



## Deliverable D2.4 Demand drivers tailored to local conditions

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# Contents

<b>CONTENTS.....</b>	<b>3</b>
List of figures .....	5
List of tables.....	5
<b>SUMMARY .....</b>	<b>6</b>
<b>1 INTRODUCTION.....</b>	<b>8</b>
1.1 interplay between segmentation and drivers and barriers .....	9
1.2 Learning from other projects .....	10
1.3 REFURB framework for clustering drivers and barriers.....	14
1.4 Tailoring the demand side drivers to local conditions.....	16
<b>2 TECHNICAL DRIVERS &amp; BARRIERS .....</b>	<b>17</b>
2.1 Urgency for renovation & lock-ins.....	17
2.2 Availability of tailor-made stepwise approach for NZEB-renovation.....	18
2.3 Inconveniences and defects.....	19
2.4 Inconvenience linked to the renovation.....	20
2.5 Technical possibilities and limitations.....	20
2.6 Less important drivers & barriers .....	21
<b>3 FINANCIAL DRIVERS &amp; BARRIERS.....</b>	<b>22</b>
3.1 Availability of financial possibilities to invest.....	22
3.2 Feel secure about investment & savings .....	23
3.3 Willingness to invest in energy efficiency vs competing products .....	23
3.4 Subsidies, financial incentives etc.....	23
3.5 Energy bill.....	25
3.6 Cost for NZEB-renovation .....	26
3.7 Return on investment.....	26
3.8 Less important drivers & barriers .....	26
<b>4 SOCIAL AND BEHAVIOURAL DRIVERS &amp; BARRIERS .....</b>	<b>27</b>

4.1	Renovation needs & intentions: increase comfort level, cosiness, personalization, taste, adjust architectural concept etc.....	27
4.2	Decision making, self-reliance & empowerment .....	27
4.3	Advice, 'unburdening' & guidance .....	28
4.4	Awareness of energy saving potential .....	29
4.5	Accurate, reliable & tailor-made information.....	29
4.6	Momentums for renovation (why now?).....	30
4.7	General knowledge level .....	31
4.8	Neighbourhood action, group action.....	31
4.9	Availability of time to manage renovation project .....	31
4.10	Values (ideas) & attitudes towards environmental issues, sustainability and climate.....	32
4.11	Less important drivers & barriers .....	32
<b>5</b>	<b>CONTEXT DRIVERS &amp; BARRIERS .....</b>	<b>33</b>
5.1	Split incentive barrier .....	33
5.2	Legislation & policy .....	33
5.3	Multi-stakeholder issues .....	34
5.4	Building sector readiness.....	34
<b>6</b>	<b>MAPPING THE DRIVERS &amp; BARRIERS IN THE SEGMENTS .....</b>	<b>35</b>
6.1	Segment 1: "young families": main drivers & barriers.....	35
6.2	Segment 2: "Post-war suburbs with detached houses": main drivers & barriers	36
6.3	Segment 3: "Empty nesters": main drivers & barriers .....	37
6.4	Segment 4: "terraced houses with a high energy bill": main drivers & barriers ..	37
6.5	Segment 5: "convinced energy savers": main drivers & barriers .....	38
<b>7</b>	<b>CONCLUSION .....</b>	<b>39</b>
	<b>REFERENCES .....</b>	<b>42</b>

## LIST OF FIGURES

Figure 1: Clustering of drivers & barriers for NZEB-renovations.....	7
Figure 3: The relationship between dwelling characteristics, dweller characteristics, drivers and barriers..	10
Figure 4: Classification of barriers as identified by the BPIE survey. Source: BPIE, 2011 .....	13
Figure 5: Christian A. Klöckner, NTNU, Norway, 2013 .....	14
Figure 6 Clustering of drivers and barriers for NZEB renovations, based upon BPIE (2013) and the ZenN project .....	15
Figure 7: Overview of drivers & barriers .....	40

## LIST OF TABLES

Table 1 Barriers and challenges of forerunning retrofitting / renovation projects as identified by the ZenN project. Source: ZenN, D1.1. Report, 2013.....	11
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# Summary

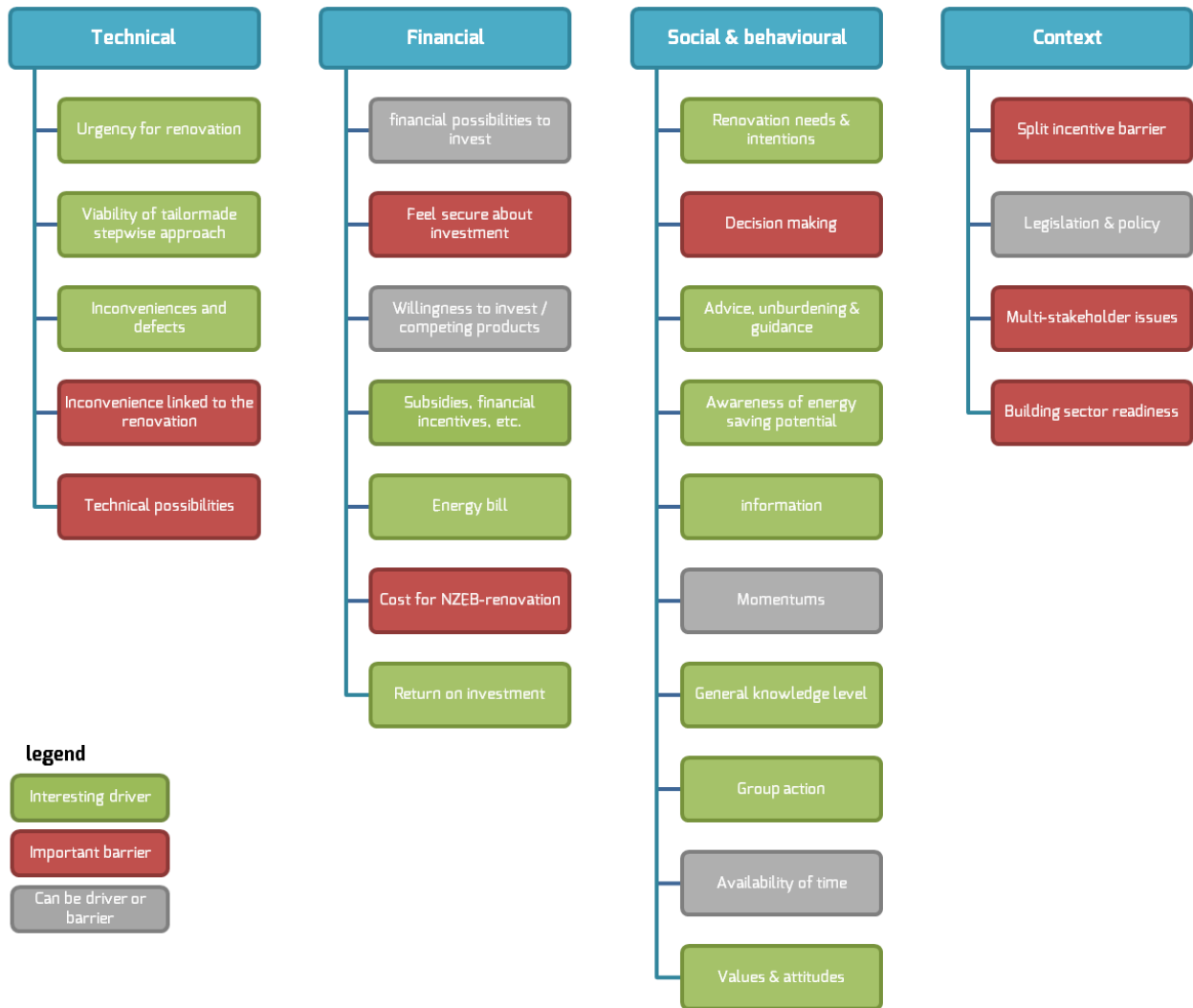
In the REFURB project a market segmentation that is relevant for NZEB-renovation and demand aggregation schemes was developed (report D2.1). These segments are linked with drivers and barriers homeowners face when deciding on NZEB-renovation. Thematically clustered (in report D2.2, Figure 1) these are:

- **Technical drivers and barriers**, linked with the dwelling characteristics and the challenge to renovate to NZEB.
- **Financial drivers and barriers**, linked with the financial possibilities of the dweller and the cost of the NZEB-renovation.
- **Social and behavioural drivers and barriers** linked with the decision-making process of the dweller, so including the behaviour, attitude of the dweller, as well as the (social) conditions to take a decision.
- **Context drivers and barriers**. These are rather external factors, not directly linked with the dweller or dwelling characteristics, but deal with the particular situation or context the homeowner has to deal with. E.g. legal and administrative issues, tenant-landlord issues, organisation of the building sector etc.

However, local critical success factors to tackle barriers and activate drivers for housing renovation will differ in the regions participating in the REFURB project. Local conditions define these success factors. **This report gives an insight in local differences, and tailors the demand side drivers to the local conditions of the REFURB-regions.** This report (D2.4) is a modified report of report D2.2. The generic drivers and barriers established in report D2.2 are checked against local parameters which influence the demand drivers and barriers and which will have to be taken into account when designing renovation packages locally. The exercise should help to identify the most important drivers and barriers for the segments of the demand side in a particular local situation. At the same time it also points to some existing solutions for barriers already present in the region. These can be solutions which these renovation packages will have to integrate or circumstances and traditions which will determine the best approaches.

It is observed that local conditions may play an important role, e.g. local legislation, the mobility of homeownership, subsidy schemes, acceptance of renewable energy, building sector readiness for NZEB, the tradition of staged renovations... Without going into detail in this summary it is for example clear that for some local circumstances it is more likely to promote a staged deep renovation solution due to traditional approaches to tackling financial barriers while in other circumstances a one-step deep renovation is more likely due to the very beneficial financial support available.

Based on this report on tailored drivers and barriers in the different segments, improved approaches to seduce homeowners to integrate NZEB-ambitions within their renovation will be designed (report D2.5), and compelling offers will be designed in the REFURB-project.



1

Figure 1: Clustering of drivers & barriers for NZEB-renovations

# 1 Introduction

Renovation in the residential sector towards increased energy efficiency is seriously lagging behind the political targets for energy renovation. As more than sufficient technological solutions are available, focus must be on removing non-technological barriers and introducing effective drivers. The main barriers relate to fragmentation of the renovation offer, resulting in inefficient or only partial solutions. One way to solve this is the use of a '1-stop-shop concept'. Many have been put in practice. Some were successful, others not. They might lack an understanding of the concerns and demands of homeowners.

The REFURB project focuses on the complex interplay of barriers through coordinated process organization, innovation and optimization. Work package 2 and work package 3 are dedicated to analyse demand and supply side drivers. This report is part of work package 2 ("demand side mapping"), and focuses on the existing barriers and drivers of the demand side. The demand side of the REFURB project refers to private homeowners, which is a diverse group of decision makers in energy efficiency investments that is not well organised and has a limited capacity and ambition to inform themselves on technical details of energy efficiency solutions.

In Work Package 2 a segmentation of the demand side is being established, and insights are gained into the wishes, needs and motives of homeowners (not) to invest in energy efficiency measures. This improves the understanding of the possible ways to better organise the fragmented demand side, and define improved approaches to seduce homeowners to integrate NZEB-ambitions within their renovation, with energy saving translated into their 'language'.

In the REFURB project a market segmentation that is relevant for NZEB-renovation and demand aggregation schemes was developed (report D2.1). These segments are linked with drivers and barriers homeowners face when deciding on NZEB-renovation (report D2.2).

**Barriers** are the psychological, social, financial and other negative arguments to not carry out a renovation. These originate in motivations, desires, needs and the financial situation of homeowners.

**Drivers** are the counterpart of the barriers: they are the psychological, social, financial and other positive arguments to carry out a renovation. These too originate in motivations, desires, needs and the financial situation of homeowners.

However, critical success factors to tackle barriers and activate drivers for housing renovation will differ in the regions participating in the REFURB project. Local conditions define these success factors. This report (D2.4) gives an insight in these local differences, and tailors the demand side drivers of report D2.2 to the local conditions of the REFURB-regions.

Examples of relevant factors are building traditions (e.g. wood frame-building vs. masonry), housing market characteristics (e.g. ownership vs. tenancy), the climate (e.g. cold vs. mild), history and culture (e.g. the share of historic valuable dwellings), public acceptance of green energy solutions, legal systems (e.g. stimulating energy renovation) etc.

**This report (D2.4) is a modified report of D2.2**, integrating an overview of the relevant local parameters. The local parameters are related to the demand-buy drivers identified in report D2.2. The insight in local parameters will foster better awareness of the homeowner of the benefits of renovation. It allows



transferring the best practice experiences (e.g. demand aggregation schemes cf. REFURB report D2.3) between countries, and adapt them to local conditions.

This report is based on available research, combined with the knowledge and experiences of the partners, such as the FP7- project ZenN (Nearly Zero energy Neighbourhoods), the IEE-project COHERENO, the Dutch programmes Energiesprong, Blok voor Blok and Energieplein 20, the Danish Project Zero experiences etc.

To tailor the drivers to local conditions, the local available information on the drivers and barriers to implement energy efficiency renovations is processed. A broader insight in the regional housing markets in the EU is already given in the REFURB-report D2.1 (Demand Side Segmentation) chapter 2 (Regional Housing Markets in the EU). Complementary, a description of the context of the 6 EU-regions represented in the REFURB-project is presented in the annexes of the report D2.1: a description of the housing stock, the energy performance, refurbishment activity, the housing market segmentation, etc. Furthermore, insights were gained from the in-depth analysis of demand aggregation schemes to organise the demand side in the REFURB regions (report D2.3).

Throughout the remainder of this chapter a general framework of clusters of drivers and barriers is made based upon the results of existing studies and projects. Then in the following chapters 2 to 5 these clusters of drivers and barriers are described in detail. In chapter 6 they are linked to the identified potential demand-side segments from report D2.1. Chapter 7 concludes.

## 1.1 INTERPLAY BETWEEN SEGMENTATION AND DRIVERS AND BARRIERS

To segment the housing market (report D2.1) from a demand-side perspective, characteristics were defined to make the distinction between the different groups (segments). Two main types of characteristics were used to define segments:

- dwelling-related characteristics; and
- dweller-related characteristics.

The segmentation (report D2.1) is related to the listing of the drivers and barriers of homeowners to decide on NZEB-renovation (report D2.2). Segments are groups of dwellings and/or dwellers that can have similar characteristics and can meet similar barriers and drivers. The characteristics to segment can be a driver or barrier at the same time, but not necessarily always, e.g.:

- People with high access to financing can be a separate segment, as they do not face similar financial barriers as people in energy poverty<sup>1</sup>, which can be a second segment. For people in energy poverty, the access to financing is a major barrier. As a result, different (financial) solutions and persuasion strategies are needed to tackle the specific barriers of these two segments separately.

In this example access to financing is a feature to design segments as well as a barrier for the two segments of homeowners.

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<sup>1</sup> The common definition of energy poverty is a share of +10% of the household budget is being spent on energy for heating. Energy poverty is more frequent with households with low income, and with households with a high energy bill.

- For different construction types of a dwelling (massive masonry, cavity walls, timber frame, cassette façade etc.) different NZEB-renovation concepts are needed. So the construction type is an obvious characteristic to segment the dwellings. But the construction type as such is not a barrier for NZEB-renovation.

The relationship between dwelling characteristics, dweller characteristics, drivers and barriers is shown schematically below (Figure 2).

It must be stressed that drivers and barriers are primarily connected to the people living in the dwellings and making the decisions on housing renovation

Only up to a minor extent, drivers and barriers relate to dwellings e.g. to technical impossibilities to implement NZEB-solutions (for example with historical buildings), the low comfort or the poor thermal condition. But this type of driver or barrier has a very different nature and has little to do with the decision-making process of a homeowner.

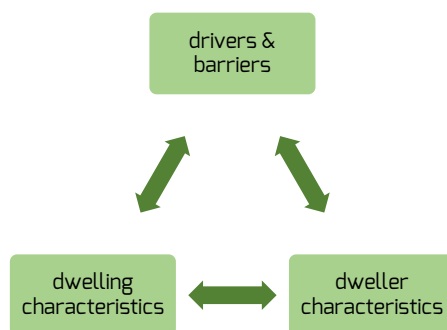


Figure 2: The relationship between dwelling characteristics, dweller characteristics, drivers and barriers

## 1.2 LEARNING FROM OTHER PROJECTS

In this report the REFURB project builds upon the results of other projects, surveys and research. In all six REFURB countries, partners conducted a desktop research on the available studies within the country. In this chapter, the findings of two pan-European reports are presented: the ZenN-project (EU 7th Framework-project), and the study “Europe’s buildings under the microscope” from the building Performance institute Europe (BPIE).

### 1.2.1 The ZenN-project: common barriers in decision making in renovation projects in EU

The project “Nearly Zero energy Neighbourhoods” (ZenN)<sup>2</sup> is being implemented from 2013 – 2017 and is funded through the EU's Seventh Framework Programme (FP7). In the ZenN- project, residential areas in Sweden, Norway, Spain and France will function as nearly zero energy building (NZEB) renovation demonstration projects where a number of measures will be implemented in connection with renovations.

Whereas REFURB focusses on both drivers and barriers at the decision-making level in renovation projects, the ZenN project only identified the **barriers**.

<sup>2</sup> <http://zenn-fp7.eu/>

*Table 1 Barriers and challenges of forerunning retrofitting / renovation projects as identified by the ZenN project. Source: ZenN, D1.1. Report, 2013*

Barriers and Challenges	Main issues
Technical	Technologies and innovative solutions
Financial	Schemes and financial incentives, balance between cost and solution
Social	Engagement, awareness, behaviour of all stakeholders, architectural and cultural heritage
Environmental and health	Life cycle perspective in design; quality of the indoor environment
Organisational/legal	Legislation, governance and policy; Project management; Stakeholder/ Ownership structure

Based on a literature study, five categories of major challenges and barriers were identified in the ZenN-project (Table 1): technical, financial, social, environmental and health, and organisational/legal. The categories of barriers and challenges can be experienced throughout the whole process of deep retrofits, from awareness raising up to the final completion, i.e. the full potential customer's journey.

For example, it is recognised that there are financial challenges for NZEB although if there are fiscal incentives and business models available.

- There is a long payback period taking between 15-30 years and residents do not stay long enough in a house to benefit from this payback period.
- There are issues where the landlord cannot raise rents for rental dwellings.
- There are very little financial instruments available in the EU that are aimed directly and exclusively at supporting NZEB renovations.

The ZenN project concludes that **many barriers and challenges** in the effective realisation of residential NZEB renovations are **similar among countries**. But it is recognized that there are also other challenges and barriers that are more **country-specific** and are just as important as the ones in common. The main barriers and challenges in common in current practice in Europe are outlined:

#### **Common barriers in the decision-making process:**

- Technical barriers: Existing building structure and technical system limit the choice of technical solutions that can be used but where technical solutions can be found, they are often costly and not financially viable.
- Financial barriers: Investment cost too high
- Social barriers: Lack of knowledge and/or interest in energy efficiency among residents and building owners, often due to lack of awareness combined with challenges with architectural and cultural values
- Environmental/health barriers: No common environmental/health barriers were highlighted

**Common organisational/legal barriers:**

- The ownership structure and need for consensus among several homeowners can hinder an NZEB renovations

**Common challenges of the retrofitting process:**

- Technical challenges: Existing building structure and technical systems limit the choice of technical solutions possible for NZEB renovations.
- Financial challenges: Building owners are unlikely to make a return on investment
- Social challenges: The need for communication and information early in the renovation process to increase acceptance among residents
- Environmental/health challenges: The risk of moisture must be taken into consideration when making a building more airtight
- Organisational/legal challenges: The need for an extensive communication between involved organisations and actors early in the process

## 1.2.2 Europe's buildings under the microscope (BPIE, 2013)

BPIE, the Buildings Performance Institute Europe, has undertaken a survey across all EU Member States, Switzerland and Norway reviewing the situation in terms of the building stock characteristics and policies in place.<sup>3</sup> The data collected was also used to develop scenarios that show pathways to making the building stock much more energy efficient, in line with the EU 2050 roadmap.

In this study, BPIE researched what is important for policy making to better understand the factors that affect decisions of homeowners. This should allow to design and implement policies that will more effectively promote energy efficiency investments and actions. The BPIE survey included the collection of information on specific barriers within the individual countries, reflecting the priorities and differing circumstances affecting implementation and improvements.

BPIE observes that in simple economic terms there is a large untapped cost-effective potential for improving the energy performance of buildings which proves that consumers and investors, as well as society in general, are not keen on investing in energy saving. Market dynamics, however, do not always follow a straight path and there is a multitude of reasons why consumers or building owners make specific decisions. **There is a need for a better understanding of why consumers act the way they do, often defying the logic of conventional economic theory.**

This study points out that it is clear that a multitude of barriers is severely limiting the achievement of the full potential. A combination of barriers is responsible for this underperformance. There are many ways to classify barriers. The BPIE survey identified the following four main categories of barriers that have a particular impact on existing buildings (Figure 3):

- Financial
- Institutional and administrative
- Awareness, advice and skills

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<sup>3</sup> BPIE, 2013

- Separation of expenditure and benefit

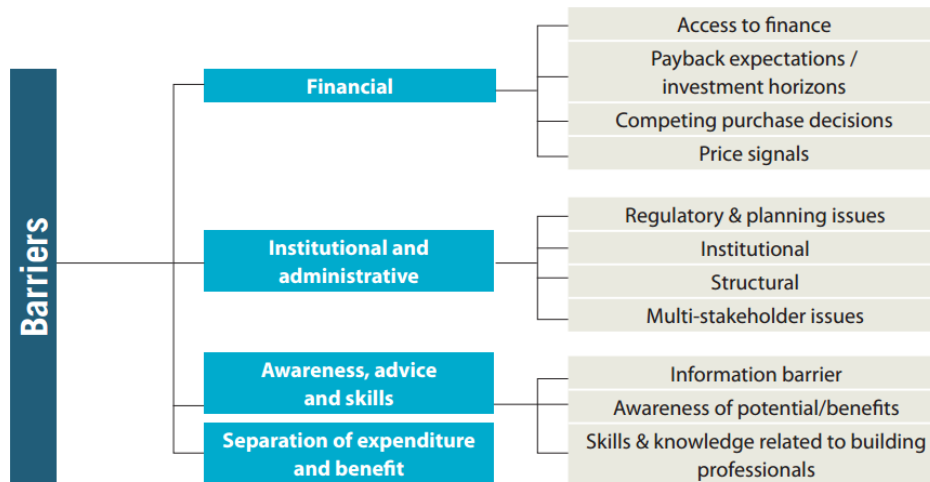


Figure 3: Classification of barriers as identified by the BPIE survey. Source: BPIE, 2011

The BPIE-report concludes that a better understanding of the decision making of consumers beyond the logic of conventional economic theory is needed. This conclusion is shared in the report<sup>4</sup> of the Energy Efficiency Financial Institutions Group. This group was established as a specialist expert working group by the European Commission and United Nations Environment Programme Finance Initiative (UNEP FI), and focussed specifically on financial drivers and barriers. For private residential buildings, EFIG members collectively saw energy efficiency investment demand drivers being more related to:

- individual payment capacities, which in turn is linked to consumer priorities and preferences;
- ease of undertaking investments (simplicity and the impact of financial and non-financial transaction costs);
- the need for tailored financial products; and
- the need for fiscal support in certain circumstances.

This suggests that success in unlocking energy efficiency investment demand from homeowners requires tailor-made solutions to tackle financial barriers and to change investment priorities. While not identified as key priority as it was not within the scope of the report, it is also clear that EFIG feels that **awareness, communication and marketing** is a priority to support the demand for energy efficiency investments in private residential buildings.

### 1.2.3 Drivers & barriers in different stages of decision-making process

A decision-making process for NZEB renovation goes through several stages. Homeowners meet different barriers at every stage. This is illustrated in Figure 4, from a study of Christian A. Klöckner, a social psychology academic (Klöckner, 2013). Klöckner focusses on the *several stages of intention*.

Four stages of intention are defined:

<sup>4</sup> EFIG, 2015.

1. "no intention",
2. "goal intention",
3. "behavioural intention",
4. "implementation intention".

Moving from each stage to the next, a number of barriers are detected, and a set of facilitators are described.

For example, barriers to move from "no intention" to "goal intention" are: homeowners are renting their house, or they have no money available, or they need to agree with the neighbours. Examples of barriers to move from "behavioural intention" to "implementation intention" are to be unsure about information about insulation, or a payback period that is too long.

Examples of "facilitators" to move from "behavioural intention" to "implementation intention" are: an increased quality of the house, more comfort, or reduced energy costs. These "facilitators" are similar to what in the REFURB project are called "drivers".

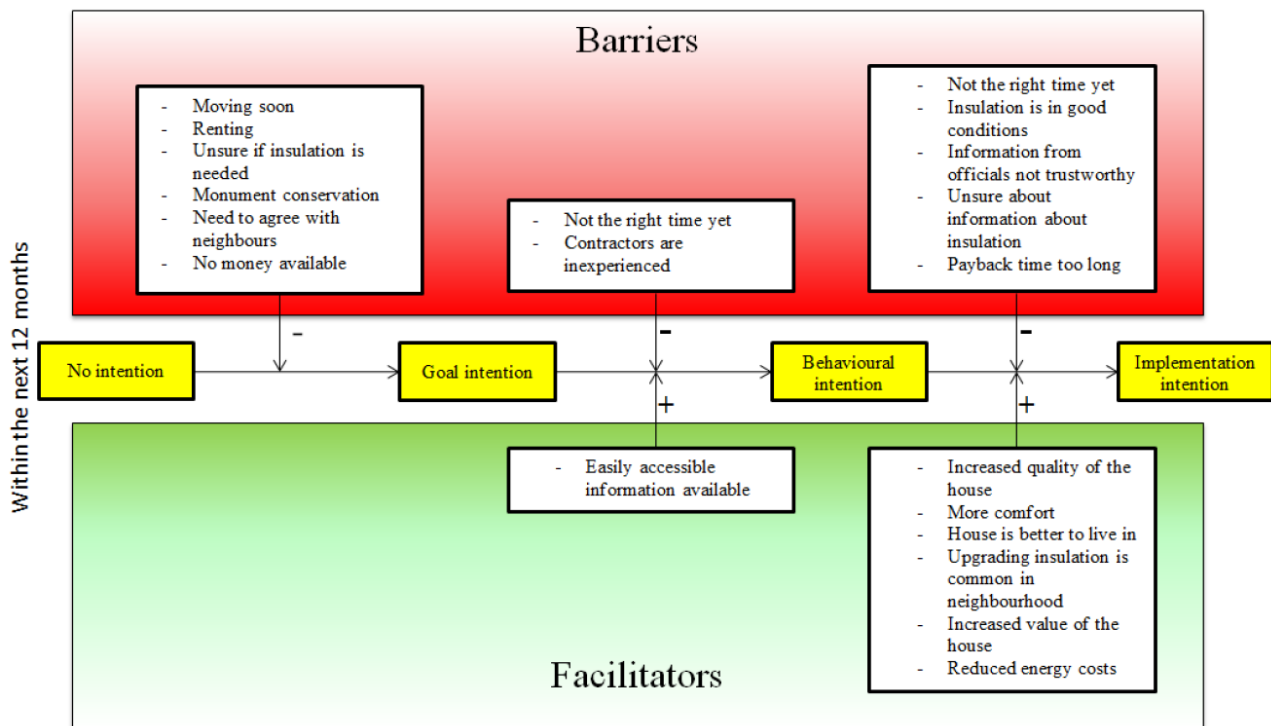


Figure 4: Christian A. Klöckner, NTNU, Norway, 2013

## 1.3 REFURB FRAMEWORK FOR CLUSTERING DRIVERS AND BARRIERS

Based on the insights of the abovementioned projects, the country reports and the conclusions of task 2.1 (housing market segmentation), a thematic clustering of drivers and barriers will be used in the REFURB project (Figure 5):

- **Technical drivers and barriers**, linked with the dwelling characteristics and the challenge to renovate to NZEB standards.
- **Financial drivers and barriers**, linked with the financial possibilities of the dweller and the cost of the NZEB-renovation.
- **Social and behavioural drivers and barriers**, linked with the decision making process of the dweller, so including the behaviour, attitude of the dweller, as well as the (social) conditions to take a decision.
- **Context drivers and barriers**. These are rather external factors, not directly linked with the dweller or dwelling characteristics, but deal with the particular situation or context the homeowner has to deal with. E.g. legal and administrative issues, tenant-landlord issues, organisation of the building sector etc.

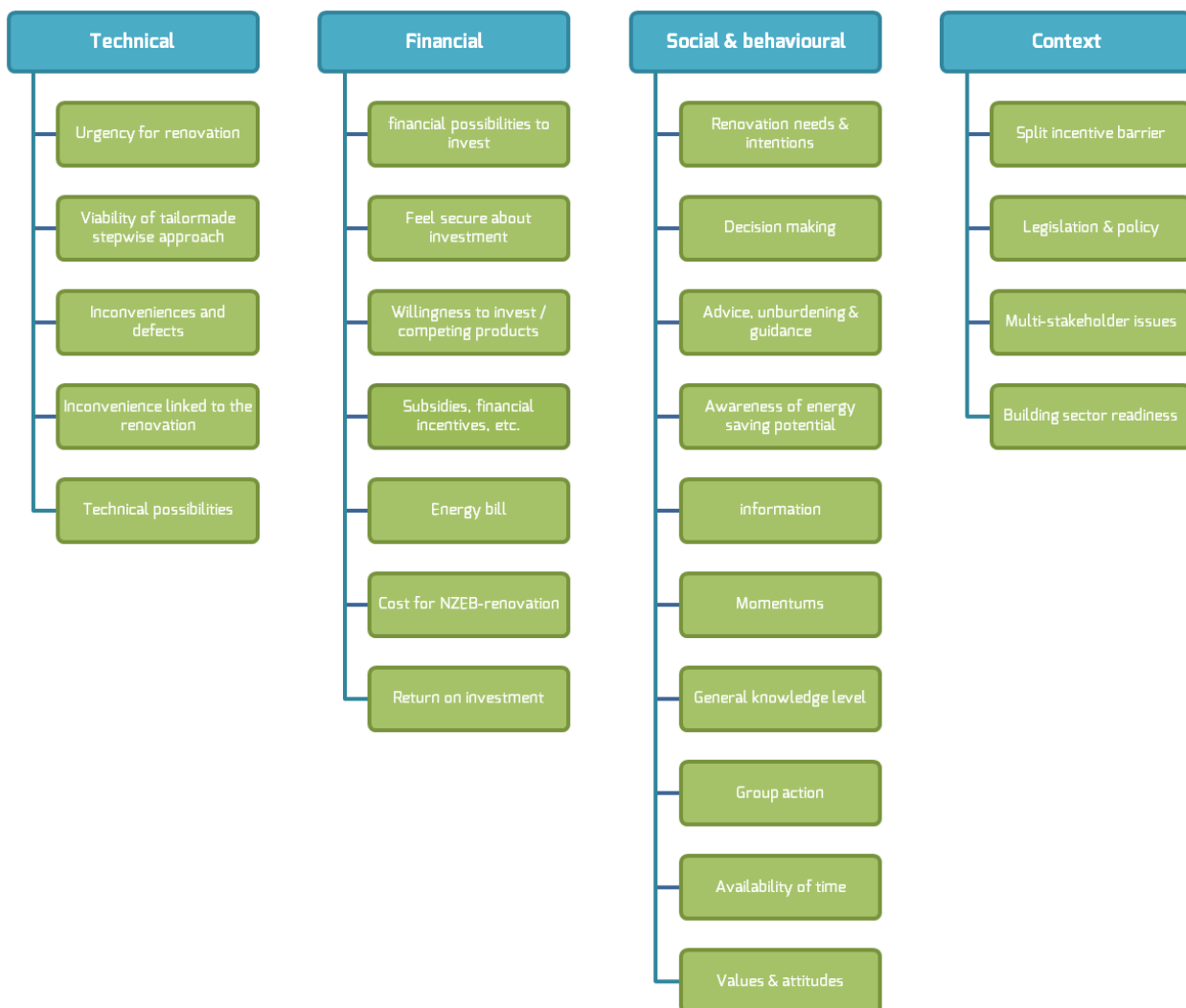


Figure 5 Clustering of drivers and barriers for NZEB renovations, based upon BPIE (2013) and the ZenN project

Within these clusters, especially in the clusters on financial and on social and behavioural drivers and barriers the following two segments might deserve particular attention:

- **Owners that are aware that their house needs renovation:** for this group the goal will be to gain insight in the motivations that the owners have to invest or not.

- **The latent demand side:** owners that are not enough aware that their house needs renovation. For this group it is important to understand why people are not aware of the fact that renovation brings added value. The central question is: how can one be made aware that his/her house needs renovation?

## 1.4 TAILORING THE DEMAND SIDE DRIVERS TO LOCAL CONDITIONS

This report (D2.4) is a modified report of D2.2, integrating an overview of relevant local parameters. The local parameters are related to the demand-buy drivers identified in report D2.2.

This report is based on available research, combined with the knowledge and experiences of the partners. To tailor the drivers to local conditions, the local available information on the drivers and barriers to implement energy efficiency renovations is processed.

The central question to process the available local information was: *“Is there a specific local condition, different from elsewhere in the EU, which makes this a more/less important driver to convince more homeowners of the benefits of NZEB-renovation? E.g. because of building tradition, climate, history and culture, public acceptance of sustainable energy, other segmentation characteristics (report D2.1)...”*.

Although it is possible to identify specific local conditions, an in-depth comparison of the extent to which local conditions differ from the generic drivers and barriers is beyond the scope of this report. A thorough study at EU level was not available. The results of the analysis are indicative and illustrative, especially since the REFURB-regions only partly cover the EU.



## 2 Technical drivers & barriers

A first set of drivers and barriers is linked with the dwelling characteristics and the challenge to renovate to NZEB, and have a technical dimension.

### 2.1 URGENCY FOR RENOVATION & LOCK-INS

This is identified as the most important driver for NZEB-renovation: to create win-wins between urgent or necessary renovations and NZEB renovations through integrating the energy renovation in one single renovation process.

E.g. houses that need refurbishment (e.g. new roof, new kitchen, painting, flooring, bathroom...), houses with safety and/or sanitary issues (e.g. risk for CO-intoxication, moisture, mould), worn-out doors and windows, leaking roof, sagging timbers, end-of-lifetime heating installations etc. **Investments need to be done anyhow**; the integration of NZEB-ambition results in an additional investment but this creates a win-win in terms of investment and efforts to organize a renovation process.

A lock-in situation is a frequent technical barrier to implement a cost-optimal NZEB-concept. A lock-in appears when recent partial renovations were not on the NZEB-level. E.g. if the thermal performance of a roof is  $0.30 \text{ kWh/m}^2\cdot\text{a}$  whereas it should be maximum  $0.24 \text{ kWh/m}^2\cdot\text{a}$  for an NZEB-building.<sup>5</sup> It is not interesting to re- renovate the roof as the cost will not be in balance with the benefits. Other (more expensive) solutions will be needed to compensate this situation.

**If a house is in good state, then this can be a barrier for deep NZEB-renovation.** Especially if the thermal performance already reaches a certain level. Every building element has a certain lifespan before it needs renovation, and this creates lock-ins. Another examples of a lock-in is a high-temperature heating system (incl. radiators), which is not preferable in combination with a heat pump (a common technique in an NZEB building).

#### 2.1.1 Local critical success factor: annual renovation rate

A higher annual renovation rate offers more opportunities to integrate NZEB-ambitions in the expected renovation cycle of dwellings. The estimated annual renovation rates in **Germany** range between 1% and 2%, with reference to the insulation of outer walls, roofs/top floors and basements floor ceilings. The annual replacement ratio of the heating supplies in residential buildings is about 3%. The average annual renovation rate, referred to residential buildings in Germany, is about 1%. Renewable energy is not widespread yet.

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<sup>5</sup> Exemplary values.

## 2.1.2 Local critical success factor: pilot NZEB in social housing sector or through housing corporations

One indirect factor that may be (indirectly) relevant is the relatively high percentage of housing corporations in the **Netherlands**. The NZEB solutions being developed in the Netherlands are mostly focussed on implementation in the social housing sector. This provides a large housing stock where, in theory, solutions also suitable to private owners are being developed. Indirectly then, the higher urgency to develop these solutions could offer a greater opportunity for the solutions in the Netherlands to be applied in private homes and even in other countries. The recent promotion of the ‘Stroomversnelling’ (Transition Zero) in the UK and France is maybe an example of this.

## 2.1.3 Local critical success factor: share of apartment buildings

**Estonia** has a high share of apartment buildings. Historically multi-apartment buildings are owned by a cooperative e.g. every apartment has a different owner. This leads to situations where achieving common perception of renovation measures is critical. There is a danger of agreeing upon “lowest common denominator” - measures with costs that are acceptable for everybody, which usually are the least expensive. Unfortunately such measures tend to be the most inefficient and almost certainly create a lock-in both technically and financially as inefficient measures do not contribute to lowering living costs.

## 2.2 AVAILABILITY OF TAILOR-MADE STEPWISE APPROACH FOR NZEB-RENOVATION

Carrying out a deep renovation can be infeasible, e.g. because of practical or financial reasons (no budget, no possibility to move out of the house etc.). The option to stage the deep NZEB-renovation into **several phases** which can be carried out over a longer period can be a convincing driver for NZEB-renovation.

### 2.2.1 Local critical success factor: share of staged renovations

An integrated concept on NZEB-renovation is usually lacking in staged renovations. In **Belgium** and **Slovenia**, the majority of the renovations are staged, thus spread out over time. This does not only apply to the comfort improvement, but also on the improvement of the energy performance.<sup>6</sup> Deep (energy) renovations are rather limited, but growing in number.<sup>7</sup> The latter is also owing to the strong link with the financial capacity of homeowners as renovation measures are taken when budget becomes available.

Also in **Denmark**, there is no tradition for deep energy renovation, and people are not used to “moving out” to improve the house. Many Danish homeowners engage in staged renovations, but they want to have the money in the bank instead of lending money for a renovation project.

<sup>6</sup> E.g. in 2015, 36% of the homeowners in Flanders intended to invest in energy efficiency. This is a considerable share of all dwellings. But only 11% has the intention to invest in 3 or more elements (e.g. roof insulation, wall insulation, photovoltaic solar energy, thermal glazing, and energy performant heating...). From: Vlaams Energie Agentschap, 2015

<sup>7</sup> The median budget spent on renovations in Flanders in the last 10 years is €22,000 in total, the average € 36,000. This indicates the low share of deep renovations, which require higher budget. From: Kathleen Van den Broeck, March 2015

If undertaking renovation measures step by step is a tradition, the long-term NZEB end result can, however, provide for a clear goal for homeowners and make it easier for them to decide upon which step to take instead of having to decide upon commercial advice<sup>8</sup>.

An approach of stepwise renovation is not encouraged in **Estonia**. Subsidies for renovation can be only applied for in case of a deep renovation.

### 2.2.2 Local critical success factor: pilots demonstrating staged NZEB-renovation

With the introduction of the project 'Stroomversnelling Koop'<sup>9</sup> in the **Netherlands** there has been some recent development of schemes and more encouragement to design and offer NZEB solutions. The progress of this scheme is slow. Pilots have been more extensive though than in past years. This does give a potential base in the Netherlands; maybe more than in other European countries, to kick start a market for NZEB solutions.

In **Germany**, the energetic requirements and regulations are associated with public subsidies and loans, provided by KfW-Bank that develops specific standards ('KfW-Effizienzhaus'). But an overview on how to renovate towards NZEB is missing in all steps of the scheme, from communication to implementation. So uncertainties due to prejudice and fear can be the reason, that energetic measures are only executed partially.

In **Estonia** there is not enough technical expertise available to homeowners to avoid lock-ins when renovating step-wise.

## 2.3 INCONVENIENCES AND DEFECTS

If a house is dealing with a lot of inconveniences and shortcomings, energy renovation becomes a driver. Wind leaks, condensation on windows, moisture problems, noise, creaky floors etc. can be solved because of the NZEB-renovation measurements, e.g. ventilation and new windows. People do not only choose for better energy performance, but also to experience the comfort of living in a house with reduced inconveniences and defects. Off course, the related required financial possibilities for investment might be a barrier (Chapter 3).

To **create a healthy dwelling** is a driver to tackle the inconveniences and defects as moisture and draft problems. A better indoor climate should be the result of an energy renovation, if this is done properly. If not, there is a risk to create unhealthy houses, e.g. when installing airtight windows without implementing an appropriate ventilation system. Poorly executed renovations, unfortunately, set bad examples and make people doubt. They turn the positive health argument a (false) barrier due to misperception.

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<sup>8</sup> An example of such an approach is the Sanierungsfahrplan in Baden Württemberg in Germany.

<sup>9</sup> <http://www.stroomversnellingkoopwoningen.nl/>

### 2.3.1 Local critical success factor: share of dwellings with poor building quality in the building stock

**Belgium** has a high share of old single family houses.<sup>10</sup> Inconveniences and defects occur more often in older houses, e.g. because they are more worn out. Moisture problems often occur in older houses, e.g. in low-lying areas with high groundwater level or when there is little ventilation. This creates health issues.

The majority of the **Estonian** housing stock was built between 1960 and 1990 and consists of concrete block multi-apartment houses. Poor airtightness of windows was a built-in feature of these houses to provide enough ventilation. As home owners started to renew their windows to modern airtight ones the ventilation was cut and moisture problems appeared, often severe. In Estonia renovation is encouraged only if it also takes into account providing good quality indoor climate – category II of EN 15251 or better.

**Slovenia** has a share of around 70% of single family houses which were built mostly in the period from 1946 onwards. After 2002 the number of new buildings has been reduced. Older buildings usually contain no or no adequate insulation, the heating devices are rather old with high a share of emissions, some older buildings haven't got a basement, therefore there is a lot of water/mould in the houses.

## 2.4 INCONVENIENCE LINKED TO THE RENOVATION

An NZEB-renovation which is feasible within a short timeframe is definitely an important driver, with the possibility to continue living in the house during the renovation, with little dust caused by the renovation works etc.

The contrary is a barrier: the need to move out of the house for a certain period, the dust, the noise, the long period of works. Some people just don't want to have any works in or around their house.

In some projects of the 'Blok voor Blok' renovation program in **the Netherlands**<sup>11</sup>, homeowners can stay for e.g. two days in a hotel during the works. This way, the barrier is overcome and for some people this even became a driver for NZEB-renovation. Another example is from **Denmark**, where a temporary dwelling was made in a container and set up in the garden as part of the renovation project.

## 2.5 TECHNICAL POSSIBILITIES AND LIMITATIONS

**Technical possibilities or rather technical limitations** are a barrier. E.g. not every house with a pitched roof allows for the installation of solar PV panels when the roof has the wrong orientation. Is district heating available, and is the district heating fed by renewable energy?

Resistance to the installation of new techniques or energy efficiency measures is also possible, due to concerns about the **maintenance** of the new installations (e.g. solar thermal, heat pump), or justified and unjustified concerns about repercussions that are associated with energy efficiency measures (e.g. poor indoor air quality, moisture problems, reduced cell phone coverage etc.)

<sup>10</sup> REFURB report D2.1, "Demand side segmentation in EU and regions". 40% of is built before 1945, whereas in EU this is limited to 28%.

<sup>11</sup> <http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/blok-voor-blok>

The homeowner also might resist available technical possibilities for other reasons, e.g. their **aesthetics**. This can be the case for solar energy, or for external wall insulation which changes the appearance of the building. If the technical possibilities can't overcome this, then limited technical possibilities are a barrier.

## 2.6 LESS IMPORTANT DRIVERS & BARRIERS

Numerous drivers and barriers can be listed. In some cases or contexts, these will prove to be (very) important. In general, they can be considered as less important:

- A dwelling with historically valuable facade, interior, plan, in a conservation area etc. faces more technical barriers as the house needs very different NZEB-concepts in order to preserve these valuable characteristics.
- The energy performance of the house can be a driver if the EPC is bad, so the energy renovation is interesting to increase the EPC if the other drivers behind a good EPC are strong enough (increased resale value? etc.) When the house has a good EPC, this can be a barrier if there are lock-ins.
- The house is too old to invest in, no need for any renovation.

## 3 Financial drivers & barriers

A second set of drivers and barriers is linked with the financial possibilities of the dweller and the cost of the NZEB-renovation.

### 3.1 AVAILABILITY OF FINANCIAL POSSIBILITIES TO INVEST

**Lack of funds** and/or inability to secure financing on acceptable terms is generally the most cited barrier to investing in energy efficiency measures. E.g. the homeowner has no savings, can't afford an extra loan etc. If people reach their financial limit when buying a house, they have no money left for renovation. People in energy poverty have a low income and have no budget to invest but need to spend a considerable amount of income to their energy bills, in proportion with their income this exceeds 10%.

Having an amount of **money to invest** (e.g. savings, a legacy) can be a huge driver, and create the right momentum to invest.

#### 3.1.1 Local critical success factor: wealth of population

The **Danish** housing stock has improved considerably over the past fifty years or so and, on average, Danes have good dwellings with ample space. However, there are still hard-pressed groups in the Danish housing market. And there are great differences in terms of welfare and financial situation between residents of the various housing types.

The wealth of the **Belgian households** is amongst the highest in the EU.<sup>12</sup> Belgians generate a lot of savings.<sup>13</sup> These savings offer a potential for energy investments, but it is not always the households with the savings that own a dwelling in need of an energy renovation. However, the high level of wealth is affected by the high ownership. The value of real estate is the main component of the savings of Belgian households. This means that (1) the funds for energy efficiency investment might be limited; (2) there is a tradition to invest savings in the dwelling.

In **Slovenia**, due to financial barriers (rather low monthly income) generally, people cannot afford bigger investments, or have limited possibility to get a loan – since banks demand either long-term employment or a mortgage on the house. Mostly people do not want to take loans and they rather wait until they have enough money in their own pocket to invest. Only some of them use national incentives (in the case the contractor for works arranges everything for them).

#### 3.1.2 Local critical success factor: height of mortgages.

The percentage of **Dutch** homeowners who have to finance their homeownership through a 100% mortgage is high compared to other European countries. This may be a barrier to financing NZEB renovations<sup>14</sup>.

<sup>12</sup> The "Household Savings Rate", defined as gross saving divided by gross disposable income, is amongst the highest in Europe. From: European Central Bank, April 2013

<sup>13</sup> Eurostat, <http://ec.europa.eu/eurostat/web/products-datasets/-/teina500>

<sup>14</sup> Eurostat, Distribution of population by tenure status, 2014 (% of population)

## 3.2 FEEL SECURE ABOUT INVESTMENT & SAVINGS

Spending money is connected with a feeling of insecurity, which is a barrier. Homeowners need to feel confident about the NZEB-investment; that it is the right investment: value for money. Homeowners must feel confident that the solution is future-proof: it needs to be enough for the future.

The same feeling of insecurity can exist with the expected energy savings and related cost savings. Is the amount of savings calculated by the building experts feasible i.e. will it become true?

As NZEB renovation concepts are only recently being executed it is still difficult to come with consistent proof of the increased real estate value or reduced energy bills.

## 3.3 WILLINGNESS TO INVEST IN ENERGY EFFICIENCY VS COMPETING PRODUCTS

Although the homeowner can have enough financial possibilities, the lack of will to invest in energy efficiency is a huge barrier. In many cases if it is stated that there is a lack of funds, it is more due to the **lack of awareness or lack of interest rather than the actual lack of funds**. A cause can be the competition with other household needs, e.g. preference to spend the budget on comfort improvement, the need to tackle defects, a new car, family holidays etc. Or homeowners are just unwilling to take out (another) loan.

On the contrary, this will to invest in energy efficiency is a huge driver, but only if the homeowner has financial possibilities or access to finance.

### 3.3.1 Local critical success factor: status

People like to use their money on something one can see and touch. Like a new car or a kitchen. But in **Denmark** it has become more and more normal (and visible) to invest in new windows, solar panels and things alike. A similar phenomenon is observed in **Belgium** with the boom of photovoltaic solar panels (2011-2013): a visible and respectable investment.

## 3.4 SUBSIDIES, FINANCIAL INCENTIVES ETC.

The availability of subsidies, tax deductions, financing schemes etc. is recognized as a driver. It convinces homeowners to invest. It increases their budget, e.g. to cover additional cost for NZEB-renovation. If the financial incentive only is awarded when meeting NZEB-criteria, this definitely is a driver for NZEB-renovation.

**Categories of financial instruments** that are used throughout Europe can be divided into: (1) grants/subsidies, (2) soft loans, (3) tax/VAT incentives, (4) energy supplier obligations (white certificates), and (5) third party financing / energy performance contracting.

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The **complexity** of such systems, e.g. complex administrative procedures, pre-financing of the homeowner and so forth are discouraging and undermine the effect. A lot of convinced homeowners also apply, although it was not necessary for their decision and financing (icing on the cake).

### 3.4.1 Local critical success factor: simplicity of the system of subsidies and financial incentives

In **Belgium**, many financial incentives, tax deductions and subsidies are available. These are offered by the federal, the regional and local governments, but also by the grid owners. 48% of homeowners made use of these when renovating.<sup>15</sup> Subsidies are considered to be an important driver: 45% of the Flemish would not implement energy-efficiency measures without subsidies. However, the subsidy system is perceived as too complex: 40% prefers having support to go through the administrative procedures of applying for subsidies.<sup>16</sup>

There is a complex system of subsidies in the **Netherlands**. Most are not aimed at NZEB renovations. At a local level there can be a wide range of schemes. At a national level there have been different schemes in different periods. Clearly subsidies do persuade people to carry out energy saving measures. However, policy is not consistent and varies from period to period. This causes peaks in demand for, for example, solar panels, followed by a through when subsidies are suddenly reduced.

### 3.4.2 Local critical success factor: one scheme with extensive subsidies & financial incentives

Subsidies are a very important driver for **Danish** house owners. For 2016 one can get a tax deduction of up to € 1,500 per person or up to € 4,500 per home for billed craftsmen man-hours on energy related energy renovations. The subsidy concept is well-tested in Denmark since 2013. Invoices on the craftsmen man-hours have to be attached when reporting income and expenses in the tax-bill. The energy supply companies are obliged to save energy and are therefore offering homeowners to buy their energy saving at a price of € 0.08 per kWh saved. The agreement between consumer and Energy Company must be done before starting the energy renovation project. The concept gives about € 500 - 2,000 per project.

In summer 2015 **Estonia** launched the second term of subsidising renovation of multi-apartment buildings built before 1991 which make up to 75% of overall housing stock. The subsidies reach 40% (in some cases 50%) of renovation costs and can be applied for if a set of criteria is being met. The amount of subsidy and the criteria are set and calculated in a way that the costs for homeowners including servicing of loans would not exceed the cost on housing before the renovation. In other words reduction in energy costs pays for the renovation. These subsidies are by far the main driver for renovation in Estonian multi-apartment buildings. As most multi-apartment buildings are over 40 years old they need extensive repairs anyway and as an energy renovation also means the refurbishment of the entire building envelope the incentive is very attractive. Although the scheme has by now approved a significant number of cases there is still a lot of scepticism especially among elderly homeowners when dealing with relatively large sums.

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<sup>15</sup> Ceulemans W & Verbeeck G., March 2015



In **Slovenia**, the only financial instrument is a national financial incentive: the ECO fund. The financial resources for Eco Fund's grants are gathered under the Regulation on energy savings ensured to final customers. The grant from scheme is 15-25% of the entire investment. Since Slovenia doesn't have a second level of administration – regional support mechanisms does not exist.

In **Germany**, the energetic requirements and regulations are associated with public subsidies and loans, provided by KfW-Bank that develops specific standards ('KfW-Effizienzhaus'). KfW developed systems of loans or subsidies that you can receive either for the achievement of a certain KfW level (new buildings, refurbishment) or single appliances/measures (refurbishment only).

### 3.4.3 Local critical success factor: subsidies and financial incentives for NZEB

In the **Netherlands**, there are no national subsidies for NZEB-renovations<sup>17</sup>. At a local level there are some new subsidies aimed specifically aimed at NZEB in the province of Overijssel<sup>18</sup>. There is increasing interest at introducing subsidies for NZEB type renovations in different provinces, including in Friesland and Groningen. In Groningen, partly because of the current debate about the need to renovate houses after local earthquakes due to gas extraction, the idea to renovate to NZEB-level has been gaining more support and is often referred to in plans<sup>19</sup>. In general, there is a growing interest in NZEB concepts. This is partly due to the 'Stroomversnelling', the innovation agenda that is being implemented in some areas of the country. This has resulted in detailed discussion about what works and does not work, in terms of technical, financial and social barriers.

## 3.5 ENERGY BILL

The energy bill is the result of energy prices, the energy performance of the dwelling, and the energy use pattern of the dweller. So this driver/barrier can be attributed to the dwelling and dweller.

Reducing the energy bill is a main driver for NZEB-renovation. It is a short-term effect of the renovation which can last for a long time. This short-term effect is important.

On the contrary, a low energy bill can be a barrier for a NZEB-renovation. Even if the house has a bad energy performance, the low energy bill can be the result of the energy use pattern. Or, e.g. the house is heated with "free" wood that the owner gets from his property.

For most households, energy bills for the home account for 3-4% of disposable income, hence they are not a major concern. The higher the income, the lower the proportion of the energy bill in the household income. Energy poverty (energy bills account for more than 10% of the income) occurs mainly with low-income homeowners. But here the financial possibilities are limited.

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<sup>17</sup> <http://www.rvo.nl/onderwerpen/duurzaam-ondernemen/gebouwen/energieneutraal-bouwen>

<sup>18</sup> Maximum of € 8.000. <http://www.overijssel.nl/loket/subsidies/@Fbp/proeftuin/> and <http://duurzaambouwloket.nl/mindcms/js/ckf/userfiles/files/Uitvoeringsregeling%20subsidie%20NH.pdf>

<sup>19</sup> For example: *Meerjarenprogramma Aardbevingsbestendig en Kansrijk Groningen 2016-2020*

## 3.6 COST FOR NZEB-RENOVATION

Usually the (high) cost of NZEB-renovation is the barrier, although a low cost for NZEB-renovation can be a driver. This barrier must be seen in relationship with the access to finance the homeowner has, his, or her willingness to invest, the expected return on investment, “competing products” (e.g. a new car) etc. For example, the investment cost is too high because the return on investment is too low, or because the homeowner does not have the financial possibilities to invest.

The high cost of a deep NZEB-renovation can be an argument to stage the renovation into several phases. So a concept for a staged NZEB-renovation might be a technique to tackle this barrier.

Not only the cost itself, but also the lack of information about the cost is a barrier, especially when buying a house. A better view on this cost could have an influence on the market price of houses which require significant renovation efforts.

## 3.7 RETURN ON INVESTMENT

Most building owners and investors across Europe tend to focus on solutions with short or medium payback periods (less than 10 years).<sup>20</sup> Ambitious energy and climate policies require savings up to 80% energy in buildings, which can only be reached through NZEB renovations. An NZEB renovation’s payback time is between 15 to 30 years (or more, depending on energy prices) and it is often not appreciated by most property owners or financial institutions. Requirements for a short return on investment are therefore a barrier to the NZEB standard.

## 3.8 OTHER FINANCIAL DRIVERS & BARRIERS

Numerous drivers and barriers can be listed. In some cases or contexts, these will prove to be (very) important.

- The **resell real estate value**: value of the house is secured after renovation; thus this is a driver, but there is uncertainty on the impact on the value as long as there is lack of proof on the increase of the value thanks to better energy performance, and second it is still unclear whether this increased value can compete with the investments made (capital expenditure) minus the savings on the energy bill (lowered operational expenditure). This driver-barrier is linked to the return on investment driver-barrier, except for the fact that this one is probably more important for people who are already thinking about reselling.
- **Energy prices** (cost per unit of electricity, gas, oil, and heat, wood) can be a driver (if rising) and a barrier (if they are too low, if prices go down). These can be very important, additionally the differing energy prices for different energy carriers can form barriers or drivers for either option, for example renewables versus fossil fuels.

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<sup>20</sup> ZenN, 2013

# 4 Social and behavioural drivers & barriers

A third set of drivers and barriers is linked with the decision-making process of the dweller, so including the behaviour and attitude of the dweller, as well as the (social) conditions to take a decision.

## 4.1 RENOVATION NEEDS & INTENTIONS: INCREASE COMFORT LEVEL, COSINESS, PERSONALIZATION, TASTE, ADJUST ARCHITECTURAL CONCEPT ETC.

This is considered the main driver for NZEB-renovation. **For the overall majority of the homeowners, energy efficiency is not a main reason to start a renovation.** They want to increase comfort level, cosiness, personalization, taste, the looks, adjust architectural concept etc. Integration with NZEB-ambitions is a key challenge.

The direct improvement of the thermal comfort of an NZEB-dwelling is an asset: during wintertime, the dwelling "feels warmer" because walls, windows, floors and/or roofs do not feel cold. The entire house can be used in the winter because all rooms are warm (in a non-energy performant house the heating is often limited to the living room and kitchen). The air quality is better because of good ventilation. During the summer, the risk of overheating should be reduced etc.

Simultaneously, the non-energy renovation needs are a barrier, as they are competing with the energy efficiency needs and might block NZEB-ambitions.

If homeowners have the intention to renovate (also non-energy), this is a driver. However, there might be the issue of "competing needs" which is a barrier, e.g. the intention is limited to non-energy renovations, and energy renovations are hard to integrate (practically, financially etc.)

An energy renovation might change the look of the house, e.g. as a consequence of facade insulation, a new external wall finishing is needed. If homeowners are attached to the looks of the ancient facade, the idea of changing the look of the house can be a barrier.

## 4.2 DECISION MAKING, SELF-RELIANCE & EMPOWERMENT

Homeowners need to make a decision to invest in NZEB-renovations. Homeowners take decisions in a different way, based on their personality. **Most of the decisions are not taken on the basis of rational arguments** like energy savings, cost savings etc. and this is a major barrier from a classical traditional economic point of view (see REFURB report D 2.1). Homo rationalis or homo economicus doesn't exist. For some people it is very difficult to take decisions, they need to feel safe about their choice (Am I doing the right thing?), want to base their choice on people they trust etc.

In particular cases, e.g. in apartment buildings with multiple owners, **leadership** also is important. A lack of leadership in the homeowner association is a barrier, good leadership is a driver. It makes the situation more difficult if there is no competence in construction business available. A decision-making process requires cooperation and trust.

## 4.3 ADVICE, 'UNBURDENING' & GUIDANCE

The availability of tailor-made advice, renovation guidance and 'unburdening'<sup>21</sup> processes are drivers for homeowners to renovate. This can be very intense (e.g. homeowners are being helped in every step of the renovation), but also be very limited (e.g. a group purchase of solar photovoltaics).

Assisting people in the many choices they make during the renovation process is a driver, as well to overview the correct execution of the work, as to complete the administration, the application for subsidies etc.

This driver is a concrete example of how the barrier of the heavy burden or hassle of a renovation has been overcome.

### 4.3.1 Local critical success factor: successful pilots and demonstration projects

Successful pilot projects throughout Flanders (**Belgium**) have shown the potential of unburdening as a driver in Flanders (cf. REFURB report D2.3). This is confirmed by the conclusion of a survey: 51% of the Flemish considers personal advice as an important driver. They want to have an advice on the works they need to carry out. 43% state that they need somebody to supervise the correct execution of the energy efficiency works and 32% would need support to find a contractor.<sup>22</sup>

Successful pilot project in Sonderborg in **Denmark** have shown the potential of unburdening as a driver in Denmark. To help answering the homeowners question "what needs to be done", the ZEROhome program offered a free energy review/consultation carried out in their homes. The consultant name was Charlie, and he became a synonym with the ZEROhome program. During the consultation the energy consumption was reviewed, improvement opportunities and cost discussed and an action plan defined.

In **Slovenia**, the implementation of several EU and regional projects with concrete solutions and savings in the past few years have been a driver for homeowners to renovate.

### 4.3.2 Local critical success factor: obligations for guidance

Renovation subsidies in **Estonia** include requirements and provisions for consultancy. Every major renovation project of a multi-family home (e.g. apartment building) has to hire a technical consultant and an independent building supervisor. The role of the technical consultant is almost exactly what is meant to be "unburdening" and also to avoid the lack of technical and organisational expertise. Lessons learned from renovation of older multi-family homes in the period of 2010 to 2014 include the acknowledged need for better supervision, support and quality control of renovation processes. These features are included in requirements and provisions of the current renovation subsidies. Additional to technical consultancy and building supervising also free expertise on technical designs of renovation is available. The latter also checks if the target for energy consumption reduction of a specific project is relevant and feasible.

<sup>21</sup> Unburdening, deburdening, dehasling are all synonyms

<sup>22</sup> Vlaams Energie Agentschap, 2015

In **Slovenia**, a national network of counsellors (paid by the national ECO fund) is available, but homeowners usually do not use them. In this context, this system is not considered to be an incentive to start a renovation.

## 4.4 AWARENESS OF ENERGY SAVING POTENTIAL

Many homeowners are not aware of the energy and cost saving potential, even if there is general appreciation that energy saving is a “good thing”. Homeowners may feel they are helping the planet by installing solar panel systems, without realising that far greater savings could be achieved from roof insulation.

### 4.4.1 Local critical success factor: gap the bridge between awareness and action

70 percent of the **Danish** homeowners are “interested” or “very interested” in energy improvements in their homes. But yet only 15 percent have planned to do an energy renovation. There is thus not enough awareness to push energy renovations. Knowledge is considered significant.<sup>23</sup>

In **Germany**, there is little relation between awareness and extensive measures of energetic refurbishments. The underestimation of potentials of energetic refurbishments is widespread among homeowners. It is a well-known phenomenon that homeowners are often unaware of their energy bills (the **Netherlands**). Installation of solar panels is often chosen while floor or wall insulation can often have a greater effect financially.

## 4.5 ACCURATE, RELIABLE & TAILOR-MADE INFORMATION

The availability of independent, accurate and complete information that is trustworthy is a driver. Why should people renovate to NZEB-standards? What should they do? Who should they work with? Which renovation assistance or subsidies can they get? etc.

**The medium** conveying the information is also very important, and depends on the personality. Some people prefer to get processed information from an expert; others like to look up all information on the internet.

**Tailor-made** (non-generic) information is also considered a driver. This encompasses specific information relevant for the dwelling and the dweller. A current barrier is that homeowners have too little information on the current energy performance of their house.

Many homeowners need **an example**. The possibility to visit exemplary houses that went through a deep NZEB-renovation and similar to the own house, is a driver.

Too much **inaccurate, unreliable and contradictory information** is a barrier for people. Many people can't judge and remain undecided. The construction sector sometimes takes advantage of ignorance of homeowners by making offers that are overpriced and/or technically unsuitable. As a result, some people have no confidence in craftsmen.

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<sup>23</sup> Dansk Energi, 28 January 2015

#### 4.5.1 Local critical success factor: availability of segment-specific information

An online tool<sup>24</sup> in **Denmark** is available from December 2015, managed by the Danish Energy Agency. It divides Danish single-family houses into typologies and for each type describes typical energy saving solutions and maintenance features. Another collection of energy solutions, advises, legislations for each building part or type, calculation tools and films is available<sup>25</sup>. The centre started in 2008 by Energy Agency and always updated to newest solutions and latest building code.

In **Belgium**, there is a high share of DIY (do-it-yourself) renovation, but tailored information might be needed for DIYs to implement measurements conform the NZEB-standards. In Flanders this is organised by local authorities in so-called regional support offices or municipal advice desks offering independent advice.

Honourable mention also for initiatives such as CONCLIP (<http://conclip.eu/>), which acknowledges open-source platforms as YouTube as a good medium to reach craftsman/DIY individuals. Although the project is about PassiveHouse building similar tools could be useful for NZEB renovations.

## 4.6 MOMENTUMS FOR RENOVATION (WHY NOW?)

There are some very important moments to decide on an NZEB-renovation. These **momentums or stages in life** are drivers for renovation. E.g. the **change of ownership** is a very important momentum, or the moment a rented house changes tenant, but also the moment one has a financial windfall, or the availability of time.

Many of those moments come unannounced, so it is hard to anticipate on them. Some type of moments can be a barrier, e.g. uncertainties about the future (threat of unemployment, financial crisis, single parents etc.)

#### 4.6.1 Local critical success factor: mobility of homeownership

There is very little mobility in homeownership in **Belgium**. The expected lengths of residence in a dwelling are very long. 48% of the Flemish homeowners reside longer than 20 years in the dwelling, 64% consider the current dwelling as the final dwelling to age in. The intention to move is lower when the past length of ownership is higher<sup>26</sup>. This reduces the number of momentums for (deep) renovation, as a deep renovation is very often carried out before moving to the newly bought dwelling.

This long expected length of residence also has an advantage. The engagement of the homeowner in the state of his dwelling is high, and it creates a long-term perspective to benefit of the advantages of an energy renovation. Only 23% of the Flemish indicates they will not live long enough in the house to start an energy renovation.<sup>27</sup>

In **Slovenia** people very rarely move and they stay in the same house for generations, mostly using their own family savings together with ECO fund subsidies for renovations.

<sup>24</sup> [www.sparenergi.dk/forbruger/vaerktoejer/bygningsguiden](http://www.sparenergi.dk/forbruger/vaerktoejer/bygningsguiden)

<sup>25</sup> Videncenter for Energibesparelser i bygninger, December 2015

<sup>26</sup> The average past length of residence of homeowners is 22,5 years. The expected lengths is much more. This is this is partly attributed to high transaction costs when buying a dwelling. In the private rental market, the average past lengths of residence is 7 years. From: Pannecoucke I. & De Decker P., March 2015

<sup>27</sup> Vlaams Energie Agentschap, 2015

The percentage of **Dutch** homeowners that plans to move within 2 years is around one third to one quarter<sup>28</sup>.

## 4.7 GENERAL KNOWLEDGE LEVEL

(NZEB-) renovations require knowledge and competences, to process the information, take decisions and manage a renovation project.

A lack of knowledge is a clear barrier against measures of energy efficient, as well as and knowledge about the opportunities that come with it and the overestimation of the energetic standards of buildings. Information and knowledge on the subject might differ very much from owner to owner.

## 4.8 NEIGHBOURHOOD ACTION, GROUP ACTION

A neighbourhood approach or a group action has proven to be a big driver. The concentration of similar houses in a neighbourhood allows for a replication of NZEB-solutions.

A social network –neighbourhood-based or not- allows to create a renovation dynamic amongst homeowners, e.g. with homeowners who pioneer and others who like to follow, homeowners who cooperate in finding craftsmen etc.

### 4.8.1 Local critical success factor: national framework to organize collective action

The situation in the **Netherlands** provides two factors that differentiate it from other countries: (1) The project ‘Stroomversnelling’ (see higher), and (2) the growth of local energy cooperatives. There is an increasing interest in local groups organising themselves and talking and taking action about energy. This has been supported by local authorities and other schemes, such as ‘Buurkracht’. However, the percentage of people actually carrying out NZEB renovations while being involved in these local cooperatives is small. At the same time, these individuals can act as important pioneers to others.

## 4.9 AVAILABILITY OF TIME TO MANAGE RENOVATION PROJECT

Homeowners need time to manage a renovation project. If they do not have time available, this is a barrier. This is e.g. the case with families with young children. Homeowners can lack time to collect information on the topic or to plan the renovation process. The homeowners can be afraid of overburdening themselves with planning and implementation.

A renovation project also can bring about a lot of **stress**. Some homeowners fear the dirt and the stress that come with renovating (cf. 4.3).

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<sup>28</sup> Centraal Bureau voor de Statistiek, 2016, and Ministerie van Binnelandse Zaken en Koninkrijksrelaties, March 2016

#### 4.9.1 Local critical success factor: share of DIY in renovation

In **Belgium**, there is a high share of DIY in renovations, especially when insulating the roof or walls: 58% of the measures taken during the last 10 year is done by the homeowner, friends or family. 54% is done by a contractor.<sup>29</sup> The availability of time is a condition for DIY, which is much more time-intensive for the homeowner.

## 4.10 VALUES (IDEAS) & ATTITUDES TOWARDS

### ENVIRONMENTAL ISSUES, SUSTAINABILITY AND CLIMATE

Having positive values and attitudes towards environmental issues is a driver, having opposite values is a barrier. E.g. homeowners, who buy energy-efficient electric devices, are happy with their PV solar system and so forth. Saving heat energy and thus contributing to environmental protection and climate protection are important drivers for owners, as is independence from rising prices for oil and gas.

## 4.11 LESS IMPORTANT DRIVERS & BARRIERS

Numerous drivers and barriers can be listed. In some cases or contexts, these will prove to be (very) important. In general, they are considered less important for the REFURB project:

- A low intensive energy use pattern can be a barrier. E.g. if the house is only partly heated, a deep renovation is not an accurate answer to the needs. The return on investment will be low.
- If people consider they will not own the house for a long period, this might be a barrier for deep NZEB-renovation. Older owners sometimes think that long-term investments are not profitable in for them anymore.
- A good technical knowledge level is a driver.

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<sup>29</sup> In some houses, multiple measures are implemented. This explains the sum of both is more than 100. from: Van den Broeck K., March 2015



## 5 Context drivers & barriers

A fourth set of drivers and barriers is linked with rather external factors, not directly linked to the dweller or dwelling characteristics, but deal with the particular situation or context the homeowner has to deal with. E.g. legal and administrative issues, tenant-landlord issues, organisation of the building sector etc.

### 5.1 SPLIT INCENTIVE BARRIER

The split incentive barrier can be considered as a financial barrier because there are financial implications. The problem arises when one person or organization owns a building and someone else uses it. As for the owner, any investment has to result in a benefit which is not necessarily through energy savings, unless it is a situation where the landlord pays the energy bills. Since the tenant does not own the facility, any investment in lowering energy bills has to be seen as financially beneficial for both parties. This often leads to a point where nothing is happening and the investor does not want to invest his or her own money if he or she is not the one who will benefit from it. Moreover, it can happen that the value of the building after renovation does not go along with the market price.

So for tenants, the main barrier (mostly the single barrier) is that they rent the house. And for landlords, the main barrier is that they do not pay the energy bill.

### 5.2 LEGISLATION & POLICY

Legislation & policy can be both drivers and barriers. The obligation to build according to the NZEB-standards from 2021 (EPBD) on should be a huge driver. Whether people are happy or unhappy with it, it needs to be done.

But legislation and policy are not always very consistent, and can be a barrier. E.g. does legislation allow for insulating a facade from the exterior if the wall is bordering the sidewalk? Many inconsistencies exist either at local, national and international level regarding inconsistent subsidies, opposing or constraining legislation etc.

Furthermore, for renovation, EPBD-related legislation does not always apply. For example, for a partial renovation of the house (roof, windows...) where no building permits is needed.<sup>30</sup> Then it is not guaranteed that these elements are renovated up to NZEB-standards.

#### 5.2.1 Local critical success factor: successful impact of EPC on renovation market

The energy label is successfully pushing energy renovation in **Denmark**, since 2011. Real estate brokers are obliged to advertise with the energy label and demand for houses with a good energy label has expanded.

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<sup>30</sup> E.g. in Belgium, only 15% of all renovations happen with a building permit. From: Escensia, 2013.

Reports have shown that every time the energy label raises one-step the value of the house increase with € 8,000-15,000.<sup>31</sup>

In **Germany**, the so-called 'Energiestandard' describes the degree of energy performance. Basically, the energetic requirements and regulations are associated with public subsidies and loans, provided by KfW-Bank that developed specific standards ('KfW-Effizienzhaus').

### 5.2.2 Local critical success factor: uptake of renewable energy

The **Netherlands** is in general performing badly in terms of sustainable energy goals. Historically, the Netherlands has relied for too long on cheap gas. The incentive to renovate to save energy has been low. While this may seem a disadvantage it may also be an opportunity. Because of the need to 'catch up' there have been some initiatives that will encourage NZEB. With the introduction of the project 'Stroomversnelling Koop'<sup>32</sup> there have been some recent developments of schemes and more encouragement to design and offer NZEB solutions. The progress of this scheme is slow. Pilots have been more extensive though than in past years. This does give a potential basis in the Netherlands; maybe more than in other European countries, to kick-start a market for NZEB solutions

## 5.3 MULTI-STAKEHOLDER ISSUES

Various barriers exist where multiple owners and/or occupiers of buildings need to decide. Ownership and responsibility can be opaque, while it can be very difficult to agree on energy saving investments in multi-family residential buildings if many different property owners have to either approve a decision or make a financial contribution.

The **multi-stakeholder barrier can interfere with the split incentive barrier** (5.1). E.g. in Slovenia, Estonia and elsewhere, some apartments can be owned by the municipality. Discussion between managers of blocks of flats, tenants and local communities arise about availability of funds for the budget. Local communities approach the refurbishment based on plans and budget available for refurbishment. The tenants of such apartments are people with low income, families with children or people with other difficulties and they pay reduced rents.

## 5.4 BUILDING SECTOR READINESS

Skill shortages exist in both the contractor market responsible for effective installation of energy saving measures, as well as in professional services, with few architects and designers familiar with how to specify a low energy renovation. A lack of knowledge, competence and focus on energy efficiency among building professionals is a huge barrier.

Contrarily, an engaged building sector would be a high potential driver to convince people for NZEB renovations.

<sup>31</sup> [www.ens.dk/forbrug-besparelser/byggeriets-energiforbrug/energimaerkning](http://www.ens.dk/forbrug-besparelser/byggeriets-energiforbrug/energimaerkning)

<sup>32</sup> <http://www.stroomversnellingkoopwoningen.nl/>

# 6 Mapping the drivers & barriers in the segments

In this chapter, some distinctive drivers and barriers are applied to the 5 high-potential demand-side segments defined in task 2.1 (report D2.1) to get a better view on what these drivers and barriers mean for the different segments. This segmentation is the first step to better understand the homeowners, a diverse group of decision makers in energy efficiency investments. The REFURB D2.1 report offers a framework to create a tailor-made segmentation or define a set of segments that fit a certain context in a country. In a second step the drivers and barriers of these segments are looked at.

Based on the insights from studies, best practices and experiences, the REFURB partners created **a matrix as a tool to design tailor-made segments**. This matrix organizes the interplay of dweller characteristics (interesting for demand aggregation schemes) and dwelling characteristics (interesting for NZEB-renovation).

To illustrate this matrix, a set of 5 high-potential segments for integrated NZEB-renovation packages and demand aggregation schemes were described: “young families”, “Post-war suburbs with detached houses”, “Empty nesters”, “Terraced houses with a high energy bill” and “convinced energy savers”. Next to these 5 high-potential segments, other segments can be defined and designed, relevant for specific countries, regions or contexts.

It is acknowledged that many drivers & barriers need to be analysed in order to get a better idea about possible motivators for the demand side. Below this analysis is constrained to the main barriers & drivers, but **tailored to local conditions**, as it is shown that there are certain local factors influencing the importance of certain drivers and barriers.

The below exercise in which the general drivers and barriers are applied to the 5 high-potential segments serves as an example. With the preceding chapters in mind these kinds of analyses can be done for any segment one would like to target with renovation packages. A better understanding of the drivers and barriers of a chosen segment will improve the marketing of a renovation package.

## 6.1 SEGMENT 1: “YOUNG FAMILIES”: MAIN DRIVERS & BARRIERS

These homeowners typically are 25-45 years old and have young children. They remodel their own house to fit future needs, with the intention to live for a long time in the house. So there is the “momentum” of a major renovation, an opportunity to integrate with deep NZEB-renovation. Unfortunately, their financial possibilities are limited and they have very limited time to manage a renovation project.

This segment is designed based on dweller characteristics. As a result, technical drivers & barriers are not dominant for young families.

**Financial barriers** are important for young families. The availability of financial possibilities to invest is a very important barrier, linked with the limited willingness to invest in energy efficiency because young

families have a lot of competing needs to be financed. The budget of young families is limited and competes with other typical needs (e.g. family car, family travel...).

Social and behavioural drivers & barriers are important as well. They have renovation needs: they need to increase comfort level, or adjust the architectural concept to house the family. The **need & intentions for comfort improvements** is an important driver for NZEB-renovation. The creation of win-wins between NZEB-ambitions and the desired increase of comfort level of the dwelling of young families is a main driver. But they have **limited time** to manage a renovation project, and the **inconveniences linked with the renovation** (dust, noise etc.) can't be too high. Thus the availability of unburdening schemes to support young families (e.g. reduce the time spend on managing the renovation, especially on NZEB-issues), is a driver to convince young families to apply the NZEB-standard.

There are **local conditions that tailor the demand side drivers**, applying for the segment of young families. For example, in **Belgium** the mobility of the homeownership is very low. When the segment of young families buys a house, it is very often for a period of 40 to 50 years. And almost all of these dwellings are renovated in the 2 years after they changed ownership. Thus the renovation cycle of a dwelling links with the homeownership cycle, covering 40-50 years. Thus the change of ownership is a crucial momentum to convince the new homeowner of NZEB. Although if a deep renovation is appropriate, a staged renovation is applied due to financial constraints. Integrated renovation packages for young families in Belgium should be designed to apply when they buy a house, offer tailor-made financial solutions, solutions for a staged NZEB-renovation, and unburden the young families in the renovation process. This situation may also apply in other countries.

## 6.2 SEGMENT 2: “POST-WAR SUBURBS WITH DETACHED HOUSES”: MAIN DRIVERS & BARRIERS

The homogeneity of dwellings, their poor thermal performance and general urgency for renovation makes this a high-potential segment. These neighbourhoods often are at the tipping point as they enter a new life cycle: the original homeowner leaves and a new generation of homeowners resides, and the first wave of renovation is necessary to preserve the quality of the dwellings. The segment does not apply in every country. In Belgium, Netherlands, Germany, Denmark this segment is present, in Estonia it is not existing. In Slovenia single family houses have a share of around 70%, of which most were built in the period from 1946 onwards.

This segment faces important **technical** issues such as the **urgency for renovation**, emerging inconveniences and defects etc. So the combination of these renovations with NZEB creates a win-win and might become a driver. An important financial barrier in this segment is the **high cost for NZEB-renovation and the unfavourable return on investment** for detached houses.

The changing homeownership offers opportunities to be used as drivers for NZEB. The **renovation needs and intentions** of the new homeowners to increase comfort level, cosiness, personalization, taste, adjust architectural concept and so forth can become drivers if they are combined with NZEB in a smart way (e.g. convince homeowners that NZEB will increase comfort). The change of homeownership creates right momentums as many renovate in the years following the purchase, and there is a clear potential for

**neighbourhood action** (group action) as a driver to convince homeowners to renovate for NZEB. For example in the **Netherlands** there is an emerging tradition on neighbourhood action.

But the changing homeownership might imply barriers: the “old” owners have too little perspective to live in the house to start to renovate, and “new” owners have limited renovation budget (spent most of their budget to buy the house).

## 6.3 SEGMENT 3: “EMPTY NESTERS”: MAIN DRIVERS & BARRIERS

These homeowners typically are 45-65 years old, and the grown-up children have left the house: the nest is empty now. They need to remodel the house to their new future needs. They are aware of environmental issues; they have more time and more financial possibilities to manage a renovation project. With empty nesters, energy investments do not necessarily need to be integrated with other planned renovations. The momentum is very important here.

An interesting sub segment is the empty nesters living in a terraced house (cf. segment 4).

Empty nesters don't face particular technical drivers & barriers. The segment has financial drivers, as there is a larger availability of **financial possibilities** to invest. And their housing needs are changed so they have **renovation needs or even intentions**. They have **time available** to manage a renovation project. These empty nesters need to be tackled at the moment they are planning their remodelling: this is the window of opportunity (**momentum**).

There are **local conditions that tailor the demand side drivers**, applying for the segment of empty nesters. For example, in **Denmark** it is reported that, in parts of the population, an energy renovation is considered to be prestigious, so it brings status. Empty nesters who have some financial savings might like to use their money on something one can see and touch. It has become more and more normal (and visible) to invest in new windows, solar panels and things alike. This is a driver to convince empty nesters with savings to invest in NZEB.

## 6.4 SEGMENT 4: “TERRACED HOUSES WITH A HIGH ENERGY BILL”: MAIN DRIVERS & BARRIERS

Terraced houses generally represent an older part of the building stock with **high energy saving potential**, and often in homogeneous neighbourhoods. A **high energy bill** indicates a high energy saving potential. Due to their age these terraced houses need renovation (structural, architectural, comfort and style, inconveniences and defects). The cost for NZEB-renovation is lower than for other dwelling types. In homogeneous neighbourhoods, very similar solutions can be applied and a renovation dynamic can be created.

This segment faces particular **technical drivers** - such as more **urgency for renovation**, e.g. because of more frequent inconveniences and defects - and barriers such as **limited potential for renewables** (ground heat pumps, solar energy), or **complex facade insulation** when the external wall borders the limits of the plot. But the cost for NZEB-renovation is lower in comparison with detached and semi-detached houses, and the

**return on investment is better**, especially because the energy bill is over €180/month. Very often with terraced houses a neighbourhood action is possible.

There are **local conditions that tailor the demand side drivers**, applying for the segment of terraced houses with a high energy bill. For example, there is a relatively high percentage of housing corporations in the **Netherlands**. The NZEB solutions being developed are mostly focussed on implementation in the social housing sector. In theory, solutions for terraced houses for social housing corporations are also suitable to private homeowners. The roll-out of proven technical NZEB-solutions developed in the sector of housing corporations to private homeowners can be a driver. A complementary driver to be exploited in the Dutch context is the increasing interest in local groups organising themselves and talking and taking action about energy. This creates a fertile ground for collective renovation schemes (neighbourhood schemes).

## 6.5 SEGMENT 5: “CONVINCED ENERGY SAVERS”: MAIN DRIVERS & BARRIERS

Convinced energy savers have the willingness and intention to invest in energy efficiency, have the right attitude and feel secure about the investment.

This is a small segment of potential pioneers and frontrunners. They can be essential in the strategy to start a transition towards NZEB-renovation. If NZEB is very well implemented with these pioneers, they can be committed to be pave the way for other homeowners. They have the right **environmental values**, the **right attitude** and **good experience**, and are **willing to invest** in NZEB these drivers offer a rich potential to convince them for NZEB-renovation.

There are **local conditions** that determine the demand side drivers of this segment. Not in every EU-country, the awareness and acceptance of energy saving or renewable energy is equal, creating different grounds for this segment. E.g. in Germany the “Energiewende” has mainstreamed the transition towards a low-carbon society, and in Denmark it has become normal to invest in energy efficiency. With their ideas, they might face resistance in legislation & policy, which is not always ready.

They do not have high expectations on return on investment, so that is not a major barrier. But convinced energy savers might have a low perspective on energy saving through NZEB-renovations because they already reduced their energy consumption. They are the first ones to meet all kinds of barriers that are linked with NZEB-renovation, e.g. the lack of readiness of the building sector. This experience in NZEB of the building sector can also differ per country (e.g. through demonstration programs like in the Netherlands). An interesting sub segment is the idealistic rebuilders with a technical background. This knowledge is driver, e.g. to overcome the lack of knowledge in the building sector.

## 7 Conclusion

In the REFURB-project a market segmentation relevant for NZEB-renovation and demand aggregation schemes was developed (report D 2.1). These segments are linked with drivers and barriers homeowners face when deciding on NZEB-renovation.

**Barriers** are the psychological, social, financial and other negative arguments not to carry out a renovation. These can originate in motivations, desires, needs and the financial situation of homeowners.

**Drivers** are the counterpart of the barriers: they are the psychological, social, financial and other positive arguments to carry out a renovation. These also can originate in motivations, desires, needs and the financial situation of homeowners.

In REFURB a thematic clustering of drivers and barriers in the REFURB project will be used, based on the insights of the projects, the country reports and the conclusions of task 2.1 (housing market segmentation):

- **Technical drivers and barriers**, linked with the dwelling characteristics and the challenge to renovate to NZEB.
- **Financial drivers and barriers**, linked with the financial possibilities of the dweller and the cost of the NZEB-renovation.
- **Social and behavioural drivers and barriers**, linked with the decision making process of the dweller, so including the behaviour, attitude of the dweller, as well as the (social) conditions to take a decision.
- **Context drivers and barriers**. These are rather external factors, not directly linked with the dweller or dwelling characteristics, but deal with the particular situation or context the homeowner has to deal with. E.g. legal and administrative issues, tenant-landlord issues, organisation of the building sector etc.

Out of a long list of potential drivers and barriers 26 of them are discussed in this report. It is demonstrated that multiple sub-categories could be developed to strictly categorize in pure drivers or barriers. For example, “financial possibilities” can indicate a lack of financial possibilities (barrier), or an availability of financial possibilities the homeowner wants to invest (driver). The report uses a more detailed description to explain the complexity instead of a multitude of subcategories.

The figure below (Figure 5) is an updated version of Figure 4, and gives insight in the dominant nature by making use of a colour:

- Green are the interesting drivers, with potential to convince homeowners.
- Red are the barriers.
- Grey can cover barriers and drivers

As explained in this report, the nature of drivers versus barriers is not always very clear and depends on the particular situation and nature of the homeowner. E.g., an insulated facade can imply a new style of the house. This can be attractive for one homeowner, but a barrier for another.

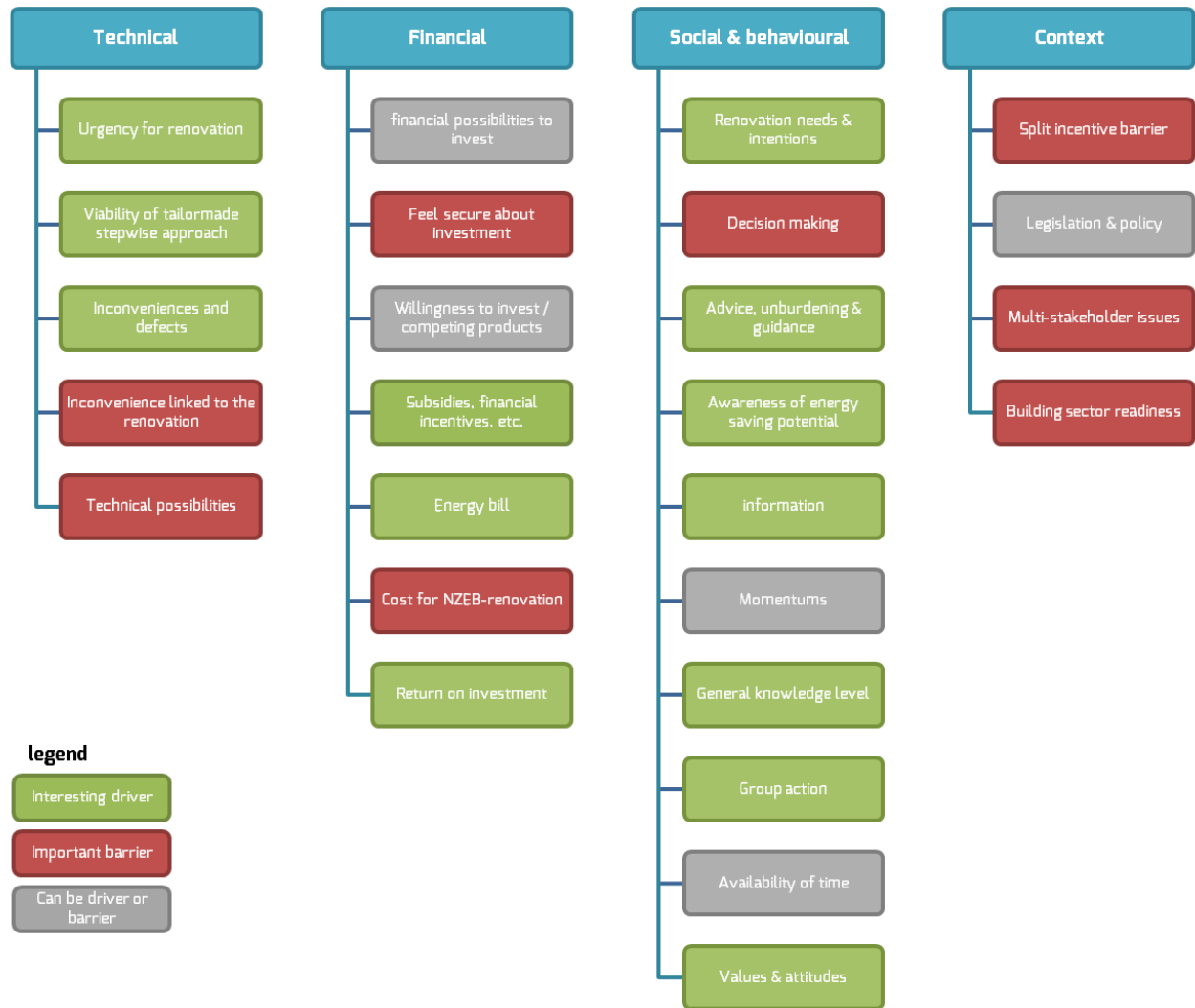


Figure 6: Overview of drivers & barriers

This report (D2.4) is a modified report of D2.2, integrating an overview of the relevant local parameters. The local parameters are related to the demand-buy drivers identified in report D2.2. Although it is possible to identify specific local conditions, an in-depth comparison of the extent to which local conditions differ from the generic drivers and barriers is beyond the scope of this report. The results of the analysis are indicative and illustrative, especially since the REFURB-regions only partly cover the EU. The analysis should guide the REFURB partners for the renovation packages to be developed. It points towards some important specificities to be taken into account when doing so.

It is shown that there are certain local factors influencing the importance of certain drivers and barriers, e.g.

- In Belgium almost all dwellings are renovated in the 2 years after they changed ownership. The mobility of the homeownership is very low, which results in the challenge to grasp the right momentum for renovation: when a dwelling changes homeownership.



- In Estonia, there is a vast subsidy scheme tailor-made for the renovation of multi-apartment buildings. This driver is pushing the renovation market in this specific segment. Therefore, this segment will be added as a “high potential segment” in the REFURB-project, a segment to develop integrated renovation packages for (cf. report D2.1 on the market segmentation).
- In the Netherlands there is an increasing interest in local groups organising themselves and talking and taking action about energy. This has been supported by local authorities and created a fertile ground for collective renovation schemes (neighbourhood schemes) , such as ‘Buurkracht’.
- Not in all countries there is a tradition of deep renovations, the staged renovation approach is dominant in the EU. In some countries, like Slovenia, a deep renovation is rare.
- NZEB-standards are not always linked with the subsidy schemes, but it is in in Germany the energetic requirements and regulations are associated with public subsidies and loans, provided by KfW-Bank that develops specific standards (‘KfW-Effizienzhaus’).
- In Denmark, the system of unburdening households has been tested and demonstrated so this driver can be rolled out more easily.

Using these clusters of drivers and barriers and applying them to the identified segments in report D2.1 gives a better insight into focus areas for removing barriers and using drivers of the identified segments. It is shown that for each of the 5 high potential segments (“young families”, “Post-war suburbs with detached houses”, “Empty nesters”, “Terraced houses with a high energy bill” and “convinced energy savers”) local conditions may activate different drivers or barriers. E.g. in the context of a considerable public acceptance of investments in energy efficiency, the willingness of empty nesters to invest in NZEB (and the status that comes along with visible investments) will be higher and can be activated as a driver.

Based on this report on tailored drivers and barriers in the different segments (D2.4), improved approaches to seduce homeowners to integrate NZEB-ambitions within their renovation will be designed (report D2.5), and compelling offers will be designed in the REFURB-project.

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