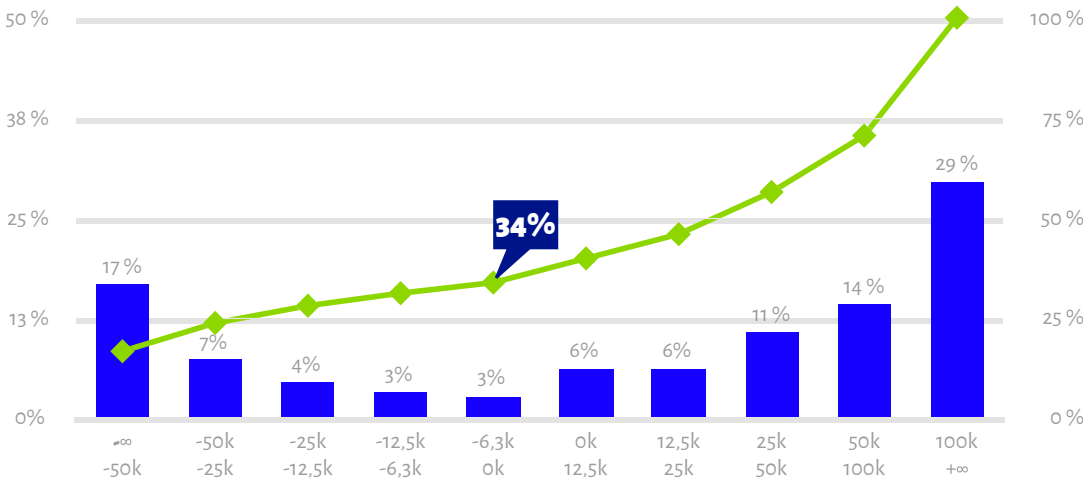


Figure 10 shows the distribution of the funding gap for housing code renovation based on the step-by-step approach (SFC). This approach calculates future savings but also takes into account all outstanding debts carried by the owner. Furthermore, these owners never raise additional debt so that the owners with the higher incomes in this distribution have a lower financing capacity than with IFC where they can easily[31] raise loan debt.

[31] It is true that this depends on mortgage and other debts already entered into.

At SFC, 34% of the owners appear to be unable to finance the housing code renovations. 17% of the owners are more than € 50,000 short. For 3% of the owners, the deficit is limited to less than € 6250. A large part of the owners can easily finance the housing code renovations.

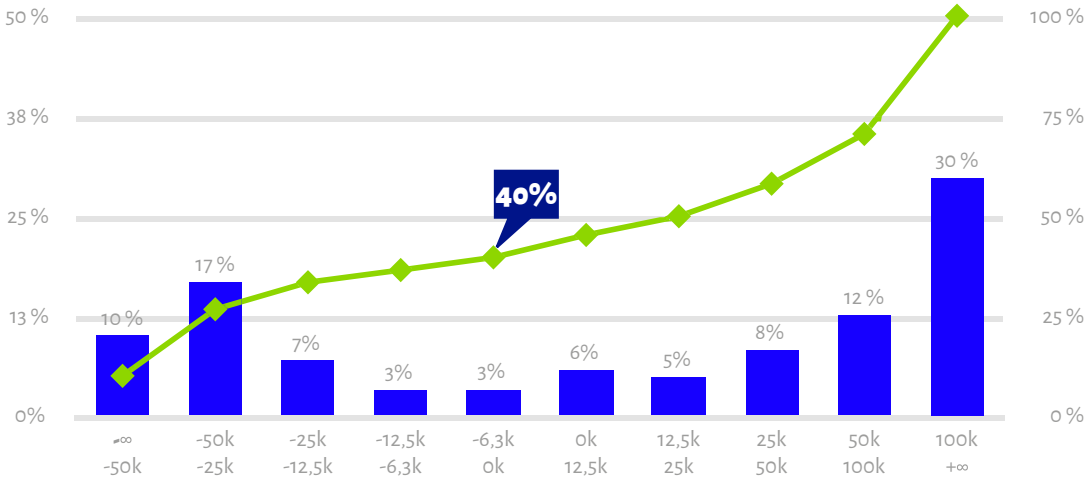
Figure 10 - Housing code renovations; FGAP at SFC



7.1.2 Climate renovations: IFC and SFC

The share of the owners who are unable to finance the climate renovations is shown in Figure 11 for the IFC and Figure 12 for the SFC. Figure 11 shows that today 40% of owners cannot finance the renovation that would be necessary to bring their house up to the 2050 energy standards all at once (IFC). 10% of households are more than € 50,000 short. 17% of the owners are between € 25,000 and € 50,000 short of one-off financing (including commercial loans). The deficit amounts to € 12,500 to € 25,000 for 7% of households.

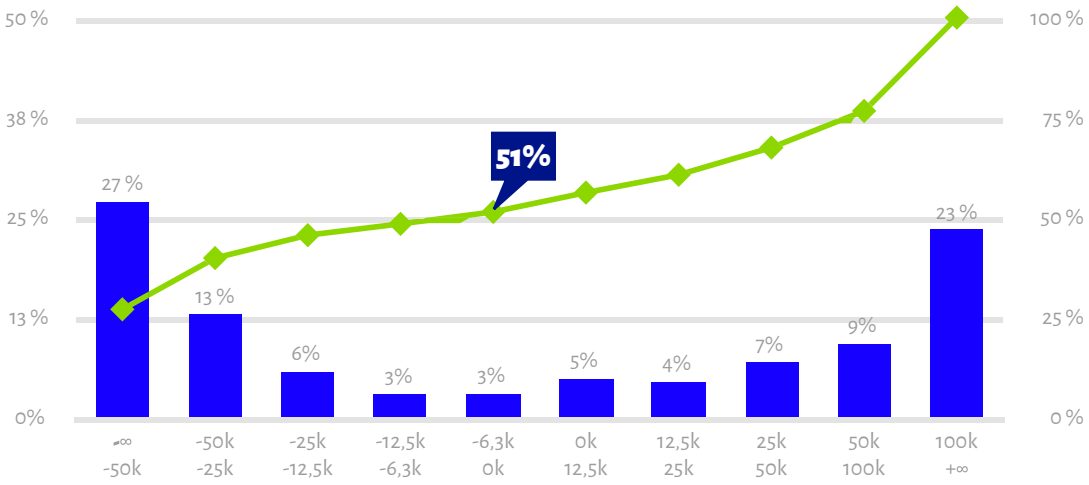
Figure 11 – Climate renovations; FGAP at IFC



In the case of step-by-step financing, 51% will not be able to finance the renovation invoice for the 2050 climate ambitions. 27% of the owners have a deficit of more than €50,000 and 13% have a deficit of between €25,000 and €50,000. 3% have a relatively limited deficit of up to € 6 250. een verschil zal uitmaken.

The scale of the shortfalls at both IFC and SFC makes it clear that the limited subsidisation of energy renovation work will only make a difference to a small proportion of the current owners.

Figure 12 - Climate renovations; FGAP at SFC



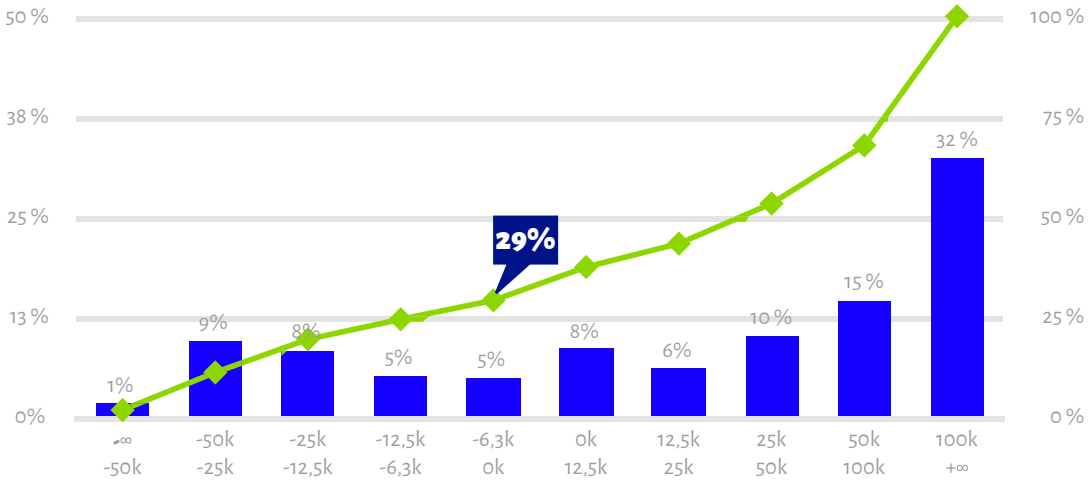
7.2 Total renovation costs, including comfort renovations

7.2.1 Housing code and comfort renovations: IFC and SFC

Figure 13 shows that 29% of owners are unable to finance the combination of housing code and comfort renovation at IFC. 5% of the owners have a maximum deficit of € 6 250.

Today, 47% of the owners have a budget surplus of more than € 50,000 after financing code and comfort renovations, which suggests that they can also finance additional energy renovations.

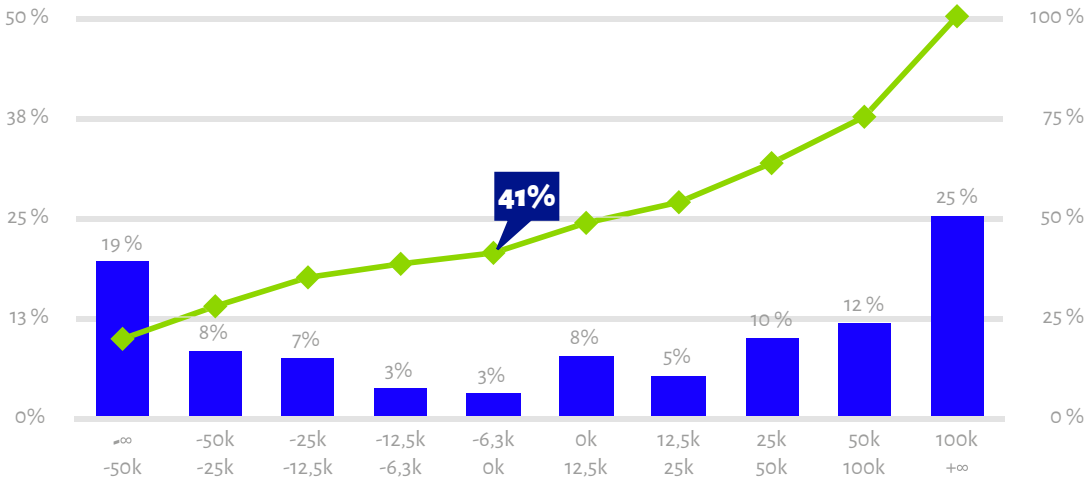
Figure 13 - Housing code and comfort renovations, FGAP at IFC



From society's point of view, the choice for the combination of housing code and comfort renovations without implementing the climate renovations is not optimal. In practice, however, a (small) part of the owners may give priority to a new driveway instead of insulating the facades. Private preferences can be very different from public optimas.

If the step-by-step approach is opted for (Figure 14), 41% of current owners appear to be unable to finance the combination of housing code and comfort renovations in the long term. 6% of the owners are up to be € 12,500 short. For 19% of the owners the deficit exceeds € 50,000. 8% of the owners have a funding gap of €25,000 to €50,000.

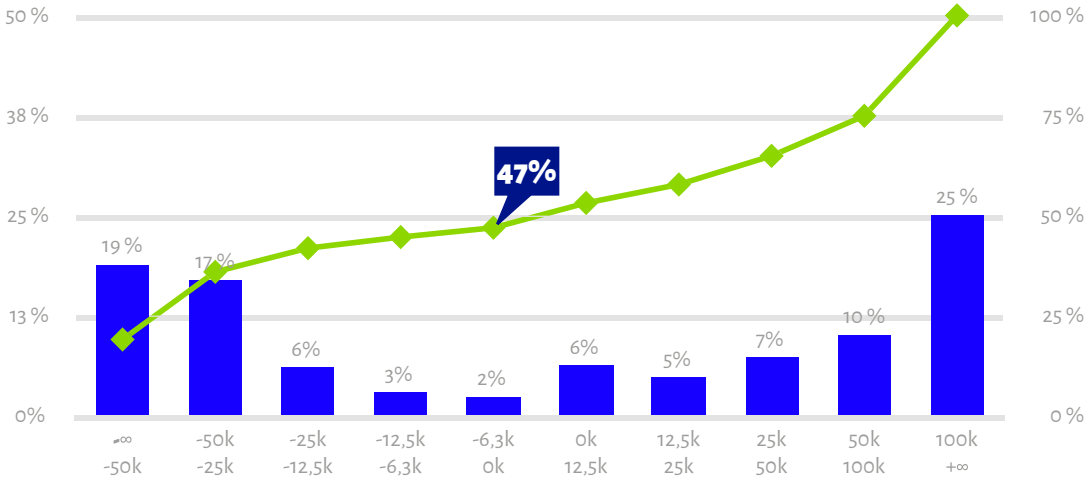
Figure 14 - Housing code and comfort renovations; FGAP at SFC



7.2.2 Climate and comfort renovations: IFC and SFC

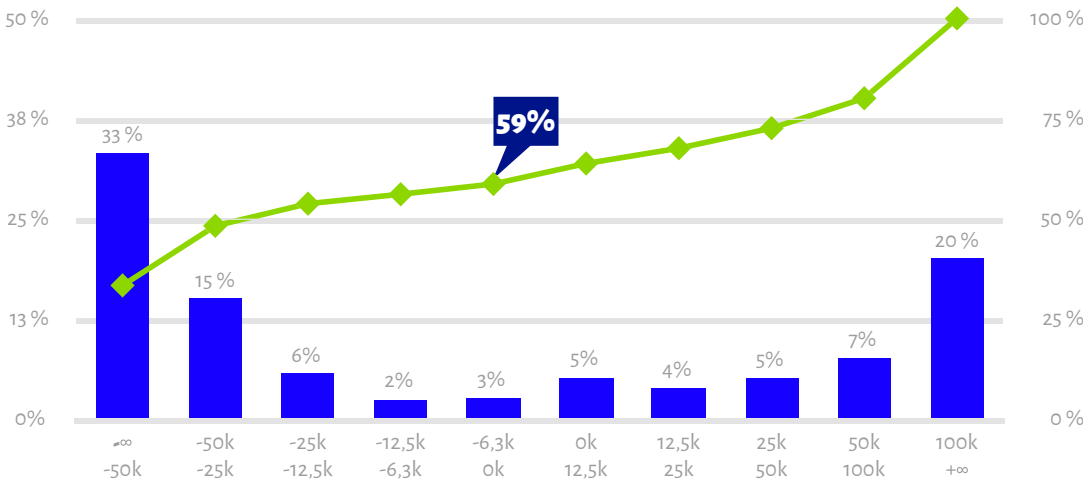
The maximum renovation invoice combines climate and comfort renovations. When the climate renovations are carried out, all necessary adjustments are also made to make the house housing code compliant. After carrying out all these renovations, the house is technically compliant, future-proof and fully meets the owner's personal comfort expectations. However, due to the higher cost of this total renovation, we have to conclude that 47% of the current owners cannot finance this invoice today (IFC). 19% of the owners are more than €50,000 short while the financing gap for 17% of the owners falls between €25,000 and €50,000. 5% of the owners are up to €12,500 short. If the government were to consider paying out a renovation subsidy of up to € 10,000 to owners wishing to renovate, this subsidy would attract a maximum of 5% of the owners. On the other hand, 35% of the owners have more than € 50,000 left after the total renovation has been carried out. One quarter of the owners even have more than € 100,000 left.

Figure 15- Climate and comfort renovations; FGAP at IFC



When systematic saving is opted for instead of the use of commercial loans, the share of owners who are unable to finance the total renovation over the life cycle increases in Figure 16 to 59%[32]. One third of the owners are more than € 50,000 short and 15% have a funding gap between € 25,000 and € 50,000. 3% of the owners are only € 6,250 short.

Figure 16 - Climate and comfort renovations; FGAP at SFC



[32] We repeat that in this case - after repaying current mortgages - households are only prepared to save 10% of their equivalent income for renovations. With the IFC, the owner takes out a loan, as a result of which he or she spends many more years - up to the age of 65 at most - about 30% of their equivalent income on repayment.

8/ DISCUSSION

The presented analysis of the funding gap is based on empirical observations. A large proportion of owners in the EU finance renovations with their own (savings) resources and spread out the works over time. The step-by-step financing capacity or SFC lines nicely with this reality. It is of course possible to work out various variants of the step-by-step financing capacity. For example, we can opt for a step-by-step approach in which the owner, five or ten years after repayment of the initial mortgage, does opt for a maximum new loan based on an increased equivalent income. This increases the renovation budget for a significant part of the owners and changes the percentages.

Empirical work shows that the current owners are anything but aware of the 2050 climate ambitions; energy renovations are often the side effect of non-energy renovations. We integrate these observations into the analysis by paying a lot of attention to the comfort renovations. Although the comfort renovations can cost up to €35,000, the impact of adding the comfort renovations is rather limited. 51% of the current owners are unable to finance climate renovations through SFC.

If we add the comfort renovations, this percentage rises to 59%. This increase is not marginal if we translate it into the number of non-renovated houses, but the bottleneck lies mainly in the insufficient capacity of many owners to finance climate renovations. By adding the comfort renovations to the housing code renovations at the IFC, the share of owners with insufficient financing capacity increases from 19% to 29%. Here, the increase is relatively higher because we add the invoice for comfort renovations to a relatively low initial amount; housing code renovations are by definition less expensive than climate renovations.

The synthetic database provides information on, among other things, the incomes of owners with an insufficient budget. Table 3 shows, for some income levels, the share of owners that cannot finance the combination of climate and comfort renovations through IFC and SFC. These shares are quite high up to a monthly equivalent income of € 2 500. Almost all households with an equivalent monthly income of € 3 000 can finance the necessary renovation costs.

Table 3 - Climate and comfort renovations: % households in deficit (negative FGAP)

MONTHLY EQUIVALENT INCOME (€)	IFC	SFC
1000 to 1500	24%	22%
1500 to 2000	34%	33%
2000 to 2500	26%	28%
2500 to 3000	9%	10%
3000 to 3500	1%	2%
3500 to 4000	1%	1%
4000 to 4500	0%	0%
4500 to 10000	0%	0%

Are there policy options to address these deficits in funding capacity? As far as climate renovations are concerned, 10% of the owners were more than € 50,000 short for the IFC. 17% of the owners are € 25,000 to € 50,000 short. If we opt for SFC, 27% of the owners have a deficit of more than € 50,000 for the climate renovations and 13% have a deficit of between € 25,000 and € 50,000. The large deficits can only be compensated by high direct subsidies for the owners. The granting of future tax benefits - for example through property tax - is only relevant for owners who are considering renovating through the SFC. Granting renovation subsidies of up to € 50,000 or more is only an option from a theoretical point of view, but one that will greatly increase the savings gap. How, for example, do tenants look at generous renovation subsidies for households whose income is high enough to become owners?

9/ CONCLUSIONS AND SOME POLICY OPTIONS

For the time being, the renovation rate responds to a limited extent to energy efficiency policies. Several barriers provide part of the explanation. We try to quantify the financial barrier 'realistically' by starting from relevant empirical observations. For example, it turns out that renovations are often only financed with own resources and are carried out step by step. Furthermore, the existing studies on renovation costs do not really take into account the personal preferences of homeowners. Many owners mainly want to upgrade their property in terms of comfort, utilisation and later sale value. Individual preferences may differ significantly from the objectives of technical regulation. We therefore pay a lot of attention to additional comfort renovations (on top of the housing code and climate renovations).

The analysis starts from the construction of a synthetic database in which we bring together relevant characteristics of owners and houses. A number of decision rules are used to estimate relevant renovation costs for the houses. As far as possible, the distributions in the synthetic database are aligned with distributions in available publications and databases. Simulations based on the synthetic database sketch a picture that is representative and in line with the most important findings from empirical analyses.

Table 4 presents an overview of the financial barriers for owners considering renovation. We calculated the proportion of owners that cannot renovate both in the case of a one-off or immediate investment (IFC) - partly financed by commercial loans - and in the case of the step-by-step approach based on savings (SFC). We can conclude that 40 to 51% of the current owners are unable to finance the climate renovations they are aiming for. After adding the comfort renovations, 47 to 59% cannot finance the total renovation as the sum of climate and comfort renovations. A large proportion of these owners are even more than € 50,000 short, so offering limited renovation subsidies will make little difference in terms of total renovation. The analysis also shows that mainly households with an equivalent monthly income of € 3 000 or more can finance all necessary renovation costs.

Table 4 - Share of owners with insufficient financing capacity (IFC & SFC)

TYPE OF RENOVATION	IFC	SFC
City code	19%	34%
Climate	40%	51%
City code + comfort	29%	41%
Climate + comfort	47%	59%

The financial barrier to major renovations is important but equally important is the observation that a large proportion of current owners have already invested in energy-saving measures such as roof insulation in the past. Many owners believe that their house is quite energy efficient or even *future-proof*. Regardless of their financing capacity, a large proportion of these owners have absolutely no desire to carry out renovation works with a very long payback period. Nevertheless, the success of renovation policy will depend on the decisions that millions of owners - with very different characteristics and preferences - will take in the coming years.

How should we interpret these findings? First of all, it is important to emphasize that the results only refer to the current owners. Between today and 2050, many houses will be sold to new owners who will be able to behave and organise themselves differently from the current owners. We cannot predict what will happen to real estate prices in the next 30 years. Certain segments may become less attractive to prospective buyers for various reasons. A drop in prices for houses in poor condition releases an extra budget for renovation by the new owner. In any case, the analysis shows that a significant proportion of current owners do not have sufficient resources to technically optimise the house (from a housing code perspective). This observation suggests that - based on their income and wealth situation - many households may be paying too much for the house. This willingness to purchase (too) expensive houses has a lot to do with the lagging behind of the private and social rental market in our country. In principle, these markets may develop strongly over the next thirty years, but this requires a strong and consistent policy. With the abolition of the Woonbonus, the beginning of a turnaround may have begun, but this remains to be seen. In the last elections, most political parties took few positions on buying and rental markets, while the proper functioning of our housing markets is very important from a social and economic point of view.

Finally, it is useful to reflect for a moment on a possible switch in the buying behaviour that we are currently observing. Today, the worst houses are bought by the lower incomes while the best houses are sold at high prices to the higher incomes. It's always been like this, but is this the way it should always be like? Suppose the lower incomes find a good house more easily on the rental markets and that some of the higher incomes want to buy old houses and thoroughly renovate them in order to be able to offer them on the rental market. Of course this is happening today, but the rental markets have their own barriers. The government could roll out solutions in the housing market to this end - for example, combinations of rent subsidies and rent guarantees - as a result of which the private rental market will pick up strongly in a decade, which in turn could have an impact on the prices of the worst houses, and so on.

We can interpret the percentages in Table 4 in a fatalistic way; the climate ambitions will then not be attainable and our housing stock will continue to consume energy. If houses remain relatively energy-efficient but consume (and waste) renewable energy, there will be CO_2 reductions. An attractive supply of renewable heat and electricity is essential with a low renovation rate.

There are no quick fixes to halve the percentages in Table 4 rapidly. It's therefore up to the government to adjust the market dynamics so that over the next thirty years they will sell, buy, renovate, rent and heat differently. The model to stimulate and maximize private ownership is clearly 'dilapidated'. Time to move...

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