UNIVERSITEIT GENT

FACULTEIT ECONOMIE EN BEDRIJFSKUNDE

GHENT UNIVERSITY

FACULTY OF ECONOMICS AND BUSINESS ADMINISTRATION

ACADEMIC YEAR 2012– 2013

THE EU ENERGY EFFICIENCY DIRECTIVE AND THERMAL RETROFITS OF RESIDENTIAL BUILDINGS IN FLANDERS

Dissertation in fulfilment of the requirements for the degree of

Master in Applied Economic Sciences: Commercial Engineer

Joris Depouillon

Supervised by

Dr Johan Bruneel

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Permission

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Joris Depouillon

Nederlandse samenvatting

Vlaanderen is de op een na meest energie-intense regio van West-Europa. Er is inderdaad een groot niet verwezenlijkt potentieel om de energie-efficiëntie op kostenefficiënte wijze te verhogen. Een vijfde van dat potentieel kan worden verwezenlijkt door de renovatie van bestaande woningen. Diepe thermische renovaties, die de thermische gebouwenschil en het verwarmingssysteem verbeteren, verminderen het jaarlijks energieverbruik met 70% op kostenefficiënte wijze. Een hogere energie-efficiëntie in woningen, leidt tot meervoudige economische, maatschappelijke en ecologische baten voor zowel bewoners als de maatschappij.

Aangezien het mogelijk en voordelig is om de energie-efficiëntie in bestaande woningen te verbeteren, komt de volgende onderzoeksvraag bovendrijven. Hoe kan overheidsbeleid de energie-efficiëntie verbeteren in bestaande Vlaamse woningen?

Om inzicht te verwerven in het huidige beleid in Vlaanderen, werden 19 interviews afgenomen met beleidsmakers, vertegenwoordigers van de bouwsector en experts van ngo's. Beleid werd beoordeeld door middel van een uniek conceptueel kader. Dit kader combineert de volgende perspectieven: het beslissingsproces, barrières en doelgroepen. Het beslissingsproces belicht de verschillende fases die een besluitvormer doorloopt wanneer hij een beslissing maakt om te investeren in energie-efficiëntie. Barrières verhinderen besluitvormers, in verschillende fases, om beslissingen ten gunste van energie-efficiëntie te nemen. Ten slotte, verdienen sommige doelgroepen speciale aandacht van beleidsmakers omdat ze sneller of trager energie-efficiënte technologieën toepassen.

Eerst werd de Europese Energie-Efficiëntie Directieve, die in voege trad eind 2012, geanalyseerd om te tonen welk van de voorgestelde maatregelen het huidige Vlaamse beleid konden verbeteren. Vervolgens werd het huidige beleid geanalyseerd door middel van het conceptuele kader om tekortkomingen te bloot te leggen.

Op basis van deze analyses, werden de volgende nieuwe maatregelen voorgesteld om het huidige beleid te verbeteren.

1. Bepaal een visie en lange termijnrenovatiestrategie volgens belangrijke principes.
2. Implementeer lokale energie- en woonloketten volgens het een-loket-principe.
3. Installeer een certificatie- en kwalificatieschema voor professionelen in de bouwsector.
4. Voer groene leningen in die goedkoop kapitaal verstrekken aan een wijd publiek voor thermische renovaties.
5. Verken en stimuleer de mogelijkheid van ESCO's in de residentiële sector.

6. Verken diverse financieringsbronnen.
7. Pak de huurder-verhuurderbarrière en de situatie in appartementsgebouwen aan met samengestelde beleidspakketten.

Daarenboven, werden volgende verbeteringen aan bestaand beleid voorgesteld.

1. Richt demonstratieprojecten op de markt van diepe thermische renovaties. Informeer professionelen en consumenten hierover.
2. Introduceer bijkomende energieconsulenten in specifieke organisaties.
3. Maak de bestaande energieaudit goedkoper of integreer hem in het beslissingsproces.
4. Hervorm de convenanten met de bouwsector om advies van bouwvaklui aan hun klanten te stimuleren.
5. Breid de wooncode uit met aanvullende verplichtingen wat betreft energie-efficiënte beglazing en verwarmingsketels.

De voorgestelde nieuwe en verbeterde maatregelen leiden tot een normatief beleidsbeeld. Dit normatief beleid werd opnieuw geanalyseerd door middel van het conceptueel kader. Deze analyse toont dat het normatief beleid het beslissingsproces, de barrières en de doelgroepen aanpakt op een meer complete wijze. De maatregelen voorgesteld in de Energie-Efficiëntie Directieve zijn belangrijk, maar moeten worden aangevuld door andere maatregelen.

Executive Summary

Flanders is the second most energy intensive region in Western Europe. As a matter of fact, there is a large unrealized potential to increase energy efficiency cost-effectively. One fifth of this potential can be realized by retrofitting existing residential buildings. Deep thermal retrofits, which thoroughly renovate the thermal envelope and the space heating system of a house, cost-effectively reduce the annual energy consumption by 70%. Improving energy efficiency in residential buildings results in multiple environmental, economic, societal, and energy system benefits to both society and occupants.

Given that it is possible and beneficial to improve energy efficiency in existing residential buildings, the following research question arises. How can policy improve energy efficiency in existing residential buildings in Flanders?

To gain insight in current policy in Flanders, 19 interviews were conducted with policy makers, representatives of the building sector, and experts from non-governmental organisations. Policy is assessed through a unique conceptual framework which combines the perspectives of the decision making process, barriers and priority groups. The decision making process throws light on the various stages the decision maker completes when making an investment decision. Barriers prevent individuals in various stages to take decisions favouring energy efficiency. Lastly, certain priority groups deserve special attention from policy because they are faster or slower than the rest of the population in adopting energy efficient technology.

Firstly, the EU's Energy Efficiency Directive, issued in December2012, is assessed to discover which of the proposed measures complement current Flemish policy. Secondly, AS IS government policy is analysed by means of this conceptual framework to discover shortcomings.

On the basis of these analyses, the following new policy measures are proposed to improve AS IS policy.

1. Determine a vision and long-term renovation strategy, bearing in mind important principles.
2. Implement local energy and housing counters as a one-stop-shop.
3. Implement a certification and qualification scheme for building professionals.
4. Introduce green loans providing low-cost capital for thermal retrofits to a wide public.
5. Explore and stimulate the possibility of residential ESCOs.
6. Explore various sources of financing.
7. Target the split incentive and multi-family buildings with complete, composite policy packages.

Furthermore, the following improvements to existing policy measures are proposed.

1. Focus demonstration projects on deep thermal retrofitting. Inform professionals and decision makers.
2. Introduce additional energy counsellors in specific organisations.
3. Make existing energy audits cheaper or integrate them in the decision making process.
4. Retailor covenants with the building sector to stimulate advice from building professionals.
5. Add additional obligations regarding energy efficient glazing and boilers in the housing code.

The new and adapted policy measures result in the TO BE policy situation. This TO BE policy is analysed once more through the conceptual framework. The analysis reveals that TO BE policy targets the decision making process, barriers and priority groups in a more complete way. The measures proposed in the Energy Efficiency Directive prove important, but should be complemented by other policy measures.

Acknowledgements

Firstly I wish to thank my supervisor, Johan Bruneel. He gave me a balanced amount of autonomy in this dissertation. On the one hand, he gave me the freedom to explore a topic on my own. On the other hand, he helped me on difficult moments. Also, he helped me (re)structuring this dissertation and supplied me with valuable perspectives.

Furthermore, this dissertation was not possible without the valued moral support of my family Vera, Roger and Fleur. Moreover, Karolien proved very patient in hearing all my worries, doubts and frustrations about my dissertation. Bregt was important in giving me advice at the start of my dissertation. Anna, was also involved from the early stages of my dissertation and set me on the track of the right methodology. Furthermore, I wish to thank Laura, Lien and Julie for the moments of sharing worries and frustrations; Stijn, Ewoud, Jasmien and Pauline for their valuable advice; Joseph, Rose, Simon and Aslan for the provision of their wonderful house in Istanbul; Anna, Maike, Ben, Kate and Owen for proofreading this dissertation and giving advice.

Furthermore I want to thank all the people who made time for an interview. Their input and explanation were invaluable to gain a good understanding of the situation of energy efficiency in Flanders. On top of that, they provided me with interesting ideas to elaborate in this dissertation.

To conclude, I want to note that throughout writing this dissertation I never printed a sheet of paper myself, except for a final draft and the necessary hard copies for my evaluators upon finishing. In this regard, I hope to inspire fellow students, academics and other people to avoid printing as much as possible.

Gent, 20 May 2013

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List of abbreviations

Abbreviation	Meaning
GHG	greenhouse gas
EC	European Commission
EE	energy efficiency
EED	Energy Efficiency Directive
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Certificate
ERP	Energy Renovation Programme
ESCO	Energy Service Company
MS	Member State

1 Introduction

1.1 Background

Climate change is a serious threat to mankind. In the Fourth Assessment Report of the IPCC, Pachauri and Reisinger (2007) show the evidence is overwhelming that mankind is causing a temperature rise on earth by the emission of greenhouse gases (GHG). These GHGs increase the greenhouse effect of the atmosphere of the earth. Because of this effect, global temperature is rising and weather patterns are changing.

The Stern Review (Stern, 2006) explains that GHGs are different from any other externalities. GHGs are global in cause and effect. The effects are potentially very large, long term and uncertain. If current trends continue the business-as-usual scenario, there is a 50% chance that global temperature will rise by 5°C or more. This temperature rise will impact food and water supplies throughout the world. It will also affect the functioning of ecosystems and increase the likelihood of extreme weather events. This will have serious repercussions on public health (Pachauri and Reisinger, 2007, p.26): “The health status of millions of people is projected to be affected through, for example, increases in malnutrition; increased deaths, diseases and injury due to extreme weather events; increased burden of diarrhoeal diseases; increased frequency of cardio-respiratory diseases due to higher concentrations of ground-level ozone in urban areas related to climate change; and the altered spatial distribution of some infectious diseases.” Stern (2006, p.26) summarizes this well:

> *“Climate change threatens the basic elements of life for people around the world - access to water, food production, health, and use of land and the environment.”*

Partly as an answer to climate change, there has been much attention recently for the concept of a green economy. Big institutions, such as the United Nation Environmental Program (UNEP), OECD, and World Bank have published comprehensive reports which propose green policy initiatives. UNEP (2011) considers the green economy as a track which leads out of the economic, ecological and social crisis. In the green economy, energy efficiency (EE) takes a prominent place. The UNEP report, for example, outlines three pillars for a green economy with energy and resource efficiency being one of them – the others being preservation and restoration of natural capital and a transition to renewable energy. Similarly OECD (2011) argues that resource and energy efficiency can boost the economy and form an answer to environmental challenges.

The EU is recognized globally as the trendsetter on environmental policy. Regarding energy consumption, the EU set out its 20-20-20 targets in 2007. These targets comprise a 20% reduction in GHGs, a rise in the share of renewable energy consumption to 20% of total energy consumption and a 20% improvement in EE. This EE target was non-binding - the other two targets were binding. In 2011 the EU has revised its EE policy, because the 20% increase in EE would not be achieved according to projections. In 2012 the EU agreed on a new Energy Efficiency Directive (EED) including binding measures which member states (MS) have to implement over the months and years to come.

1.2 Problem definition

How do Belgium and Flanders perform on the area of EE? In 2011, Flanders was the second most energy-intensive regions in the EU after Finland (Van Steertegem, 2013). Indeed, the energy performance of the building envelope (walls, windows, doors) is a pivotal and long-lasting determinant in the energy use of residential buildings. According to figures of McKinsey&Company (2009) residential buildings in Belgium consume significantly more energy than in neighbouring countries. This means that there is a big potential in residential buildings to increase EE and save energy. Improvements in the building envelope could account for 21% of total potential energy savings (with positive NPV) in Belgium (McKinsey&Company, 2009).

But why is there such a large, unrealized potential to decrease energy use in buildings cost-effectively? Apparently there is an 'EE gap': the actual uptake of EE measures is much lower than its potential, despite a whole range of benefits and the urgency for action (because of climate threats). The reason for this EE gap, both in Flanders or Belgium and in other countries, is a series of barriers preventing higher potentials from being reached (Sorrell et al., 2000).

1.3 Research question

It demands vigorous policy to overcome these barriers. The federal and, most of all, the Flemish government run a programme on EE in buildings. In this regard, barriers have been identified and are partly being addressed. There is still room for improvement, though. In this regard, the EU's new EED presents an opportunity to improve policy regarding EE in existing buildings.

The main research question of this dissertation is the following:

How can policy further improve energy efficiency in existing residential buildings in Flanders?

To answer this research question this dissertation will assess the current policy from three perspectives: the decision making process, barriers and priority groups. From this analysis, a set of guidelines will be formulated for improving current policy. Furthermore, it is assessed how the EED can complement current policy.

1.4 Scope

This dissertation will investigate the Flemish and federal EE policy on retrofitting existing residential buildings in Flanders. It will use this narrow focus to ensure an in-depth analysis. In this regard, the scope of the research is limited.

- Firstly the analysis is geographically limited to Flanders, one of the three regions in Belgium (besides Wallonia and Brussels).
- Secondly the analysis is limited to the residential sector.
- Thirdly, the analysis is limited to energy use in existing buildings. New buildings are not considered.
- Fourthly, the analysis is limited to thermal retrofits, which improve the energy performance of the thermal envelope and heating system.
- Fifthly and lastly, the analysis is limited to the policy situation and state structure as of May 2013.

1.5 Methodology

1.5.1 Conceptual framework

To address the central research question of this dissertation, government policy on EE will be investigated from three important perspectives. Together, they form the conceptual framework to assess policy. This framework is depicted in Figure 1. The three building blocks (decision process, barriers and priority groups) naturally build on each other, as indicated by the grey arrows on the right. On the other hand, these building blocks all offer an interesting perspective to assess policy as the three arrows on the left depict. This triple perspective towards EE policy is unique. The literature mostly assesses government policy from the barrier perspective only. The additional complementary perspectives of the decision making process and priority groups will result in a thorough as well as novel analysis.

Firstly, this dissertation focuses on the decision making process of the decision maker. It is important that policy supports decision makers in all stages of the decision making process. Indeed, to make individuals invest in thermal retrofits, government policy could create awareness about thermal retrofits, make the individual discover benefits and costs of such an intervention, and give financial incentives to stimulate investments in thermal retrofits. The thermal retrofit is then executed and the individual benefits from a house with increased thermal comfort and decreased energy use. It is important that policy assures the quality of the thermal retrofit executed by building professionals, to guarantee satisfaction of the decision maker. After all, individuals are likely to influence other potential decision makers. In this regard, the analysis will scrutinize what stages of the decision making process are sufficiently targeted by policy and how policy could be improved.

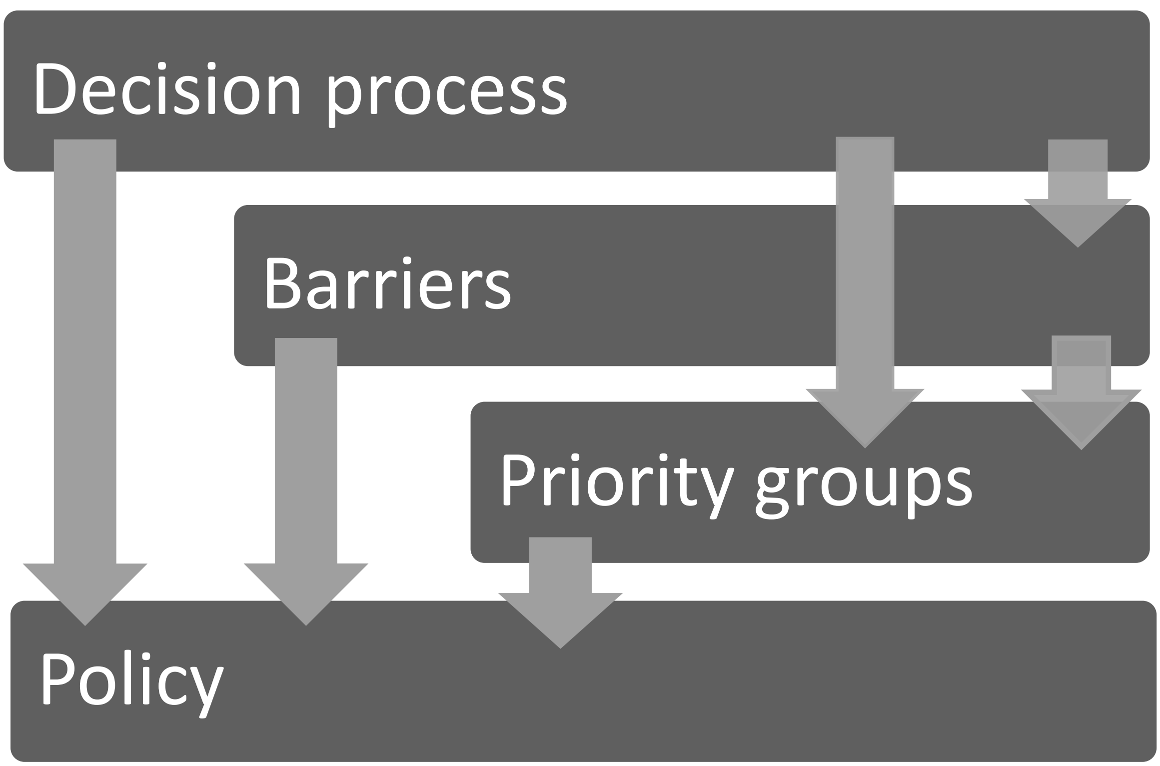

Figure 1: Visual representation of the conceptual framework used to analyse government policy on EE.

Secondly, barriers prevent individuals from investing in thermal retrofits. These barriers can be mapped into the stages of the decision process. As such, the barriers perspective builds on the perspective of the decision process. This categorization of barriers has not been used before in the literature. Each of these barriers represents an opportunity to reach a higher level of EE. Therefore, policy can seize this opportunity by tackling the underlying barrier through appropriate policy measures. The analysis will assess which barriers are sufficiently addressed by policy and how policy could further target important barriers.

Thirdly, the analysis will segment the population in different priority groups. Indeed, the total population is heterogeneous. Therefore, policy should focus on a few homogeneous priority groups. Some groups of the Flemish population in this study are motivated to adopt thermal retrofits, without government support. Other groups in society do not consider thermal retrofits despite large government support and obvious benefits. This dissertation will show which more or less homogeneous groups of the entire population deserve special attention. These priority groups will be characterized to show how they go through the decision making process differently. Furthermore, building on the barriers perspective, the analysis will investigate which barriers are more important for certain priority groups than others. These two aspects give an indication how different priority groups should be targeted. Furthermore, this dissertation shows which priority groups remain unaddressed and how policy should be improved to further address these priority groups.

1.5.2 Data retrieval

This dissertation makes use of three categories of secondary information sources.

- Firstly, the international literature on EE is an important source of internationally valid information on EE in general, as well as on some topics in particular such as EE in buildings, the residential context, thermal retrofitting.
- Secondly, the national literature on EE in Flanders is analysed. These are reports and studies from various stakeholders. A considerable share consists of documents of governments or administrations. Another share is published by stakeholders such as NGOs and building associations.
- Thirdly, legal documents of the EU are important for this study. These are so called ‘communications’ (e.g. the European Commission’s Energy Efficiency Plan 2011), but also legal texts such as the new EED.

Furthermore, the author of this dissertation has conducted qualitative research in the form of interviews. These interviews were carried out in order to gain a deeper insight in EE in the Flemish residential context. Personal interviews were conducted as much as possible. Due to geographical constraints, telephone or Skype interviews were conducted a few times. In total, 19 interviews have taken place. These interviews were conducted from December 2012 to April 2013. Most of the interviews took place in Brussels. The language of the interview was mostly Dutch; five interviews were conducted in English. The duration of the interviews varied from 40 minutes up to 2.5 hours.

The interviewees were selected from a stakeholder perspective with regard to policy on EE in existing buildings. In total, 19 interviews were conducted. The interviewees can be classified in three groups.

- Firstly, policy makers, advisory bodies, members of administrative institutions and parties executing policy were consulted. These people are involved in the policy-making and -executing process. There were six interviews in this category.
- Secondly, representatives and practitioners in the building and electricity chain were consulted. This is the supply side of EE measures. As companies or federations of companies are consulted by policy makers, they also have a role in driving demand for EE measures. Furthermore, they are affected by government policy. On the one hand, they benefit from stimulating government policy towards decision makers. On the other hand, they are subject of government regulation regarding quality control etc. There were 6 interviews in this category.
- Thirdly, experts from non-governmental organisations were interviewed. These were mainly organisations driven by environmental or social concerns. Environmental organisations benefit from ambitious policy, because this saves energy and GHG emissions. Social organisations benefit from government policy stimulating EE in homes, because such policy decreases fuel poverty with underprivileged people. On the other hand, they are reluctant to risk instating a policy which could adversely affect their priority group. The Flemish organizations which were interviewed, effectively are consulted in the policy making process. There were 7 interviews in this category.

An overview of the interviews can be consulted in the table below. The interviews are also included in the bibliography (as ‘personal interview’ or ‘telephone interview’) and are cited like other sources.

Table 1: Overview interviews with policy makers, advisory bodies, members of administrative institutions and executive institutions.

Organization	Interviewee(s)	Subject	Location	Date
Vlaamse Woonraad	*Pol Van Damme, secretary *David Van Vooren, policy advisor	*Flemish policy *Barriers Flanders	Vlaamse Woonraad, Koning Albert II-laan 19, Brussel	11/12/12
Vlaams energieagentschap (VEA)	*Tine Tanghe *Wilfried Bieseman, senior advisor	*Implementation EED *Methodology *Flemish policy	Vlaams Energieagentschap, Koning Albert II laan 20, Brussel	4/1/2013
Cabinet of minister of energy Freya Van den Bossche	Jan Schaerlaekens, energy advisor minister Freya Van den Bossche	*Implementation EED *Flemish policy *Barriers Flanders	Cabinet of minister Freya Van den Bossche, Martelaarsplein 7 - B-1000 Brussel	18/3/2013
Intelligent Energy Europe - European Commission	Pau Garcia Audi, Project Officer	*Implementation EED *Barriers building sector	EC, Covent Garden Building, Place Rogier 16, Brussels	25/3/2013
Vlaams energieagentschap (VEA)	Roel Vermeiren	*Implementation EED *Flemish policy *Barriers Flanders	Vlaams Energieagentschap, Koning Albert II laan 20, Brussel	25/3/2013
Infrax (energy distributor)	Guido Claes, responsible rational energy use	*Energy distribution obligations	Infrax, Brussels	11/03/13

		*ESCO *Flemish policy		

Table 2: Overview interviews with representatives and practitioners in the building and electricity chain

Organization	Interviewee(s)	Subject	Location	Date
+Home, Bostoen, provider of total solution of deep thermal retrofits	Geert Verspeel, head sales	*Flemish policy *Barriers Flanders	+Home, Merelbeke	17/01/2013
Vlaamse Confederatie Bouw	Geert Matthys, responsible energy efficient and sustainable building	*Flemish policy *Barriers Flanders *Implementation EED	Vlaamse Confederatie Bouw, Brussels	25/02/2013
Bouwunie	Mieke Bonnarens, energy counsellor	*Flemish policy *Barriers Flanders *Implementation EED	Bouwunie, Gent	28/02/2013
Eu.ESCO	Stephane Le Gentil, CEO	*ESCO *EED *Barriers for ESCOs	Telephone interview	04/03/2013
Fedesco	Christophe Madam (CEO) and Lieven Vanstraelen	*ESCO *EED *Barriers for ESCOs	Fedesco, Brussels	04/03/2013

Bouwunie	Geert Ramaekers, director wood and education	*Education and knowledge of building professionals	Telephone interview	02/04/13

Table 3: Overview interviews with non-governmental organisations

Organization	Interviewee(s)	Subject	Location	Date
Gezinsbond	*Charlotte Claessens, energy counsellor *Pieter Ledeganck, energy counsellor	*Flemish policy *Barriers Flanders	Gezinsbond, Troonstraat 125, Brussel	10/12/12
Bond Beter Leefmilieu	Sara Van Dyck, policy advisor	*Implementation EED *Methodology *Flemish policy *Barriers Flanders	BBL, Tweekerkenstraat 47, Brussel	11/12/12
Samenlevingsopbouw, organisation for underprivileged people	Wannes Starckx, energy counsellor	*Underprivileged *Flemish policy *Barriers Flanders	Samenlevingsopbouw, Brusselsepoortstraat 8, Mechelen	18/02/13
Vlaams Huurdersplatform	Geert Inslegers, legal policy staff member (and member Vlaamse	*Split incentive *Barriers Flanders	Vlaams Huurdersplatform, Diksmuidelaan 50, 2600 Berchem	05/03/13

	Woonraad)			
European Climate Foundation	Erica Hope, EU Affairs Manager	*EED *Best practices	ECF, Brussels	11/03/13
E3G	Ingrid Holmes, programme leader	*EED *Financing facilities	Telephone interview	28/03/13
Building Performance Institute Europe	Bogdan Atanasiu, Senior Energy Efficiency Expert	*Deep retrofits *Flemish and EU policy *Best practices	Skype interview	11/04/13

1.6 Structure

The structure of the remainder of this dissertation is as follows.

- Chapter 2 gives a definition of EE, explains determinants and benefits of EE in residential buildings and how EE can be improved in buildings.
- Chapter 3 gives a view of EE in residential buildings in Flanders.
- In chapter 4 the conceptual framework is constructed.
- Chapter 5 discusses the current policy in Flanders. It also contains a benchmark of the current policy to the EED and uses the conceptual framework to analyse current policy.
- Chapter 6 elaborates suggestions for policy improvements of the chapter before. Then it uses the conceptual framework to show how policy would improve by implementing the suggested improvements.
- Finally, chapter 7 gives a general conclusion.

2 Energy efficiency in existing residential buildings

2.1 Definition of EE

This dissertation will regard EE as a property of an object or a system which is "using less energy to produce the same amount of services or useful output" (Patterson, 1996, p. 377, p.377). Because, this dissertation focuses on the thermal EE in residential buildings (cf. infra), it will exclude practices which decrease or shift energy consumption. In this dissertation, EE is about 'doing it more efficiently' rather than 'doing without'.

2.2 Determinants of energy use in existing residential buildings

Energy in residential buildings is mostly consumed by the following energy services: space heating, air conditioning, cooling, hot water, cooking, appliances and lighting (De Smet and Bachus, 2011; Economidou, Atanasiu, Despret, Maio, and Nolte, 2011; Papagiannis, Dagoumas, Lettas, and Dokopoulos, 2008). Economidou et al. (2011) state that space heating accounts for 70% of energy end use in European homes. In the US, too, space heating is the most important form of energy consumption (Levine et al., 2007).

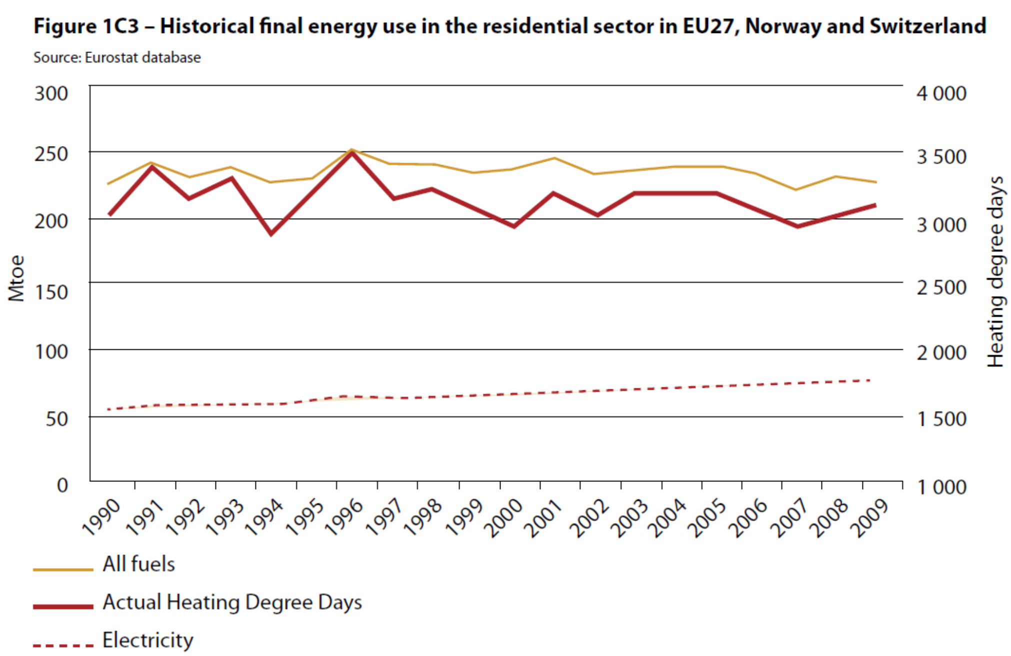

Figure 2: Energy use in residential buildings in EU (source: Eurostat database). Taken from Economidou et al. (2011).

Figure 2 demonstrates this for Europe. The left y-axis indicates energy use measured in Mtoe (megatons of oil equivalent). Heating degree days, on the right y-axis, are an indicator for climatic conditions, which largely determine energy use for space heating. The x-axis denotes the time in years. One can see a clear correlation between the total energy use per year (orange line) and climatic conditions (red line). Indeed, people want to have a constant indoor climate, so they compensate climatic conditions with heating or cooling. The rising share of electricity (lower dotted line) is characteristic for the rising share of electric appliances (Economidou et al., 2011).

If space heating is the most important form of energy consumption in residential buildings, what are the determinants for the energy use of space heating? The remainder of this section explains which elements of buildings are most important. Successively, the thermal envelope and its constituting components, the space heating system and other elements are explained.

2.2.1 Thermal envelope

The thermal envelope is the shell of a building. It is a barrier between interior and exterior climate by preventing thermal transfers (Economidou et al., 2011). Additionally, the building envelope is used as a thermal depot: the building stores heat according to its heat capacity during the daytime and releases it during the night. The thermal envelope determines the efficiency of space heating. Important thermal elements of the building envelope are walls, roof, floor, doors, windows and how these elements are integrated. Levine et al. (2007, p. 395) state that “improvements in the thermal envelope can reduce heating requirements by a factor of two to four compared to standard practice, at a few per cent of the total cost of residential buildings.”

2.2.1.1 Insulation

Additional to natural thermal characteristics of building materials, insulation can further reduce heat transfers. It is important to consider thermal bridges and water ingress on places where thermal insulation is not integrated properly (Levine et al., 2007). Ex-post insulation is more or less complicated or time-consuming dependent on the specific building component. Common types of insulation include roof insulation, attic floor insulation, external wall insulation, cavity wall insulation, floor insulation and basement insulation.

2.2.1.2 Windows and doors

Windows and doors are potential leakages in the thermal envelope. Single glazing, for example, is one of the symbols of a badly insulated, old house. Today, energy efficient glazing can decrease heat losses through windows by 80% (VEA, 2012b). Glazing has gone through a major revolution. Thermal performance has increased by double and even triple layers of glazing panes (Levine et al., 2007). In between those panes, an invisible metal coating or gas film increases the thermal performance. This increase in performance has developed under constant or even decreased costs (Levine et al., 2007). Airtightness of external cabinet work, which integrates glazing and building shell, greatly influences thermal characteristics.

2.2.1.3 Integration

The importance of integrating the building elements discussed above cannot be underestimated. Levine et al. (2007, p.396) illustrate that "in cold climates, uncontrolled exchange of air between the inside and outside of a building can be responsible for up to half of the total heat loss." On the other hand, 'leakages' can cause humidity. Airtightness should go hand in hand with proper ventilation systems. If an existing building is retrofitted to a level where no air can escape or come in, this can cause unhealthy conditions due to bad air quality (Economidou et al., 2011). Weatherstripping or an impermeable continuous barrier are common practices in residential buildings (Levine et al., 2007).

Airtightness can only be reached when different components and techniques are integrated in a correct and coordinated way. This emphasizes the importance of a sufficient knowledge of and cooperation between building professionals.

2.2.2 Space heating system

The space heating system certainly is an important determinant of residential energy use. Firstly, thermal efficiency of the system is an important factor. Modern boilers, using condensing operations, can reach internal efficiencies of 80-99%; old equipment at most can reach an internal efficiency of 70% (Levine et al., 2007). Heat pumps are a sustainable alternative, as they partly use geothermal energy. Additionally, they can cool the indoor climate in summer. As a downside, heat pumps use electricity in most cases as an energy input.

A second factor is the way of transferring the generated heat. Levine et al. (2007) suggest hydronic floor radiant systems as the most efficient ones. Another important factor is the energy source which is used to generate the heat. In this regard, electric heating should be avoided.

2.3 Benefits of increasing energy efficiency in residential buildings

Ultimately it is the decision maker which has to invest money to retrofit his/her home. Consequently, the only benefits which are monetized by the decision maker are the projected saved energy costs (Staniaszek, Bruel, Fong, and Lees, 2013). There are many additional benefits, though, both for the occupant and the society at large. It is important that governments take these additional benefits into account, as good policy on EE can cause much more than only energy savings. A German study shows that each euro which was invested by the German government's KfW bank (for the CO2-Building Rehabilitation Program) in construction and refurbishment returned 5 euro of societal benefits (Kuckshinrichs, Kronenberg, and Hansen, 2011). Governments should thus see their EE programs as an investment rather than a cost on which they can cut in times of crisis.

What follows is an overview of the benefits of increasing EE in residential buildings. The classification used, is taken from Staniaszek et al. (2013).

2.3.1 Environmental benefits

Environmental benefits of EE in buildings are twofold. Firstly, by using less energy, the demand of fossil fuels and the greenhouse gas (GHG) emissions linked to fossil fuels decrease. IPCC (2007) states that industrialized countries have to reduce their CO2 emissions by 80-95% by 2050. EE is the most cost-effective way of reducing GHG emissions (Ryan and Campbell, 2012). This is visualized in Figure 3. The y-axis denotes the mitigation potential in gigatons of CO2-equivalent per year. The x-axis gives an overview of different sectors and different levels of carbon prices. The IPCC report of 2007 shows that throughout the world, the CO2 reduction potential is largest in buildings, regardless of CO2 prices (IPCC, 2007). Cutting CO2 in buildings by improving EE is, thus, necessary and possible.

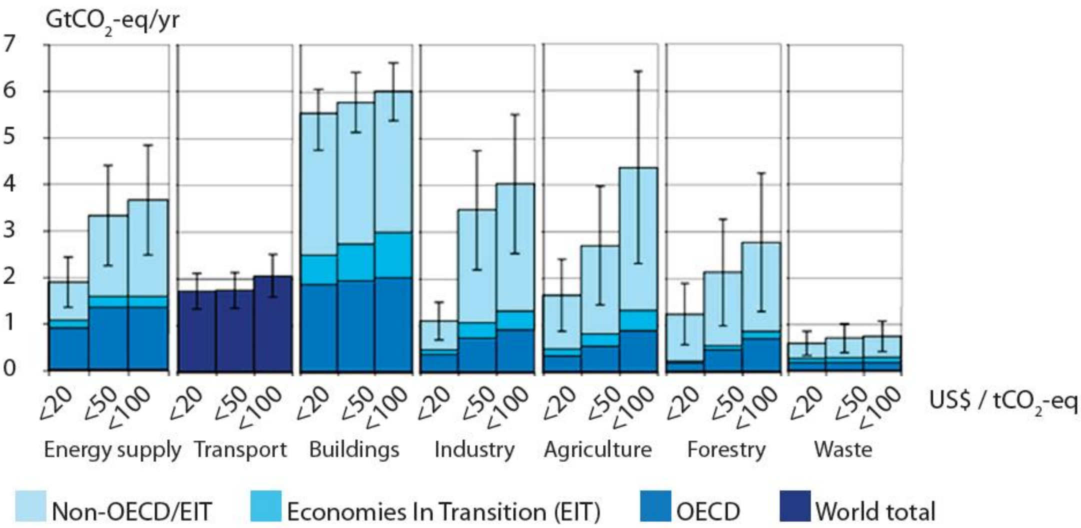

Figure 3: Comparison of cost-effective CO2 reduction potential in 2030 by sector, at different carbon prices. Source: IPCC (2007).

In this regard EE also buys time (Jollands et al., 2010; Lovins, 2004). It extends the period in which GHG emissions must peak. In this way, there is more time to decarbonize the economy by developing more efficient techniques for energy use and energy supply. Also, there are synergies between EE and sustainable energy: EE slows down energy demand and renewable energy forms an alternative to carbon-intensive energy supply (Prindle et al., 2007). Investing in EE allows renewable energy to cut deeply in the market share of fossil fuel energy (Prindle et al., 2007). Minaraad and SERV (2012) emphasize that measures which increase EE are among the most cost-efficient ways to reach European climate and renewable energy targets (renewable energy targets are relative targets on total energy use).

A third environmental benefit of EE in housing is a reduction in air pollution (Staniaszek et al., 2013). This has positive effects for public health (cf. infra) and prevents damage to buildings and nature (Levine et al., 2007).

2.3.2 Economic benefits

EE has economic benefits on an individual, sectoral, national and international level. At the individual level, a more efficient use of energy implies an increased disposable income (Ryan and Campbell, 2012). Staniaszek et al. (2013) state that average energy bills in the EU vary between €1000-1800 per year.

Deep retrofits could cause savings between €700-1260 per year. Furthermore, property with high EE yields rental and sales premiums, increasing its asset value (Ryan and Campbell, 2012).

In addition, investments in EE create jobs (Levine et al., 2007). Firstly, there is direct job creation in the building sector. Staniaszek et al. (2013), for instance, calculated that the EU should invest €940bn between now and 2050 to achieve EE levels necessary to battle climate change. Such an investment would give the building sector a lasting economic boost. Secondly, there are indirect job creating effects. Indeed, the additional purchasing power mentioned above boosts economic activity throughout the economy because of the multiplication effect. This can even have a positive impact on governments' budgetary positions (Copenhagen Economics, 2012).

Levine et al. (2007) emphasize that an increase in demand for thermal retrofits induces learning effects and economies of scale. They show that this results in continuously better performing materials and techniques combined with decreasing real prices.

2.3.3 Energy system benefits

Another important benefit of EE is energy security. Essentially, increasing EE enables a country to supply an equal amount of consumers with less energy. On the one hand, for energy importing countries, this means less energy (oil, gas, electricity) has to be imported. This makes an importing country (geopolitically) less dependent of exporting countries and improves the trade balance. For energy exporting countries, increased EE reduces the pressure on their natural resources (Ryan and Campbell, 2012). This increases the long-term availability of energy reserves.

On the other hand, EE ensures security of supply. Increasing EE implies that more consumers can be supplied with the same amount of electricity generating capacity, which reduces the investment needs for additional expansion of the electricity sector (Council, 2010). Also, because peak demand is lowered by increasing EE, EE reduces operating costs (Ryan and Campbell, 2012). Internationally, the aggregated effect of EE can mitigate the steady growth of energy prices (Ryan and Campbell, 2012). It can create market power on the demand side (Lovins, 2004). These factors increase affordability.

2.3.4 Societal benefits

EE proves important in alleviating poverty. Energy efficient housing is important to enable low-income families to purchase affordable heating (Staniaszek et al., 2013). By reducing energy costs more money is available to spend on other critical needs (Ryan and Campbell, 2012). But there is also a direct impact on health and well-being. Indeed, warmer homes, less mould and condensation, and better indoor air quality induce better health, which has a direct impact on costs of healthcare (Ryan and Campbell, 2012; Staniaszek et al., 2013). Copenhagen Economics (2012) estimates these avoided health costs to be bigger than saved energy costs, as shown in Figure 4. The figure denotes the potential savings from different benefits resulting from higher EE. In both scenarios the health benefits (white frame) from increasing EE are substantial.

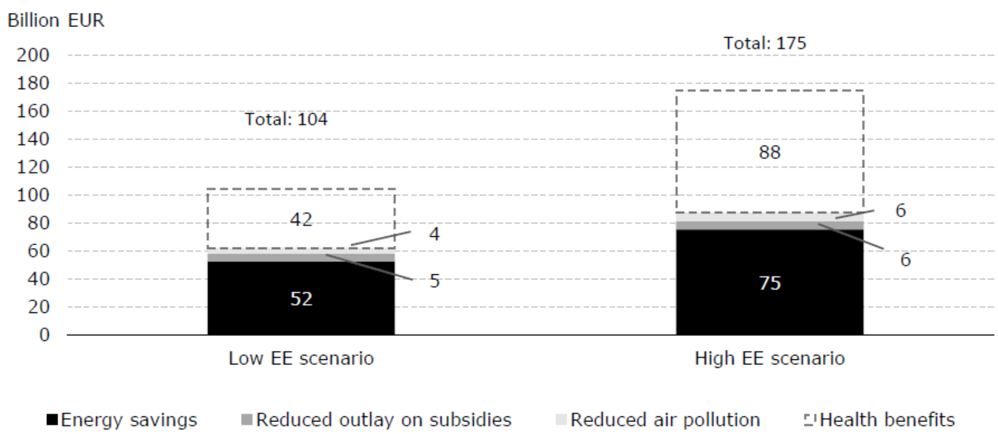

Figure 4: Annual gross benefits to society from energy efficient renovation of buildings including rebound effect, 2020. Taken from Copenhagen Economics (2012).

Furthermore, Staniaszek et al. (2013) mention that also occupants who do not live in fuel poverty can benefit from an increased level of comfort. Increased thermal comfort, decreased levels of outdoor noise, and less cold surfaces (such as windows) may increase quality of life and productivity (Levine et al., 2007).

2.4 Achieving the potential: thermal retrofits

In the chapters above, the most important factors of energy use in buildings were outlined. There appears to be a large untapped EE potential. The numerous benefits of EE plead to achieve this potential. In this section, it is suggested how this can be done.

Retrofitting (or renovation) is the process of changing a building after it was built and occupied. Thermal retrofitting addresses the thermal characteristics of a building described above. It increases the EE of the building by changing aspects of the thermal envelope (insulation, glazing, airtightness), of the heating system or other elements relevant for thermal efficiency. Roughly, there are two kinds of retrofits, depending on the ‘depth’ of the intervention. Firstly, one could upgrade the building through simple, separate measures which moderately decrease total energy use. This will be indicated as ‘shallow retrofitting’. Secondly, one could make more fundamental adaptations to the thermal envelope. This will be indicated as ‘deep retrofitting’.

Both in the literature and with governments (Schaerlaekens, 2013), there is a lack of clarity about what exactly characterizes deep retrofitting and how it is distinguished from shallow retrofitting. Generally, though, the depth of retrofits is characterized by the saved percentage of annual energy use prior to renovation (Neuhoff, Amecke, Stelmakh, Rosenberg, and Novikova, 2011b), although there remains a lack of clarity about how this should be measured (Walker, Fisher, and Less, 2012). Energy use reduction levels for shallow retrofitting range from 15 to 35% (Levine et al., 2007). Walker et al. (2012) state that the most appropriate definition for deep retrofits is at the 70% reduction level. Levine et al. (2007) emphasize that shallow retrofits can be executed at any time and that deep retrofits mostly occur at the moment of a major renovation, which is also made for reasons of “sustainability, comfort, historic preservation, occupant health and safety” (Walker et al., 2012, p.1).

Shallow retrofits encompass increasing airtightness by addressing air leakages, adding insulation to loose elements such as pipes, or to attics, walls or wall cavities (Levine et al., 2007). Deep retrofitting encompasses a more integrated approach in which high-performance components may be used (Neuhoff et al., 2011b). Measures may include: adding (additional) insulation (in cellars, roofs, or a continuous barrier in walls), window and door replacement, reduction of heat bridges (Walker et al., 2012). Sometimes, also water heating systems are upgraded, lighting and appliances are replaced and renewable energy technologies are installed (Neuhoff et al., 2011b).

Hermelink and Müller (2010) stress the vast importance of deep thermal retrofits. Their report argues that performing many shallow renovations instead of fewer deep renovations with the available budget may result in “unwanted, irreversible long-term consequences” (p. 20). These consequences are caused by potential lock-in effects. Buildings with the highest energy savings potential are renovated first. If these renovations are shallow, a big potential remains unaddressed. Due to a low renovation rate it is likely that the building will be locked in consuming more energy than necessary. In this way, it is very hard to reach the 2050 goals of decreasing energy consumption and GHG emissions. Therefore, buildings which are renovated now, should be tackled by a deep thermal retrofit, so that these buildings are 2050 proof (Minaraad and SERV, 2012).

2.5 Conclusion

EE is understood as using less energy to produce the same thing. In the context of residential buildings, space heating is the most important source of energy consumption. Structural determinants of the thermal efficiency of an existing house are the thermal envelope and the space heating system. The performance of the thermal envelope is determined by thermal values of insulation, windows, doors and how these elements are integrated.

Increasing EE in existing buildings has a broad range of mostly unmonetized benefits. EE is the most cost-effective way to reduce GHG emissions. It gives time to renewables to diffuse and reduces air pollution. The decision maker saves on energy costs. Investments also have a positive effect on the broader economy resulting in job creation. EE increases energy security. Lastly, EE may reduce fuel poverty and enables healthy living conditions.

This cost-effective potential in existing buildings can be realized by performing thermal retrofits. This encompasses that an existing building is renovated by improving the thermal parts of a building. Deep retrofits generally reduce energy consumption by 70%. Deep retrofits require an integrated approach. It is important that retrofits are deep, so that less energy efficient techniques are not locked-in.

3 Energy Efficiency in residential buildings in Belgium and Flanders

The following sections focus on EE in Belgium and Flanders. Firstly, general EE is described. Secondly EE and the potential to increase EE in residential buildings are discussed. As (internationally comparable) figures about Flanders are hard to find, the paragraphs hereunder will describe mostly Belgium's EE performance.

3.1 Current energy efficiency in residential buildings

The most important energy consuming sectors in Belgium are industry, households and transportation. Households make up for 33.5% of total final energy use in 2009 (FOD Economie K.M.O. Middenstand en Energie, 2011). According to McKinsey (2009), residential buildings used about 25% of all energy in 2005.

According to figures of the Odyssee database (Odyssee, 2010), the household sectors in Belgium is increasing its EE at a higher rate than the EU average. This is depicted in Figure 5. The graph shows that only in 2004 these improvements took a start.

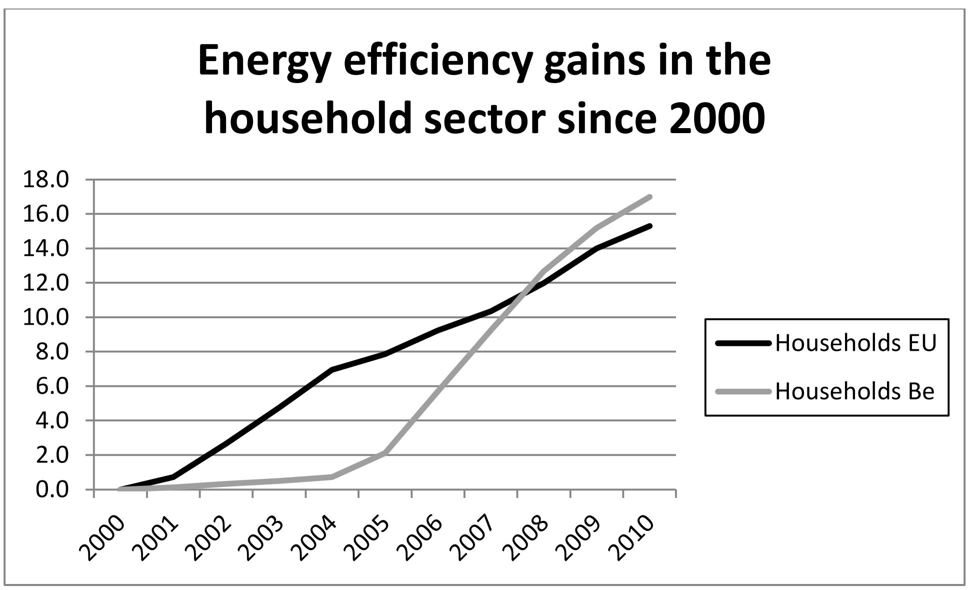

Figure 5: energy efficiency improvements per sector in EU and Belgium since 2000. Figures based on Odyssee database, (Odyssee, 2010)

Compared to neighbouring countries, Belgium's energy use in residential buildings is remarkably high. Belgian houses consume substantially more energy than houses in the UK, Germany and the Netherlands, even though climatic conditions are more favourable in Belgium (less heating degree days) (McKinsey&Company, 2009), as can be seen in Figure 6. Residential buildings in Belgium use 72% more energy than the European average. It should be noted, though, that this average also includes countries with more favourable climatic conditions than Belgium. McKinsey&Company (2009) mention two important reasons for this low energy performance of Belgian houses.

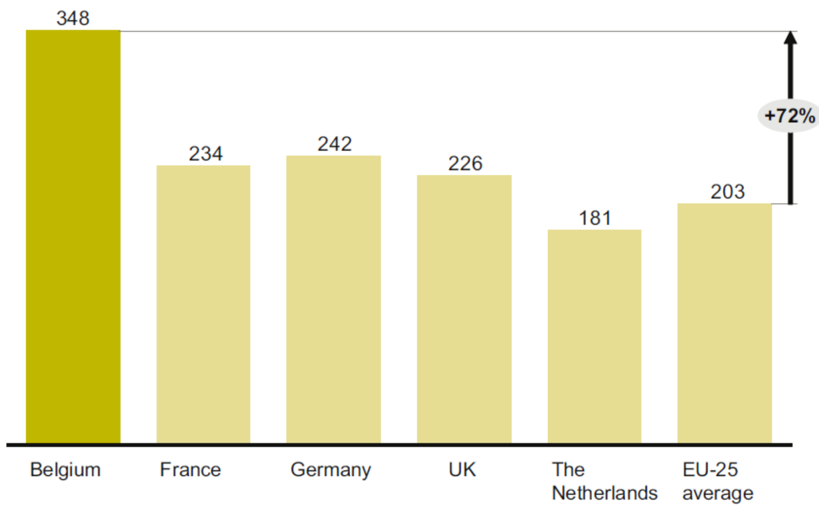

Figure 6: Average residential energy consumption (heating, cooling, lighting, appliances) in neighbouring countries. KWh/m², 2005. Source: McKinsey&Company (2009).

One reason is the age of the residential building stock. Older houses consume more energy. Compared to neighbouring countries, a high percentage of houses (66%) originated before 1970 (McKinsey&Company, 2009). Minaraad and SERV (2012) remark that buildings in Flanders have an average lifespan of more than 80 years. On top of that, figures of Building Performance Institute Europe (BPIE) (2011) show that the renovation rate of Belgium in 2011 was at a very low level of 0.75%, lower than the European average of 1% and much lower than the 2.5% per year necessary to achieve 2050 GHG reduction goals (Staniaszek et al., 2013). According to the same figures the new build rate in the residential sector was about 0.68%.

Secondly, there is a high portion of single-family houses. In both Belgium and Flanders, only 25% of the housing stock consists of apartments, which naturally use less energy (FOD Economie K.M.O. Middenstand en Energie, 2012). Another important reason is that the size of households has been continually decreasing since 1990 (Vlaamse minister van leefmilieu natuur en cultuur, 2011). This causes a more scattered energy use, which is less efficient. Also the size of an average house is not adapted to such small families.

3.2 EE potential in existing residential buildings

According to McKinsey&Company (2009) Belgium has an energy savings potential (with positive NPV) of 105 million barrels of oil equivalents (boe) by 2030, equal to 29% of primary energy use in the business-as-usual scenario. The largest share (58%) of this savings potential can be found in buildings.

According to McKinsey, more than 21% (or 31 million boe) of the total savings potential in Belgium could be reached by renovating thermal envelopes of existing residential buildings to an energy use of 15-35 kWh/m² (McKinsey&Company, 2009). A first package of measures would include basic measures such as attic insulation, weather-stripping doors and windows and making homes airtight. This would save up to 14 million boe. A second package of measures, including better insulation of roof and walls would save up to 17 million boe.

Figures of VEA (2011) confirm that there is a large potential in existing buildings: 15% of the existing residential buildings do not have full double glazing, 24% do not have attic or loft insulation, 72% do not have floor insulation, 59% do not have external wall insulation. Hermelink and Müller (2010) showed that deep retrofits are the preferred solution from both ecological and economical point of view. By renovating 'right first time', houses would be '2050 proof' (Minaraad and SERV, 2012). These deep retrofits reach German energy performance standards for new buildings in 2009 or even a passive house level, saving 70-90% of annual energy consumption for heating.

According to calculations of Hermelink and Müller (2010), it would be cost-efficient for both single-family houses and multi-family houses in Belgium to make deep retrofits: the cost of energy consumption is higher or equal to the cost of saving energy.

3.3 Conclusion

Belgium, and especially Flanders, is a weak performer on the plan of EE, but is decreasing its energy intensity steadily. Residential buildings account for about a quarter of total energy use in Belgium. Belgium's energy use in residential buildings is substantially higher than in neighbouring countries. This is due to the high age of the building stock and the high percentage of single-family houses. Also, the size of households has been continually decreasing.

In effect, Belgium has a large unrealized potential to improve EE. 21% of this potential can be realized by retrofitting existing residential buildings. Deep thermal retrofits would be cost-effective for both single- and multi-family buildings.

4 Conceptual framework

The cost-effective potential to improve EE in existing buildings is vast in Flanders. Therefore, the research question of this dissertation is all the more relevant. *How can policy further improve energy efficiency in existing residential buildings in Flanders?* Firstly the AS IS policy situation will be analysed. This analysis and the EED will be used to propose measures to improve this policy.

To be able to analyse current policy on EE and the new EED, this dissertation will look at these subjects from three perspectives, as depicted in Figure 1.

Firstly, this dissertation looks at the internal decision making process. It is important that policy supports decision makers in each stage of their decision process. What are these stages and which stages could be targeted by additional policy measures?

Secondly, barriers hindering the uptake of thermal retrofits are mapped in the decision making process. These barriers give an overview of the constraining factors for households throughout the decision making process. Each of these barriers is an opportunity to increase EE. Policy makers can seize this opportunity by tackling these barriers with the appropriate policy measures.

Thirdly, policy should target a few homogeneous priority groups instead of the entire population. Policy should target these priority groups with specific measures, considering the characteristics and barriers relevant for each priority group.

4.1 The decision making process

In this section, it is explained how households make decisions about EE investments. Firstly, three key stages in the decision making process are distinguished. The staged nature of the decision making process has the implication that policy should target each stage of the decision making process. Furthermore, each stage has different forms of communication and information which are more appropriate. This is elaborated in the second section of this chapter.

4.1.1 The stages of the decision making process

In the literature, an important contribution to the decision making process is made by Rogers (2003). He distinguishes five stages in the decision making process: the knowledge, persuasion, decision, implementation, and confirmation stage. For three of those stages there is clear evidence: the knowledge stage, the decision stage, and the implementation stage. Also, Labay and Kinnear (1981), in a study on the adoption of solar systems, and Novikova, Vieider, Neuhoff, and Amecke (2011b), in a survey on the drivers of thermal retrofits in Germany, confirm the importance of these three stages.

This is logical. One can see these stages as necessary links in the cause-and-effect chain. Indeed, in the retrofitting decision making process, individuals needs to have knowledge about the possibility, specifications, advantages and disadvantages of retrofitting their house. Only then they can make the decision whether or not to make such an investment. After making a plan for the renovation, the retrofit is implemented.

It is clear that policy should cover each stage of the decision making process to facilitate a smooth flow through the process. Wilson and Dowlatabadi (2007, p.180) illustrate that policy should target particular stages in the decision making process with appropriate policy instruments to reinforce behaviour. "Taking thermostat-setting behaviour as an example, raising awareness is more relevant for early stage decision makers, and reinforcing choices through feedback is more appropriate during later stages. The precede-proceed model, also from public health, similarly emphasizes the importance of reinforcing factors, e.g., advice, subsidies, and feedback, to sustain behaviour that may have initially been prompted by predisposing factors such as awareness, norms, and attitudes."

In the remainder of this dissertation, a model of the decision making process with three stages will be used as presented in Figure 7. These stages are: the knowledge stage, the decision stage and the implementation stage. The following paragraphs elaborate the three stages of this process.

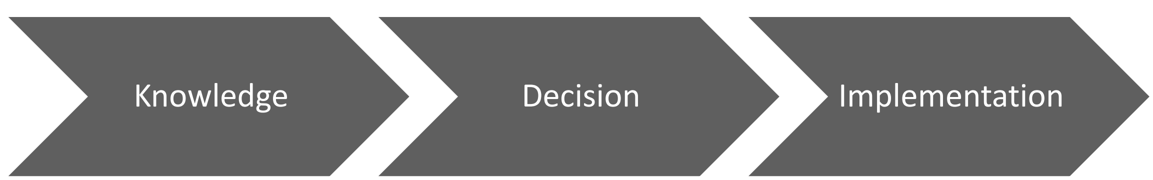

Figure 7: Thermal retrofitting decision making process. Inspired by: Rogers (2003), Labay and Kinnear (1981) and Novikova et al. (2011b).

Firstly, in the knowledge stage, the decision maker notices the existence and possibility of retrofitting. Furthermore, he/she may become aware about (the magnitude) of his/her general energy use and the importance of space heating.

In the decision stage, the decision maker has to search for more in-depth information on benefits and costs of retrofitting in order to shape his/her attitude on thermal retrofits (Rogers, 2003). Then the individual makes the decision whether or not to invest to retrofit his/her residence. The decision maker does this by balancing costs and benefits of the decision. Rogers (2003) adds that the perceived uncertainty about an innovation is very important. He mentions that key characteristics of an innovation are relative advantage, compatibility, complexity, trialability and observability.

Furthermore, the individual makes a more specific plan in the decision stage: he/she decides on what components he/she will target during this renovation and how deep he/she will make the retrofit (degree of insulation, airtightness etc.). This determines the upfront cost of the investment, the ex-post energy use and thus also the energy savings by increasing EE. In this stage the decision maker might consult an architect or a building professional for advice.

In the implementation stage, the principal searches for a building professional to retrofit his/her house. This professional executes the renovation. The retrofitting process and the quality of work influence the satisfaction of the decision maker. The quality of work is essential to realize the foreseen energy savings. Thus the satisfaction of the decision maker is greatly dependent on the skills of the building professional executing the investment. Ex-post satisfaction is important, as the individual is probable to influence the people around him who are going through the same decision making process as he/she has gone through.

4.1.2 Communication in the decision making process

Communication is an essential aspect of the decision making process. Throughout the decision making-process, the decision maker is influenced by different forms of communication. In this section, it is investigated what communication channels and information is more appropriate per stage of the decision making process. This is depicted in Figure 8.

Rogers (2003) states that mass media channels are relatively more important in the knowledge stage. In this regard, channels such as internet, radio, television, and information brochures are more suitable "to create knowledge and to spread information" (Rogers, 2003, p.205). Novikova et al. (2011a) add that, because people are not actively searching for information in the knowledge state, information should be presented in such a way that people "stumble across it" (p. 7). They outline that such information could be information on the building's energy cost (through energy bills) or generic information on thermal retrofit options.

Interpersonal channels are more important at the decision stage of the decision making process (Rogers, 2003). Rogers states that a face-to-face exchange is more effective "in dealing with resistance or apathy on the part of an individual" (p. 205) because interpersonal channels allow two-way communication which can persuade an individual by taking away uncertainties and questions. Novikova et al. (2011a) indicate that people have most trust in family and friends and local trades-people. Official information from authorities or EPCs also receives high trust. Novikova et al. (2011a) add that information which can persuade people typically provides details about different retrofit options or information on government support measures.

Novikova et al. (2011a) explain that in the implementation phase, decision makers want to be sure that the planned retrofits are executed in an optimal way. Therefore, they want contractors who are "qualified and experienced in order to effectively implement EE measures and provide thorough marketing advice and technical justifications to their customers" (Novikova et al., 2011a, p.7). Decision makers benefit from a label which identifies skilful building professionals. Qualification schemes and expert certification are highly appropriate for this, provided "that policy has a well-considered communication strategy" (Novikova et al., 2011a, p.21). On the other hand, education and information provision towards contractors is essential to help them acquire the necessary skills (Novikova et al., 2011a).

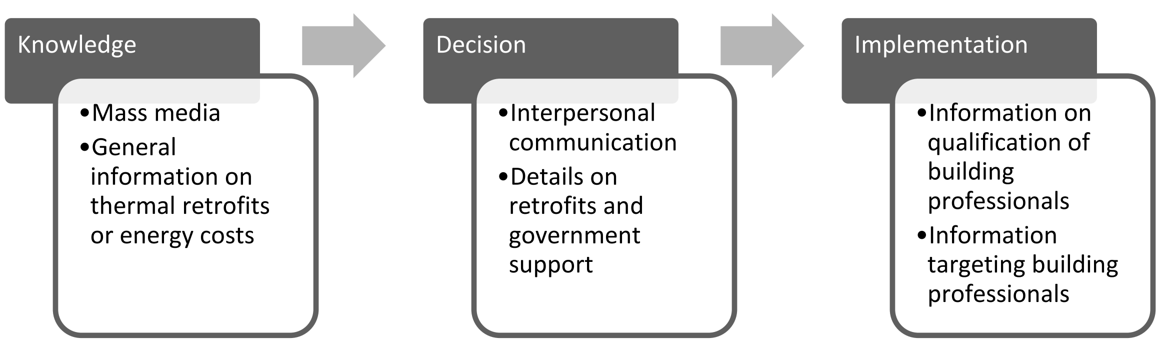

Figure 8: Communication throughout the decision making process

4.1.3 Conclusion

Three stages can be discerned in the decision making process on thermal retrofits: the knowledge, decision and implementation stage. In order to facilitate a smooth flow through the decision making process, policy should cover each stage of the process thoroughly.

In the knowledge stage, the decision maker gains awareness and basic information on thermal retrofits. In the decision stage, he/she weighs the costs and benefits of performing a thermal retrofit on the basis of more detailed information. Furthermore, he/she makes more detailed plans about the retrofit activities. In the implementation phase, a building professional executes the retrofit. The decision maker may further influence other decision makers through interpersonal communication.

Mass media channels, providing general information on thermal retrofits or energy costs are most effective in the knowledge stage. Interpersonal communication providing details on retrofits and government support are most effective to make people decide to invest. Information on the qualifications of building professionals is the most important for people in the implementation stage. Also information targeting building professionals is important to help them acquire the necessary skills.

4.2 Barriers to investment in the existing housing market in Flanders

The decision process outlined in the previous section gives a good image of the internal process when deciding upon executing a thermal retrofit. There are other important constraining factors, though, which influence the decision making process. Bachus and Van Ootegem (2011) explain that "a distinction is made between on the one hand people's motivation to change behaviour, and on the other hand their ability to change" (p. 12).

In this section, the emphasis will lie on factors constraining people's ability to change behaviour, in this case to invest in thermal retrofits. Such factors are known in the literature as barriers. These barriers naturally complement the (internal) perspective from the decision making process. Barriers constrain the individual in different stages of the decision making process. Sometimes the distinction between internal, motivational factors and external, constraining factors is not that clear. In effect, some of the barriers described in the literature further explain internal aspects of the decision making process.

Each of these barriers should be seen as an opportunity to reach a higher level of EE (Sathaye, Bouille, and Verbruggen, 2001). Such an opportunity can be seized by tackling the underlying barrier through policy intervention. Such a policy intervention can tackle more than one barrier in the same time (Sathaye et al., 2001).

In the following section, a short literature overview is given about barriers. Then, an attempt is made to integrate the barriers described in literature in the decision making process (cf. supra). In the interviews conducted for this dissertation there was an emphasis on barriers in Flanders. In that regard, the importance of the outlined barriers in the Flemish context will be illustrated by findings from the conducted interviews and Flemish surveys or reports. Also, additional important barriers in Flanders will be revealed in the field of policy.

4.2.1 Barriers: a short literature overview

Despite various benefits of increasing EE (cf. supra), actual uptake of EE measures remains much lower than its potential. In this regard there seems to be an energy-efficiency gap. This energy-efficiency gap, often denominated 'the energy paradox', corresponds to the difference between the actual and the optimal level of energy use (Jaffe and Stavins, 1994). There seems to be a wide range of technologies which would improve EE in a cost-effective way. Their gradual diffusion is much slower than would be optimal. Hence, the economic potential of technology diffusion, which would be reached when all cost-effective technologies would be implemented, is not attained. This potential is often referred to as the no regrets potential.

The fact that there is a 'no regrets' potential is striking. Implementing cost-effective technology would be advantageous for the involved parties and the society as a whole (cf. supra). A series of barriers is the classic explanation in the literature for the gap between market potential, economic potential and even higher potentials (Sorrell et al., 2000). These barriers prevent the diffusion of energy efficient technologies.

Weber typifies a barrier by three features: the obstacle, the subject hindered, and the action hindered (Weber, 1997). Weber outlines that obstacles could be people, patterns of behaviour, regulations or economic interests. Subjects could be consumers, voters, households or administrations of any kind of entity. The action hindered could be buying more efficient equipment, retrofitting, establishing public traffic network or establishing a law (Weber, 1997).

There is much work in literature which tries to categorize barriers. Sorrell et al. (2000) categorize barriers in economic, behavioural and organizational barriers. Weber (1997) typifies barriers into institutional, market, organizational and behavioural barriers. Levine et al. (2007) categorize barriers into: 'financial costs/benefits', 'hidden costs/benefits', 'market failures' and 'behavioural and organizational non-optimalities'. Lastly, Economidou et al. (2011) use the following classification of barriers: 'financial', ‘institutional and administrative’, ‘awareness, advice and skills’ and ‘separation of expenditure and benefit’.

The barriers most commonly cited by these taxonomies are: imperfect information, bounded rationality, lack of access to capital, high upfront costs, split incentives, hidden costs, low importance, and price distortions. Other, less often cited barriers are: form of information, low awareness of potential benefits, inertia of behaviour, risk, lack of trust, long investment horizons, principal-agent situations, cultural barriers, building process barriers, insufficient skills and knowledge related to building professionals, fragmented market structure, and administrative and regulatory barriers,.

Hereunder, the author presents a selection of the most important barriers and proposes a taxonomy of barriers. In this taxonomy, the author aims to categorize barriers on the basis of the decision making process outlined above. To the author’s knowledge, such a classification has not been used in literature yet. In this taxonomy, barriers are classified by the stage in the decision making process they hinder. Barriers hindering the knowledge stage, decision stage and implementation stage will be regarded consecutively. On the other hand, government policy influences the decision making process as a whole. Indeed, policy determines the playing field in which decisions are made by individuals. Therefore, policy barriers will be regarded as a separate category of barriers. An overview of these barriers can be found in Figure 9.

This taxonomy is different from most taxonomies used in the literature. Indeed, the author has no knowledge of any other overview of barriers which is structured according to the decision making process. This taxonomy is not meant to be exhaustive, nor deeply detailed. It is an attempt to make a clear distinction between barriers. This is not easy because some barriers overlap or are connected to one another. As Weber (1997) states, each barrier has aspects from each category of barriers. Weber (1997, p.2) resumes:

> *“It is empirically impossible to find the ‘true’ reason behind an energy-conserving action which has not been taken. Barriers cannot be classified because they are invisible. They are real, but not observable.”*

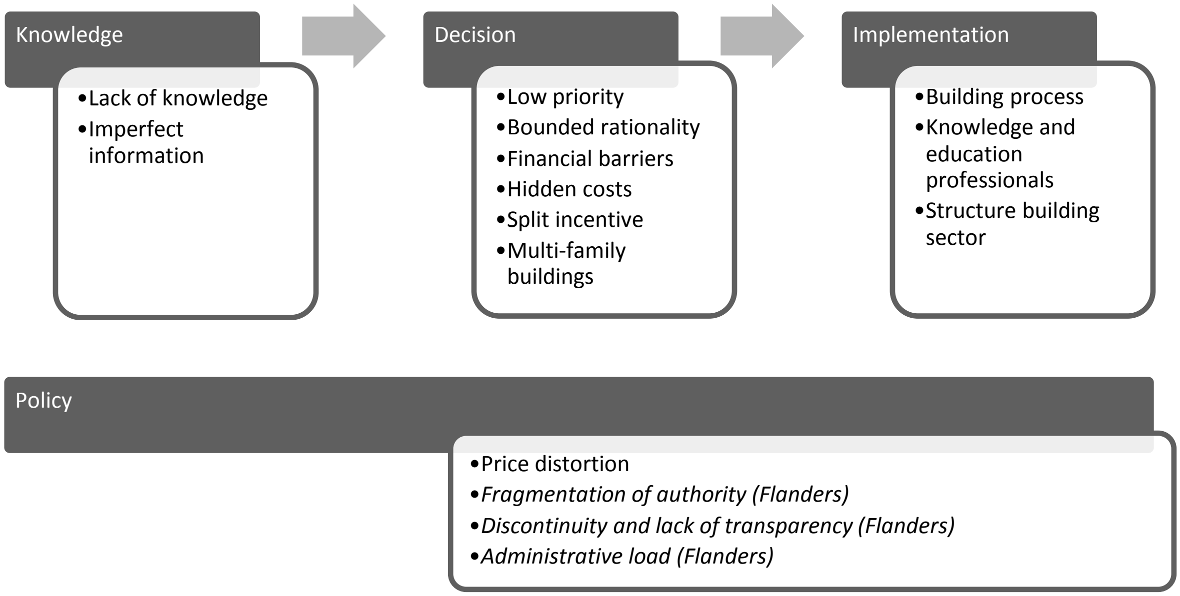

Figure 9: Barriers in the decision making process. The barriers in italic are specific for the situation in Flanders.

4.2.2 Barriers in the knowledge stage

As described above, knowledge about general energy use, thermal retrofits, and other EE measures is an essential step before someone can consider a thermal retrofit.

4.2.2.1 Lack of knowledge

It is often recognized in the literature that households have a lack of knowledge about the availability of, the benefits of, and the government support for energy efficient technology (International Energy Agency, 2008). Furthermore, consumers generally cannot estimate the magnitude of energy use (and cost) of different energy services, nor do they understand how much energy (and money) EE measures can help them to save. This, leads to wrong cost-benefit judgements when deciding upon EE investments. Possible explanations for this lack of knowledge are information failures (cf. infra) and the rapid evolution and complex character of technology.

Findings in Flanders

Figures of a study conducted by Tns and VEA (2011) reveal that about 65% of the respondents didn't have a clue how much it costs to place roof insulation - those who had an idea generally overestimated the costs by on average 70%. Furthermore, only 63 to 72% of the population knew about financial support measures (Tns and VEA, 2011). These figures have improved, though, over the last years. The interviews conducted confirmed that potential decision makers lack knowledge on EE measures, and on the magnitude and division of their energy use. Claes (2013) explains in an interview. “Some retrofit measures such as cavity wall insulation are still relatively unknown and distrusted by people.” Ramaekers (2013) added the following. “Customers lack knowledge of the building process and EE measures.”

4.2.2.2 Imperfect information

Information failures (or imperfect information) can be caused by missing or partial information, by a lack of dissemination of information, by the credibility and trust in the information source, by the way information is presented or by the complexity of the information (Council, 2010; Sathaye et al., 2001; Sorrell et al., 2000). Novikova et al. (2011a) state that information from different sources is often inconsistent, which limits its value. Sorrell et al. (2000, p.48) emphasize that information, in order to cause a change in behaviour, should be “specific, personalized, vivid, simple and available close in time” Also, energy efficient technologies are characterized by ‘invisible’ benefits, so it may be hard to assess their performance (Levine et al., 2007). Information failures lead to a lack of knowledge (cf. supra). Imperfect information is often cited in the literature as a market barrier because the market has a general tendency to underprovide information, because of its public good nature (Sathaye et al., 2001).

Findings in Flanders

Information failures also exist in Flanders. Ramaekers (2013) illustrates that “there is much information on the internet, but it may be hard for households to distinguish correct information from contradicting false information.” Hendrickx, Smets, and Van der Wilt (2011) show in a study on EE with underprivileged people, that 82% of the respondents have difficulties finding information. Either they don’t know where to start looking for information, or the information is too complex. In 2011 47% of the Flemish population had heard about the government website www.energiesparen.be (Tns and VEA, 2011). Verspeel (2013) adds that some information on this website is not accurate: “the energy calculator does not correctly indicate the energy savings from different measures.”

4.2.3 Barriers in the decision stage

In the decision stage, the decision maker shapes an attitude and decides whether or not he/she will execute a thermal retrofit. The literature provides six important barriers affecting this stage. Firstly there are two important barriers explaining the internal decision process: low priority and bounded rationality. Secondly, there are two constraints affecting the costs-benefit analysis on performing a thermal retrofit: financial barriers and hidden costs. Thirdly, there are two situations which prevent a decision favouring EE from being made: the split incentive and the situation in multi-family buildings.

4.2.3.1 Low priority

Individuals often attach low priority to energy decisions. Energy costs only make up for a fraction of total budget – Economidou et al. (2011) give an estimate of 3 to 4% of disposable income. This results in a low incentive to make energy use more efficient. Also, payback times are long, despite a positive NPV (Economidou et al., 2011). Furthermore, when making a decision, other factors (health, safety, comfort, convenience) often receive higher priority than EE (International Energy Agency, 2008), not in the least in decisions on housing. Moreover, the benefits of EE investments generally are not visible, in contrast to the visible benefits of a new kitchen or bathroom.

Findings in Flanders

In a survey conducted by Tns and VEA (2011), 90% of the Flemish people found saving energy important (and 51% very important). 66% of those respondents described themselves as being (very) frugal with energy. The survey revealed, though, that this attitude did not always result in action (Tns and VEA, 2011). Matthys (2013) confirms that EE is mostly not the first priority in people's housing decisions. "When building or renovating a house, people don't dream of a zero-energy house; they dream of a large house with a chic bathroom and a big kitchen. " In addition, a study on energy use with underprivileged people revealed that underprivileged people have other, more important problems (financial problems, emotional problems) on which they have to focus (Hendrickx et al., 2011).

4.2.3.2 Bounded rationality

Bounded rationality prevents an individual from acting as the utility maximizing 'homo economicus' assumed by economic models. Individuals face constraints on attention, resources or ability to process information. These constraints are particularly present in decisions on EE because of complexity and information failures (cf. supra) (Sorrell et al., 2000). To avoid difficult decisions, people make use of rules of thumb or stick to habits (inertia). In effect, individuals make systematically biased decisions, mostly not favouring EE investments (Bachus and Van Ootegem, 2011). Bounded rationality can be seen as an upper limit to what can be reached by correcting other barriers (Sorrell et al., 2000).

4.2.3.3 Financial barriers

A lack of capital prevents customers from paying the upfront cost needed for the investment. On the one hand internal funds might be unavailable. On the other hand, people don't have access to a loan on agreeable terms (Economidou et al., 2011) or have an overall reluctance to contract a loan (Sorrell et al., 2000). These financial constraints lead to a preference for short-term profitability, which is disadvantageous for energy efficient technologies because of their usually higher prices (Council, 2010). Lower-income sections of society naturally are most vulnerable to this barrier (International Energy Agency, 2008). Sorrell et al. (2000) and Economidou et al. (2011) show that this barrier is one of the most important barriers Economidou et al. (2011) add that the financial crisis makes this barrier more severe.

Findings in Flanders

Claessens and Ledeganck (2012) argue that the fundamental problem is the higher price of energy efficient products. "Higher prices restrict EE goods to a niche position." A survey of VEA and Tns reveals the importance of the financial barrier: the reason 'no money, too expensive' was consistently one of the most important barriers to investment (Tns and VEA, 2011). Bonnarens (2013) added in an interview that "the [abolished] federal support measures were a trigger for many households because they decreased the relative cost to 'normal' products."

4.2.3.4 Hidden costs

A decision to invest in EE measures incurs a number of hidden costs, which are not expressed in monetary terms. Nevertheless they are real and sometimes they are perceived larger by decision makers than the objectively monetized values. Sorrell et al. (2000) add that not including these costs makes studies overestimate the cost-effective EE potential.

What are these hidden costs? Firstly people need to gather information on technical options, funding, possible government support or building professionals. Then they need to analyse this information to make the right choice (Sorrell et al., 2000). In addition, there is the administrative load of demanding subsidies afterwards (cf. infra). These activities consume time and thus incur an opportunity cost. Secondly, there is inconvenience when performing the construction works. For deep retrofits, for instance, renovation works can only take place in a vacant building (Economidou et al., 2011). In that case, occupants have to find another place to live during a significant period.

Findings in Flanders

Hidden costs are important in Flanders. Tns and VEA (2011) showed in a study that practical considerations are consistently among the three most important reasons for not investing in EE measures. Especially for floor insulation and wall insulation people saw 'too much fuss' as an important obstacle. Claessens and Ledeganck (2012) mention that (elderly) people also don't like the fact that strangers are present in their house.

4.2.3.5 Split incentive (landlord-tenant barrier)

The split incentive (principal-agent mechanism) between landlord and tenant is one of the most well-known barriers to EE in the literature. The tenant pays the energy bill; the landlord is responsible for making investments in the house. In this situation, the tenant would benefit from the landlord's investment. But the landlord does not have an incentive to invest: he/she cannot realize the benefits of the investment (Sorrell et al., 2000). On the other hand, the tenant does not invest, because he/she may move out before the investment has paid off. As a result, no investment is made. In principle, tenant and landlord could come to an agreement together. In effect, the landlord could make the investment and the tenant could pay a higher rent. Economidou et al. (2011), though, mention that legislation does not always allow such a voluntary agreement. Economidou et al. (2011, p.60) designate this barrier as "the most complex and long-standing barrier relating to existing buildings, particularly in countries where there is a high share of rental accommodation in the residential sector."

Findings in Flanders

In the study of Tns and VEA (2011) the split incentive consistently turns out to be the most (or second most) important barrier to EE. 90 to 97% of tenants don't want to invest in various EE measures because they rent the house (Tns and VEA, 2011). Inslegers (2013) explains that landlords are generally not inclined to invest in EE either. "Landlords are generally rather old and not professional. They own two to three buildings. They don't see the need to invest in EE measures." Van Dyck (2012) explains in an interview that one could "encourage landlords to invest by allowing them to increase the rent pro rata with the energy savings." The BECO-study (2010b), though, explains that due to federal regulation the landlord in most cases can't raise the rent after an investment, even if the tenant would agree with such an arrangement. Firstly, the investment should raise the value of the house by more than 10% to justify a raise in the rent, which seldom is the case for the type of EE investments the government currently stimulates (low cost separate components, no deep retrofits). Secondly, the frequency with which the landlord can raise the price is restricted to every three years.

Due to federal policy supporting house ownership (e.g. fiscal stimulus policy for mortgages), the private rental market has become tighter and tighter. Indeed, demand is larger than the supply of rental houses (BECO, 2010b). Schaerlaekens (2013) explains that "tenants on the private rental market often are frictional tenants or underprivileged people." These are people who have a difficult relationship with their landlord, but who are nevertheless dependent on the goodwill of their landlord for the quality of their house (Hendrickx et al., 2011). The scarcity in the rental market and the split incentive result in houses of a lower structural and EE quality than privately owned houses and dwellings on the social housing market in Flanders (Heylen and Winters, 2009). In Flanders a relatively high portion of the market consists of owner-occupied houses (Building Performance Institute Europe (BPIE), 2011): 18.50% of all buildings are on the private rental market.

4.2.3.6 Multi-family residential buildings

Multi-family residential buildings are buildings which consist of multiple separate individual housing units, such as apartments. These buildings form another complex situation in which little investments in EE measures occur. This is because multiple owners have to agree on investments in the building. Economidou et al. (2011) explain: "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" (p.58). Little attention in the literature is attached to this barrier.

Findings in Flanders

In Flanders, different owners in a multi-family building have to approve investments in a general assembly with a 75% majority. This holds for investments on communal parts such as roofing, central heating, insulation of the building shell (BECO, 2010a). Matthys (2013) explains in an interview that this leads to difficult situations. “The general assembly of the co-owners association is very diverse. It is a mix of poor and rich, young and old.” Also, some of the decision makers might be owner-landlords who are subject to the split incentive described above.

Matthys (2013) proceeds in the interview: “this leads to perverse situations where the general assembly decides whether or not the owner of the top floor can insulate the roof, even though the lack of insulation mostly affects his/her energy bill.” The apartment property manager has to put forward potential measures to maintain (the value of) the apartment. The property manager often has a lack of knowledge about EE measures and/or members of the general assembly have a lack of trust in the property manager (BECO, 2010a). In Belgium, about 35% of residential floor space lies in apartments (Building Performance Institute Europe (BPIE), 2011).

4.2.4 Barriers in the implementation stage

In the implementation stage, the decision maker hires a professional to implement the retrofit on which he/she decided in the decision stage.

4.2.4.1 Building process

EE generally is not an important factor in the decision process in the building chain (Sorrell et al., 2000). Herein, building sector professionals have an important role (Novikova et al., 2011b). They have a potentially large impact by suggesting more energy efficient products to customers. In this regard, the mechanism of adverse selection plays an important role. Building sector professionals suggest and offer goods on the basis of customer preferences, rather than on quality (Sorrell et al., 2000), otherwise they exclude themselves from consideration of the customer.

Findings in Flanders

Interviews confirmed the view from the literature. Matthys (2013) explains: “price, rather than energy efficiency, is the most important criterion.” Ramaekers (2013) gives a typical example. “A carpenter offers to make an airtight installation of windows, even though this is not explicitly required in the tender. Airtightness causes an increase in installation time of 15%, but makes the window more energy efficient. This feature makes the total cost of installation rise by 3 to 4%. As the customer doesn’t know the importance of airtightness, he/she drops this feature to decrease costs.”

4.2.4.2 Knowledge and education of professionals

Professionals (building professionals, architects, and financiers) who lack knowledge about EE measures can cause several negative effects. Firstly they may deter potential investors by giving wrong or conflicting advice (Economidou et al., 2011). Secondly a lack of knowledge leads to low quality of professional’s work. This may lead to negative feedback from customers (Economidou et al., 2011). Neuhoff, Amecke, Novikova, and Stelmakh (2011a) state that information of friends and colleagues (e.g. who have executed a building renovation) is highly relevant and credible to potential investors. Thirdly, a house which undergoes a (poorly executed) deep renovation today will not be renovated for many years. Such a sub-optimal house is locked in (Economidou et al., 2011) using more energy than it should.

Findings in Flanders

Stakeholders, policy makers and building sector experts all indicated a lack of knowledge and skills of mostly building professionals regarding EE measures. Ramaekers (2013) declared in an interview that “only 25% of building professionals have an adequate knowledge of EE measures and techniques.” Geert Ramaekers (2013) of Bouwunie indicates insufficient education as a cause. “Young professionals who enter the labour market lack knowledge about the latest EE techniques and materials due to inadequate education. Only next year’s curricula in technical schools will cover more techniques on EE.” Vermeiren (2013) adds. “Also small contracting enterprises have difficulties to afford to send their employees on training. Especially older managers don’t see the need to waste valuable working hours of themselves or their staff.” Matthys (2013) points to the importance of cross-competence education. “Building professionals need to learn about techniques outside of their own field of expertise as techniques from different fields increasingly need to be integrated. Only then a more holistic functioning of the building chain is possible.”

Ramaekers (2013) thinks that architects are more up to date. "Architects are more knowledgeable of trends and novelties regarding EE. They have to keep up with the regulation for the construction of new buildings." Indeed, architects are responsible for making a new building comply with energy performance requirements. In this regard, they have an overview of possible techniques and materials.

4.2.4.3 Structure of the building sector

The structure of the building sector for renovations is typified by a high number of small companies specialized in their own domain. According to Levine et al. (2007, p.419) this results in the fact that responsibilities throughout "each stage of design, construction and operation" are fragmented over many actors. This results in suboptimal results in the design phase. Economidou et al. (2011, p.59) illustrate that "all too often the focus is on individual products and not on entire end-to-end, holistic solutions."

Findings in Flanders

"The building chain for renovations consist of a high number of small companies such as carpenters, general contractors, glaziers, builders etc.", confirms Matthys (2013) in an interview. The numbers are telling: Bouwunie, which focuses on Flemish small enterprises, counts 8,000 members; Vlaamse Confederatie Bouw, which focuses on every type of building enterprise in Flanders counts 9,000 members. This scattered structure reflects the fact that building professionals don't tune their work to each other. Verspeel (2013) states in an interview "that retrofits need a holistic approach to obtain the most efficient, integrated solution." Ramaekers (2013) sees a solution. "Building teams, in which professionals of different specializations work more closely together, could be a good solution for these problems."

Another problem in the building sector, raised by Mieke Bonnarens (2013) of Bouwunie, is the non-transparent market of building professionals (architects and contractors): "customers have little means to check the skills and reliability of building professionals. It is hard to compare building professionals." Bouwunie (building professionals) introduced the label of energy-conscious contractors. Bonnarens (2013) stated, though, that "for building professionals still only a small fraction of the market is certified."

4.2.5 Policy barriers

Policy makers and public administrations shape the playing field where supply and demand meet. On the one hand, decision makers and building professionals have to comply with certain rules and regulations which are set by the government. On the other hand, governments can influence decision makers by providing incentives and information. In this regard, policy makers can influence the entire decision making process, as depicted in Figure 9.

However, Weber (1997) states there are also barriers situated within policy and public administration on EE. Obstacles could be laws which hamper the uptake of EE measures, a set of political rules or the functioning of institutions. BPIE illustrates that in Italy "fragmentation, delay and gaps in the regulatory action of public planning have not allowed the public sector to be the driver for improved EE in buildings that it should be" (Economidou et al., 2011, p.57). A first important institutional barrier in the literature is the distortion in energy prices. Also, three more policy barriers are proposed on the basis of interview findings. These are: fragmentation of authority, discontinuity and lack of transparency, and administrative load.

4.2.5.1 Energy price distortion

Energy price distortions prevent consumers from receiving the right incentives for purchasing more energy efficient products. This is because energy is subsidized and externalities (pollution, resource depletion) are not included in the price of energy (International Energy Agency, 2008). It makes the upfront cost higher in comparison to the future financial savings of the investment. Government has a major responsibility in this, because of its authority regarding taxes (potential to internalize externalities) and subsidies.

Findings in Flanders

Energy price distortions in Belgium are substantial. A recent study of IMF (2013) estimates post-tax subsidies in Belgium to be 0.21% of GDP for natural gas and 0.09% for coal (this is 0.42% and 0.19% of government revenue). Furthermore, there are relatively low tax levels for households, transport and industry (Ecofys and WWF, 2011). Also, the actual cost of nuclear energy to Belgium is much higher than its price reflects (BBL, 2011). Using taxes to make energy prices reflect true costs to society could increase EE.

4.2.5.2 Fragmentation of authority (findings in Flanders)

4.2.5.2.1 Regional fragmentation

Regional fragmentation of authority is inherent to Belgium's state structure. Belgium is a federal country. The fragmentation of authority leads to a dual problem. Most of the authority connected to EE regulation lies at the level of the regions: Flanders, Wallonia and Brussels. Ecofys and WWF (2011, p.3) explain. "While at the regional level there were some ambitious approaches, there was an overall lack of harmonisation across the measures, and those issues which required national level solutions often lagged behind." In this case, the obstacle is most important for the supply side of EE measures. Verspeel (2013) illustrates: "contractors have to cope with different regulations if they work in the Brussels-capital region or in Flanders."

4.2.5.2.2 Fragmentation between different policy fields

A second issue, specific to the policy field of EE, is the fact that it is related to other policy domains. Cooperation and coordination between these entangled policy fields is necessary to craft a coherent policy on EE. The most obvious link is the one between the policy fields of EE and housing. Thermal retrofits occur within houses, but policy is crafted by the Flemish ministry of energy and executed by the public administration of energy (VEA). This leads to situations where it is possible to obtain subsidies for roof insulation to improve the EE quality of the house, whereas the structural quality of the house can force the demolition of the house. The money spent for insulation is money down the drain. Tine Tanghe and Wilfried Bieseman (2012) of VEA (Flemish Energy Agency) confirm in an interview that "both policy fields should more closely consult with each other." They argue, though, that an integration of those policy fields is not evident. "The two policy fields have different priorities. A social housing policy should ensure affordable housing for everyone. EE policy tries to minimize carbon dioxide emissions. That's why the cabinets of energy and housing don't want to merge."

Since 2009, minister Freya Van den Bossche has been responsible for both the Flemish energy and housing portfolio. Vermeiren (2013) sees this as a missed opportunity. "The fact that the housing and energy portfolios were with one minister, was seen by many people as a chance to integrate the energy and housing policy more closely. Until now, this has only marginally been the case though."

4.2.5.2.3 Crisscross of incentives

Lastly, within Flanders there are several institutions which offer incentives independently of each other to encourage investments in EE. Firstly, the Flemish government offers general renovation subsidies. Until recently, the federal government was offering tax cuts for a variety of EE measures – now only a few measures are left. Furthermore, provinces and municipalities also provide incentives. Finally, the energy distributors offer a wide package of incentives. This leads to a crisscross of incentives. Claessens and Ledeganck (2012) state the following about this. “People are confused by the multitude of institutions offering support. They don’t know where to start in the crisscross of incentives.”

4.2.5.3 Discontinuity and lack of transparency (findings in Flanders)

Another obstacle is uncertainty about government policy. On the one hand, people are afraid of discontinuity. Geert Verspeel (2013), a salesman of holistic EE solutions, adds that “people are sceptical about government support. They fear that such support is too good to be true and it will suddenly be abolished, as was the fact with the federal tax cuts for EE measures.”

On the other hand, communication about policy should be more clear and transparent. Policy changes frequently and without a clear transition period. This makes it hard to stay up-to-date for people. A much cited example concerning EE is the prompt decision of the federal government at the end of 2011 to abolish (the lion’s share of) tax cuts on EE investments. Energy counsellors Claessens and Ledeganck (2012) remark in an interview that “a certain group of people only decides to invest in EE measures, when they know subsidies will disappear within a certain time period.” This group of people should be addressed by transparent time paths which show the evolution of policy support. Jan Schaerlaekens (2013), advisor of minister Freya Van den Bossche, adds that “subsidies are more instable than regulation, because subsidies are always re-evaluated during budgetary decisions.”

4.2.5.4 Administrative load (findings in Flanders)

The administrative burden connected to government policy induces a burden to both professionals and customers. Bonnarens (2013) of Bouwunie explains that “especially contractors and boiler installers are subject to a high administrative burden concerning certification of their work.” Matthys (2013) illustrates: “contractors of boilers either need a quality certificate or have to prove their work is in line with quality requirements." Bonnarens (2013) concludes the following. "This administrative work takes time they can't use to install boilers. Professionals have to charge this time to their customers."

On the other hand, subsidies and tax cuts place an administrative load on consumers. If they want to obtain government support they have to cope with different application forms for different institutions. This administrative load is another form of hidden costs (cf. supra). A more automatic approach in granting subsidies is advisable (Minaraad and SERV, 2012).

4.2.6 Conclusion

The decision-process in the previous section explains the motivation of people to change behaviour. Barriers explain people's ability to change behaviour. They form an explanation to the fact that not all cost-effective energy efficient technologies are implemented. In effect, these barriers prevent the diffusion of energy efficient technologies. Therefore, each of these barriers should be seen as an opportunity which policy must seize to reach a higher level of EE.

Barriers to the uptake of EE measures can be classified according to the stage of the decision making process they hinder.

Firstly, a lack of knowledge by decision makers and imperfect information are important barriers in the knowledge stage.

Secondly, the decision stage is complicated by low priority for EE issues and bounded rationality of decision makers. Also financial barriers and hidden costs of inconvenience are important. Furthermore, two specific situations impede action on EE. The split incentive in rental houses results in no action of both tenants and landlords. The communal decision-process prevents action from being taken in multi-family buildings.

Thirdly, in the implementation stage, the building process does not seem to stimulate EE. Also the knowledge and education of professionals is sufficient to guarantee good advice and implementation of EE measures. Lastly, the scattered and non-transparent structure of the building sector is not beneficial for thermal retrofits.

Barriers on policy influence the entire decision-process. Price distortions make less energy efficient products more attractive to decision makers. Fragmentation of authority in Belgium and Flanders prevents a more coherent policy on EE. Discontinuity and lack of transparency make it hard for decision makers to stay up-to-date for people and causes a lack of trust in government support. Lastly, the administrative load to obtain support is another important barrier.

It is hard to give an objective indication about the relative importance of these barriers. The literature mentions financial barriers, hidden costs and the split incentive as the most important barriers. Personal impressions from interviews confirm these are important barriers. Bounded rationality and energy price distortions were not mentioned often in interviews as important barriers. However, this could be due to the fact that it is not evident to tackle these barriers. To give an objective and more precise indication of the relative importance of different barriers, this would require systematic research on a wide scale.

4.3 Priority groups

The total population is heterogeneous. Therefore, to be effective, policy should focus on a few homogeneous priority groups. Rogers (2003) divides the members of the social system into innovation adopter categories. Also in the diffusion of thermal retrofits, one can discern more or less homogeneous adopter categories who adopt an innovation at about the same time. On the one hand there are groups which adopt deep thermal retrofits without government support. On the other hand there are groups in society which lag behind in adopting even less recent innovations such as double glazing and roof insulation.

In the following chapters the characteristics of Rogers' different adopter categories are illustrated. Next, it is considered which specific groups exist in the case of thermal retrofits in Flanders, what are specific barriers and characteristics of these groups, and how these groups coincide with Rogers' adopter categories. In this regard, the goal is to make policy recommendations on how to approach different priority groups in the diffusion of thermal retrofits.

4.3.1 Innovation adopter categories

The diffusion of an innovation like thermal retrofits happens gradually over time (Rogers, 2003). Rogers (2003) divides the adopters of an innovation into five adopter categories according to their innovativeness and the moment of adoption. These five categories are: innovators, early adopters, early majority, late majority and laggards. Members of different adopter categories complete the decision making process in different ways.

Rogers (2003, p. 288) compares socio-economic characteristics from earlier adopters (innovators, early adopters, early majority) with later adopters (late majority and laggards). He states that "earlier adopters generally have more years of formal education, higher social status (income, level of living, occupational prestige), and a greater degree of upward social mobility than do later adopters." The implication of Rogers' (2003) findings is that policy makers should approach different adopter categories in a different way.

The initial uptake of an innovation is very important. Rogers (2003) underlines that the increase in uptake from 10 to 20% of the population is crucial. "After that point, it is often impossible to stop the further diffusion of a new idea, even if one wished to do so" (p. 274). In this regard, the two first categories of adopters are pivotal to start spreading an innovation. Firstly, innovators can be characterized as being venturesome and able to process complex information, although they are not always respected (Rogers, 2003). Secondly, early adopters typically are respected opinion leaders who are crucial in spreading an innovation (Rogers, 2003). Another interesting group are laggards, which are last in adopting an innovation. Laggards are characterized as being traditional and suspicious, living isolated, and disposing of limited financial resources (Rogers, 2003).

Mass media communication channels are most important for innovators and early adopters (Rogers, 2003). These groups require technical information explaining a high comparative advantage over earlier technologies, as explained by Mohr, Sengupta, and Slater (2009). Further groups (early majority, late majority and laggards) rely more and more on interpersonal communication channels (Rogers, 2003) with a high credibility, for example from valued members of the social network (Bartiaux, 2008). Targeting the late majority and laggards can be done by emphasizing reliability, simplicity and cost-effectiveness (Schilling, 2010).

4.3.2 Priority groups of thermal retrofits

This section aims to distinguish homogeneous groups in the diffusion of thermal retrofits in the Flemish population. Firstly, this section looks at which groups current government policy targets or should target. Then, different groups are described and characterized bearing Rogers' adopter categories in mind.

In the Energy Renovation Programme (ERP), VEA (2011) wants to increase the uptake of measures for which a building permit is not required. These are typically measures with a high impact on energy consumption. The ERP has the goal to ensure by 2020 that (1) every house has roof or attic insulation, (2) all single-glazed windows are replaced by at least energy efficient double glazing and (3) central heating systems and natural gas heating systems have a thermal efficiency of at least 90%. In 2011, 85% of houses had full double glazing; 76% of houses had roof or attic insulation and 72% (natural gas) and 34% (heating oil) of houses had an energy efficient heating system (Tns and VEA, 2011). In the ERP, VEA (2011) outlines specific groups which lag behind in the uptake of EE measures. These groups still have a high potential to increase their EE. These groups should be targeted if policy makers want to reach the goals outlined above.

Another important set of measures comes from the Action Plan Almost Energy Neutral Buildings (VEA, 2012a). The measures in this report apply for renovations which need a building permit. In this report, VEA (2012a) aims for a significant amount of existing houses being renovated into almost energy neutral buildings. In this regard, VEA aims (1) to increase the rate of renovation and (2) significantly increase the portion of deep renovations. In this plan, VEA uses a strategy in which it counts on innovators and early adopters to create a market transformation. These priority groups should bring about the crucial diffusion from 10 to 20% of the social system. As stated above, once this uptake has been reached, it is hard to stop the further diffusion of the innovation.

It is clear that these two strategies are very different. In the ERP, VEA targets people who have not undertaken replacement of high-impact components such as roof insulation, double glazing and heating systems. 70% or more of the population already has installed these measures (except for heating systems with heating oil). Reaching the targets of the ERP requires a strategy targeting the so-called laggard. This is a strategy opposite to the strategy used in the Action Plan Energy Neutral Buildings. The strategy of the latter plan aims to reach innovators and early adopters. The following sections attempt to discern crucial priority groups for both strategies. By investigating the characteristics of these groups, recommendations can be made on how to reach them.

In order to attain the goals set out by the ERP, VEA (2011) acknowledged that some groups in society could not be reached by general policy measures. “We have to respond to the specific reasons why certain sections of the population until now have not executed very profitable energy saving investments” (VEA, 2011, p.26). VEA distinguished the following priority groups:

1. Highly educated, middle class and high income
2. Buyers of a home or apartment and young owners
3. Lower education - lower income

4. Elderly owners
5. Landlords

In the following sections, each of these priority groups is elaborated on to discover their characteristics, to see how they pass through the decision making process, and to see what the most important barriers are for them. This is based on information from interviews, reports and surveys in Flanders. For clarity, this dissertation will refer to the first three categories respectively as 'upper middle class', 'recent owners' and 'underprivileged people'. Table 4 summarizes the findings of the following sections.

	Knowledge	**Attitude**	**Uptake of EE measures**	**Specific barriers**	**Adopter category**
Upper middle class	High	high	High	/	Earlier adopters
Recent owners	High	Low	Low	Low priority, financial barrier, multi-family residential buildings	Laggards
Underprivileged people	Low	Low	Low	Imperfect information, lack of knowledge; low priority, financial barriers, hidden costs, split incentive; administrative load	Laggards
Elderly owners	Low	Low	Low	Lack of knowledge; Hidden costs, low priority; administrative load;	Laggards
Landlords	Low	Low	Low	Low priority, split incentive; administrative load	Laggards

Table 4: Different priority groups and their characteristics regarding the uptake of thermal retrofits.

4.3.2.1 Upper middle class

People from the upper middle class are typically highly educated and do not have to worry about money. VEA (2011) states that this group generally has high environmental awareness, is well informed about technical features and government support and is prepared to make investments. Generally, government support is enough to trigger them. The study of Tns and VEA (2011) reveals that the people from a higher social class are more likely to think about their energy use. Also the study reveals that the more people are educated, the more likely they are to know the government information website www.energiesparen.be.

In an interview, Verspeel (2013) reveals the following: “middle-aged families, whose children have moved out and whose mortgage is paid off, often invest in thermal retrofits in order to benefit from tax advantages.” A German survey of Novikova et al. (2011b) also reveal that more educated respondents were more likely to have implemented a thermal retrofit. In this study, education and income were highly correlated. In this regard, Blackley and Shepard (1996), who assessed the diffusion of innovations in home buildings, state that people of “higher socioeconomic status, higher income, and greater education and training are more willing to accept the risks of developing or adopting innovations” (p.306).

In this regard, one can conclude that this group of society falls into Rogers’ (2003) adopter category of earlier adopters (innovators, early adopters, early majority). This is consistent with the generalizations (cf. supra) that earlier adopters have a higher education and a higher social status.

It is this group that government has to target if it wants to make deep renovations more widespread. If this group takes up deep thermal retrofits, the rest of society may follow, as predicted by Rogers. Government could support these groups by decreasing uncertainty about thermal retrofits through (technical) information provision via mass media and demonstration projects. Government should be careful, though, to change its communication strategy from early adopters to early majority. These both groups need a different kind of communication (cf. supra). Financial incentives could convince this priority group.

4.3.2.2 Recent owners

When a home or apartment is bought, this is a natural moment for the new owner to renovate the building. Indeed, most recently-bought houses in Flanders undergo a (major) renovation within a year after the building is bought (VEA, 2011) - for apartments this fraction is substantially less. In this regard, one cannot underemphasize the importance of this priority group. As described above, once a retrofit has been implemented, the building shell may remain untouched for several decades. Therefore, every retrofit should be a deep thermal retrofit in order to avoid lock-in and not to miss such a unique opportunity in the lifespan of a building.

Because recent owners plan on retrofitting their recently bought dwelling anyway, their knowledge of technical specificities and government support is thorough (VEA, 2011). Upon execution of these home renovations, however, little use is made of government support (VEA, 2011). They restrain themselves to the minimum obligations forced by law or simply want to execute the building activities themselves, so that they cannot apply for most subsidies. In this regard, these renovators are restrained by financial resources. Moreover, they attach higher priority to other factors. They prefer to invest in "building activities which make the dwelling more appropriate to the way of living of the new occupants" (VEA, 2011, p.17). A study of Tns and VEA (2011) reveals that 72% of owner-occupied buildings have roof insulation. With regard to renovated homes, this percentage was only two per cent higher. This is a major missed opportunity.

With regard to recently bought apartment buildings, major renovations occur much less frequently (VEA, 2011). Thermal retrofits in this situation mostly are limited to improvements in glazing. This is because of the specific barrier in multi-apartment buildings.

With regard to the adopter categories of Rogers (2003), recent owners can be classified as laggards. Indeed, limited economic resources, in combination with a relatively low priority, prevent them from adopting deep thermal retrofits. One could conclude from this that recent owners need financial support. Because of the unique moment this priority group is in, the government should do everything to seize the opportunity to make these people perform deep thermal retrofits. Therefore, this group should be targeted by government support to create a market transformation with regard to deep retrofits.

4.3.2.3 Underprivileged people

People who are underprivileged often combine a low level of education with a low income. They are subject to a variety of barriers. VEA (2011) reveals three important constraints. Firstly, underprivileged people lack knowledge about the financial benefits of thermal retrofits, about governments support and about general energy use. In this regard, complexity of information is an important factor (imperfect information). Indeed, Hendrickx et al. (2011) reveal in their study that 80% of underprivileged people find issues on EE a difficult matter, 90% lacks technical knowledge on the matter, 63% of underprivileged people don't know what to do about energy issues. Another 63% are ignorant about government support. Starckx (2013), though, states in an interview, that a certain portion of underprivileged people do have high awareness about their energy use, simply because they have such limited resources.

Secondly, underprivileged people attach more importance to other urgent problems (VEA, 2011). EE issues only receive limited attention (Samenlevingsopbouw, 2010). Indeed, Hendrickx et al. (2011) reveal that 82% of underprivileged people give other matters priority over EE. 60% mentions not having the emotional strength to actively look for solutions.

Thirdly, even if underprivileged people want to install EE measures, they face financial constraints, which make investments unfeasible. In the study of Hendrickx et al. (2011), for 88% underprivileged home owners the cost of energy investments is too high.

VEA (2011) acknowledges that these people can't be reached through traditional channels. They need accessible information, substantial financial support and personal guidance throughout the whole building process.

Samenlevingsopbouw (2010) underlines that underprivileged people can't summon the courage to make the effort of undergoing the inconvenience (hidden costs) regarding building activities and administrative hurdles. In this regard, administrative load is an important additional barrier. Hendrickx et al. (2011) reveal that 70% of underprivileged home owners see moving materials for renovations as an important barrier.

Starckx (2013) emphasizes in an interview that "a relatively large portion of underprivileged people are tenants." They are also subject to the split incentive barrier (Samenlevingsopbouw, 2010). Inslegers (2013) further said: "underprivileged people are driven back to rental houses of low structural and EE quality. First and foremost they are glad they can afford a roof over their head." Hendrickx et al. (2011) mention that the sour relationship with their landlords makes the situation even more difficult.

With regard to the adopter categories of Rogers (2003) it is clear that underprivileged people belong to the laggards category, because of their often isolated position, their limited knowledge and their limited economic resources. A whole set of other barriers aggravate their situation.

4.3.2.4 Elderly owners

VEA (2011) indicates that elderly owners (tenants generally don't invest) have old houses with a high potential for EE measures. Even though they have a positive attitude towards saving energy according to the study of Tns and VEA (2011), they don't know enough about EE measures. And even if they have sufficient knowledge, they are not interested in executing EE measures. Many elderly owners don't see the benefits of investing in a thermal retrofit. They think the investment is not of use to them, because they probably won't be able to benefit anymore from the investment (Tns and VEA, 2011).

Interviews revealed a number of additional issues for elderly people. Claessens and Ledeganck (2012) indicate that "the inconvenience linked to renovation activities (hidden costs) is an important barrier to elderly people." Vermeiren (2013) confirms that administrative and practical inconveniences for elderly people are significant. "Actually, elderly people just want peace and quiet." Van Damme and Van Vooren (2012) point out the following. "Elderly people don't want to invest because they are afraid of higher inheritance taxes once they die."

Bachus and Van Ootegem (2011) explain the influence of age. Older people would be less aware of environmental problems. Also, they state, residential energy use rises with the age of occupants. Blackley and Shepard (1996) further indicate that older people may be more conservative and less willing to take the (perceived) risk linked to the adoption of EE measures. On the other hand, older people have more experience and financial resources to execute investments in EE.

With regard to Rogers' (2003) adopter categories, it is clear that elderly people can be classified as laggards. This is because of their low uptake of EE measures and their conservative attitude.

4.3.2.5 Landlords

The section on the split incentive in the tenant-landlord situation, made clear that landlords are reluctant to invest in thermal retrofits because they can't realize the benefits (lower energy costs) of this investment. As mentioned before, landlords are legally restricted in raising the rent by the frequency (every three years) and by the increase in value of the house (more than 10%). In general, tenants simply don't invest in thermal retrofits.

BECO (2010b) showed in a survey that, if thermal retrofit activities happened in the last ten years, 95% of these activities were conducted by the landlord. 56% of landlords who have not invested, state as most important reason that they considered improvements in EE not necessary (low priority). Only 11% indicated the fact that they couldn't realize the benefits from the investment as the most important reason (BECO, 2010b). In this situation, an important government measures is the EPC. Each house which is put up for rent has to have an EPC. The value of the EPC has to be mentioned in any advertisement. This tool could increase the importance of the EE quality on the level of the rent and the selling price (VEA, 2011). It might increase landlords' priority to invest in EE. Also the recently launched initiative of the Flemish government to estimate the fair rental price of a house, Huurschatter, includes EE and the EPC as a determinant for the rental price (Redactie.be, 2013).

Inslegers (2013) mentions in an interview that "the average age of landlords is quite high." In this regard, the problems linked to elderly people also apply for landlords. He proceeds: "another serious problem is the shortage of rental houses. Landlords in low-quality rental segments always find a tenant. Therefore, there is a guarantee of demand. As such, they don't see the necessity of increasing the EE quality because EE measures such as roof insulation and double glazing are much less observable than increased comfort."

Another important barrier for landlords revealed in the survey of BECO (2010b) is the administrative load both to obtain government support and during the execution of the building activities. BECO further indicates that in this group knowledge of EE measures is also a problem.

With regard to Rogers' (2003) adopter categories, landlords can be classified as laggards. They are generally rather old and attach low priority to EE.

4.3.3 Conclusion: targeting priority groups

The Flemish population is too large and diverse for policy to be targeted as a whole. The priority groups' perspective of the conceptual framework reveals which homogeneous groups of the population take priority for government policy.

The Flemish government has two important strategies. On the one hand, it aims to ensure that every house has roof insulation, energy efficient double glazing, and an energy efficient heating system. These are technologies which have been diffused widely in the market. Some groups in society, though, lag behind in the uptake of these measures. These groups are underprivileged people, elderly owners, recent owners, and landlords. These groups can be identified as laggards.

Rogers (2003) shows that laggards should be reached through interpersonal communication channels, especially by peers. Information should emphasize reliability, simplicity and cost-effectiveness. Another important line of action should aim to tackle the barriers hampering these groups. A lack of knowledge seems to be a general finding (except for recent owners). Financial barriers are present for both recent owners and underprivileged people. Low priority is another very important barrier. The administrative load is also important for underprivileged, elderly owners and landlords. In this regard, it seems that underprivileged people, elderly owners and landlords could benefit from personal guidance aiming to increase knowledge, increase priority, and help them with the administrative load. Financial support would be beneficial for recent owners and underprivileged.

Another strategy of the Flemish government is to make deep thermal retrofits more widespread by targeting innovators and early adopters. It seems that the upper middle class is the group in society which is most open for innovations. Government could guarantee a rapid diffusion by providing technical information through mass media which stresses the comparative advantages, demonstration projects and by providing incentives. Recent owners should also be targeted by this strategy in order to avoid lock-in. Financial incentives (subsidies and loans) seem very important to them.

4.4 Conclusions of conceptual framework

The decision making process explains the internal motivation to perform retrofits. There are three essential stages in the decision making process on thermal retrofits. Firstly, knowledge on thermal retrofits is needed to be able to consider such an investment. Secondly, in the decision stage, the decision maker decides to invest by weighing costs and benefits of a thermal retrofit and makes plans for the retrofit. In the implementation stage, a building professional executes the retrofit. It is important that policy supports the decision maker in each stage of the process.

Barriers explain constraining factors to implement thermal retrofits. Each of these barriers can be seized by policy as an opportunity to increase the uptake of thermal retrofits. A limited knowledge and provision of information hinder decision makers in the knowledge stage. The decision stage is hindered by low priority, bounded rationality, financial barriers, hidden costs, the split incentive and the situation in multi-apartment buildings. The implementation stage is hindered by the building process, the skills and knowledge of building professionals and the structure of the building sector. Policy interferes in all stages. Policy barriers are energy price distortions, fragmentation of authority, discontinuity and lack of transparency, and administrative load.

The population is too large and diverse to address it entirely. Policy should target different priority groups. Underprivileged people, elderly owners, recent owners, and landlords should be targeted in order to complete the diffusion of high-impact thermal components such as double glazing, roof insulation and efficient heating systems. The upper middle class should be targeted in order to diffuse deep renovations. Recent owners should also be targeted to avoid lock-in. These different priority groups demand different approaches by policy.

5 AS IS Policy in Flanders

This chapter will investigate the AS IS situation of policy in Flanders on retrofits of existing buildings. In this regard it will look at the policy of both the Flemish and the federal government, as those two governments hold the authority on EE in Flanders. This dissertation will assess the situation as it is in May 2013, before the sixth state reform has been executed. Also, the influence of Europe on Flemish policy is regarded. Specifically, the potential influence of the recent EU Energy Efficiency Directive is assessed.

Firstly, the division of authority on EE in Flanders and the influence of Europe on policy in Flanders are explained. Secondly, the current policy in Flanders is outlined. Then a double analysis of AS IS policy is made. On the one hand, AS IS policy is benchmarked to the EU Energy Efficiency Directive. On the other hand, AS IS policy is assessed by means of the conceptual framework from the previous chapter.

5.1 Authority on EE in Flanders and relationship to the EU

On the Belgian level[1], the regions have the lion share of responsibilities regarding EE (Nationale klimaatcommissie, 2008). In addition, the federal government has authority over the FRGE, which provides low-cost loans for EE measures (cf. infra), and over fiscal policy and VAT-rate. Furthermore, the Flemish government is currently responsible for the entire policy field of housing, except for the general rental legislation and the so called ‘home bonus’ (Dutch: woonbonus) which foresees in tax rebates on mortgages for an own house.

The relationship of the Flemish government with the EU is twofold. On the one hand, Flanders can influence the European policy making process by participating directly or indirectly. On the other hand, Flanders has to execute and implement European policy (Baetens and Bursens, 2005).

The European Council is the main way that the Flemish government gives input in the European decision making process. EE is part of the policy field of energy on the European level. Flanders is not represented directly in the European Union. Europe applies the principle ‘one state, one vote’. This means that the EU considers Belgium as one country, regardless of the policy area and who is responsible for that policy area (Baetens and Bursens, 2005). MSs can have a substantial influence on the European policy

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[1] This is the situation in May 2013. The 6th state reform has not been implemented yet.

formation when they have adopted “a clear opinion and an elaborated strategy” (Baetens and Bursens, 2005, p.6). Therefore, coordination is essential in a federal country. The representation of Belgium in the policy area of energy is regulated in the so called ‘cooperation agreement’ of 1994 which determines the mechanisms of coordination and representation of Belgium in the EU (Baetens and Bursens, 2005).

With regard to the implementation of European policy there is no formal agreement. In this regard, there is no guarantee of coordination in the implementation phase. This clearly is one of the reasons for the fragmented policy among the regions in Belgium.

5.2 AS IS policy in Flanders

This section provides an overview of the current policy instruments concerning retrofits in existing buildings in Flanders. It is not the intention to provide details of every measure. Only implemented (and not planned) measures are described. Policy measures can be categorized into ‘frameworks and plans’, ‘information’, ‘financial incentives’ and ‘regulation and requirements’. In the paragraphs hereunder the most important frameworks and plans are discussed. In Table 5 a brief overview is given of the concrete policy measures implementing these frameworks. Appendix I contains a more elaborate description of these policy measures.

A first important policy framework for EE in existing residential buildings is the Energy Renovation Programme 2020 (ERP). This plan’s aims are that “in the Flemish region there are no energy-eating homes anymore in 2020” (VEA, 2011, p.10). To reach this strategic goal, it has a number of operational goals. Three tangible goals state that in 2020 each house has roof or loft insulation, all single-glazed windows are replaced by at least energy efficient double-glazed windows and that each central heating boiler and natural gas heater have an efficiency of at least 90% (VEA, 2011). Also the plan commits to supporting the placement of external wall insulation, cavity wall insulation, floor insulation and the replacement of electric heating. The ERP discourages air conditioning in residential buildings.

A second important policy framework is the ‘Action plan for almost energy neutral buildings’ (VEA, 2012a). The focus of this plan primarily lies in the construction of new buildings. For existing buildings it states the following goal (p.35): “… that by 2021 a substantial amount of existing buildings comply with almost energy neutral requirements.” This goal is carried out by applying part of the EE requirements for new buildings to renovations for which a building permit is required. It is stimulated by the measures of the ERP.

Table 5 gives an overview of the policy measures implement these frameworks. They are described in a brief way. More information on each of these measures can be found in Appendix I. In the appendix it is also indicated which policy measures are driven by European policy.

Policy category	**Name measure**	**Brief description**
Information	Energy audit	A thorough assessment of the energy performance of a building.
	Energy scan	A shallow scan of the building to see how a building could save energy in different ways.
	Covenants with building sector	An agreement with important sector associations to push their members to inform customers on EE.
	Energy counsellors	EE experts who provide information and set up projects concerning EE in their organization.
	Heating audit	An obliged audit of old heating systems providing EE advice.
	Energy Performance Certificate (EPC)	A certificate which informs about the energy performance of a building which is to let or for sale.
	Demonstration projects	Building projects exploring energy efficient building techniques and materials.
	Information EE and sensitization	Targeted communication about the benefits, specifications, and support measures for EE measures.
Financial incentives	Subsidies energy distributors	Subsidies for several types of energy efficient glazing, heating systems and insulation.
	Tax cuts federal government	30% tax cut for roof insulation.
	Subsidies for social housing	Subsidies for the social housing sector supporting energy efficient glazing and heating systems.
	Social roof insulation	Financial and project support for the placement of roof

	projects	insulation in rental houses with underprivileged occupants.
	Flemish renovation subsidy	Subsidy for renovation of old houses.
	Flemish improvement subsidy	Subsidy for renovation of old houses with tighter income boundaries then the Flemish improvement subsidy.
	Loan FRGE	An interest-free loan targeting underprivileged people.
	Social loans	Low-cost loans for underprivileged people.
Regulation and requirements	EE requirements major renovations	Requirements for minimal levels of EE for major renovations of existing buildings.
	Energy-performance requirements in the Flemish housing code	Energy performance requirements on roof insulation in the Flemish housing code for rental houses.

Table 5: Current policy measures in Flanders related to thermal retrofitting.

5.3 AS IS policy benchmarked against the Energy Efficiency Directive

This section explores the recent EU Energy Efficiency Directive, further denoted as the Energy Efficiency Directive or 'EED', which came into force in December 2012. The coming months and years, Flanders has to implement this directive. This section explores whether current policy complies with this directive and which proposed measures of the EED are complementary to AS IS policy in Flanders.

This section explains the background of the EED. Furthermore, it outlines other important directives regarding EE in existing buildings to give an impression of the impact of EU policy on the EE policy in Flanders. Moreover, this section gives an overview of the relevant measures in the EED and assesses which of these measures are new and could improve AS IS policy.

5.3.1 Background

Directive 2012/27/EU can be seen as the legislative outcome of a cascade of successive policy documents. On 3 March 2010, ‘Europe2020’ was proposed by the European Commission. This document describes the growth strategy of the EU. It stresses “smart, sustainable, inclusive growth” (European Commission, 2010). This document contains the ‘20-20-20 objectives’: a reduction of 20% in GHG emissions (compared to 1990), an increase in the share of renewable energy to 20% of total final energy consumption and an increase of 20% in EE to be reached in 2020. The two former targets were binding for member states. The target on EE was not binding.

To limit climate change, in February 2011, the European Council agreed to lower its GHG emissions by 80-95% (compared to 1990) by 2050, as is advised by the IPCC (Pachauri and Reisinger, 2007). In March 2011, the European Commission (2011d) promptly presented its ‘Roadmap for moving to a competitive low carbon economy in 2050’, in which the Commission shows that emissions in buildings could be reduced by around 90% by 2050.

In the context of this Energy Roadmap 2050, the ‘Energy Efficiency Plan 2011’ was put forward by the European Commission (2011b). From the EC’s analysis it appeared that the non-binding EE target set out by the EU would not be met (European Commission, 2011b). The Energy Efficiency Plan elaborates the Energy Roadmap in specific measures and principles. These measures aim to still reach the 20% EE target in 2020. The document states these measures could generate financial savings up to 1000 euro for each household. This plan, in its turn, resulted in the more concrete legislative texts of the proposal which became the new Energy Efficiency Directive (European Commission, 2011a).

A first draft version of the EED was put forward by the European Commission in June 2011. In June 2012 the European Council, the European Parliament and the European Commission agreed on an adjusted version of the EED. In October, the EED was formally approved. In December 2012, the EED came into force.

5.3.2 Other important directives

A number of other directives affect the Flemish policy on EE in residential buildings. These are Directive 2002/91/EC, Directive 2010/31/EU and Directive 2006/32/EC. The EED complements and builds on these measures.

The EU issued its Energy Performance of Buildings Directive (EPBD), Directive 2002/91/EC, in 2002 (European Parliament and Council of the European Union, 2002). For the residential sector, there were four important measures: (1) a framework for calculating the integrated energy performance of buildings, (2) minimum standards for new buildings and for major renovations on existing buildings, (3) the energy performance certificate (EPC) for new and existing buildings (4) regular inspection of boilers and heating systems. In May 2010, the European Parliament and European Council (2010) adopted Directive 2010/31/EU. This is a recast of the EPBD of 2002, which more strictly addresses existing buildings.

Another important European directive is the Energy end-use and energy services directive of 5 April 2006 (European Parliament and European Council, 2006). Directive 2006/32/EC aims to increase EE throughout the supply chain, including households. Key measures included an indicative target of 9% energy savings by 2017, a three-yearly National Energy Efficiency Action Plan, stimulation of the market of energy services, and provision of information. This directive can be seen as the predecessor of the EED issued in 2012. Indeed, many of the aspects of this directive were tightened or repeated in the EED issued in 2012.

In order to support the implementation of the directive outlines above, the EU set up a number of initiatives. Firstly, Intelligent Energy Europe contributes to achieving the EU 20-20-20 goals (Intelligent Energy Europe, 2011). Furthermore, the BUILD UP Skills programme aims to upgrade the education and skills of building professionals with regard to EE and renewable energy (BUILD UP Skills, 2011). Finally, Concerted Action EPBD is an initiative to stimulate collaboration in the implementation of the EU EPBD (Directive 2010/31/EU).

5.3.3 Overview of the EED

The EED does not include a binding target on EE. It does include a number of binding measures. These measures should bring the EU back on track towards the 20% EE target.

The EED amends the Ecodesign and Energy Labelling Directives (Directives 2009/125/EC and 2010/30/EU) and repeals the Cogeneration Directive (Directive 2004/8/EC) and the Energy End-Use Efficiency and Energy Services Directive (Directive 2006/32/EC). This latter directive was described above. Its 9% savings target is preserved. Furthermore, the EED retakes or further elaborates other provisions of these earlier directives.

The energy chain, energy distributors, industry, public sector and households are all covered by Directive 2012/27/EU (European Parliament and European Council, 2012). A good share of the measures in the directive influence EE in residential buildings. These measures are briefly described in the next section. They are classified in the same categories as the Flemish policy.

Furthermore, there are a number of measures which mostly affect companies and the public sector (European Parliament and European Council, 2012). Firstly, the public sector has to lead by example. Each year, 3% of central government buildings (larger than 500 m²) have to be thermally retrofitted. Secondly, governments must make energy efficient purchase decisions. Thirdly, companies will be subject to obligatory and regular energy audits. Fourthly, MSs have to assess and promote cogeneration. Even though these measures indirectly have a positive influence on the market for EE, EE in households and thermal retrofits, these measures will not be discussed in detail.

One of the first important deadlines is 30 April 2013. At that time, governments will have to submit an indicative target of energy savings (cf. infra). Each year, MSs will have to report on their progress towards achieving this target. On 30 April 2014, MSs have to submit a National Energy Efficiency Action Plan. This will have to be updated every three years. Implementation of other measures is due at the end of 2013 or in 2014. The Commission will track the progress of the MSs by performing a review in 2014 and 2016 (Euractiv, 2012). If the EU is not on track, the Commission will propose additional binding measures and eventually binding targets.

In Table 6 hereunder, an outline is presented of the measures of the directives which are relevant for buildings in the residential context. These measures are categorized in frameworks and plans, information, financial incentives and regulation and requirements. Also, the measures are assessed on their stringency (binding/non-binding) and their novelty (whether a measure is taken from previous directives). Appendix II offers a more elaborate description of each of these articles.

Policy instrument Category	**Article and article name**	**Summary**	**deadline**	**Stringency**	**novelty**
Frameworks and plans	Article 3: energy efficiency targets	Set a national indicative EE target, taking into account the overall EU target.	30 April 2013	Indicative target	Directive 2006/32/EC required an indicative target of 9% energy savings by 2017.

	Article 4: Building renovation	Make a long-term strategy for the renovation of the national building stock.	30 April 2014	binding	New
	Article 19: Other measures to promote energy efficiency	Evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers.	30 April 2014	binding	Briefly touched in Directive 2006/32/EC.
Information	*Article 8: Energy audits and energy management systems*	Promote the availability to all final customers of high quality and cost-effective energy audits.	Not stated	binding	Energy audits were required by Directive 2006/32/EC
	Article 9: Metering	*Provide competitively-priced individual meters for energy. *Requirements regarding the implementation of smart meters.	Not stated	*loopholes *binding, if smart meters are introduced	*Repetition of Directive 2006/32/EC *Elaboration of Directives 2009/72/EC and 2009/73/EC
	Article 10: Billing information	Make bills accurate, understandable and based on actual consumption.	Not stated	loopholes	Partly repeats Directive 2006/32/EC
	Article 11: Cost of access to metering and billing information	Final customers should receive their bills free of charge.	Not stated	Binding, except in multi-apartment buildings	New
	Article 12: Consumer information	Take appropriate measures to promote and facilitate an efficient use of energy.	Not stated	Binding, but free to choose	New

	and empowering programme			which measures.	
	Article 16: Availability of qualification, accreditation and certification schemes	Make available certification and qualification schemes for providers of energy services, energy audits, energy managers and installers of energy-related building elements	1 January 2015	Binding if the national level of technical competence, objectivity and reliability is considered insufficient.	Partly repeats Directive 2006/32/EC
	Article 17: Information and training	Provide information on benefits and options of EE, policy measures and mechanisms stimulating EE.	Not stated	Binding	Further elaborates requirements which were stated in Directive 2006/32/EC.
	Article 18: Energy Services	Promote the market of energy services and take away legal and non-legal barriers.	Not stated	Binding	Further elaborates measures which were stated in Directive 2006/32/EC.
Financial incentives	*Article 20: Energy Efficiency National Fund, Financing and Technical Support*	Establish financing facilities to improve EE, for instance an Energy Efficiency National Fund. Resources can be used from public and private sources.	Not stated	Vague requirements and a number of suggestions	Further elaborates measures that were stated in Directive 2006/32/EC.
Regulation and requirements	*Article 7: Energy efficiency*	Set up an energy efficiency obligations scheme which imposes energy retailers or	1 January 2014	Loopholes decrease the annual 1.5%	Directive 2006/32/EC suggests the use of

	obligation schemes	distributors to achieve annually 1.5% of energy savings with their final customers.		target to 1.1% per year.	energy efficiency obligation schemes.

Table 6: Measures of the EED affecting thermal retrofits and EE in residential buildings. Measures underlined and in italic are elaborated in the next chapter.

5.3.4 Novelty and complementarity of the EED

This section investigates whether or not the EED has the potential to add improvements to the current policy on EE and thermal retrofits in Flanders. Therefore, it will examine which current policy measures are already in place and whether these measures should be adapted or not. The EED is analysed per category of policy measures. The measures which seem to complement Flemish policy will be elaborated in the next chapter.

With regard to frameworks and plans, current Flemish policy only takes into account the short-term horizon of 2020. The required long-term strategy in Article 4 of the EED seems to demand a necessary reflection for Flanders. It will require policy-makers to consider the long term. The indicative EE target which is required in Article 3 seems like an appropriate short term goal. The roadmap resulting from the long-term strategy must stipulate a number of those goals towards 2050. The analysis on barriers required in Article 19 should be an inherent part of the long-term strategy.

The measures required in the information category are mostly a repetition or an elaboration of measures required by an earlier directive. The energy audits required by Article 8 are already in place in Flanders. They could be improved by making them less costly (cf. infra). The requirements on metering and billing (Article 8, 9, 10 and 11) further shape the playing field, but will not bring about big changes to the requirements of earlier directives. Article 12 requires informing and empowering consumers. Article 17 requires MSs to provide information on EE, benefits and options of EE and mechanisms stimulating EE. These latter two requirements are already executed by various existing policy measures in Flanders (energy scans, energy counsellors, information and sensitization etc.) but could be further improved.

Article 16 of the EED requires MSs to implement qualification, accreditation and certification schemes "if the national level of technical competence, objectivity and reliability is considered insufficient" (European Parliament and European Council, 2012, p.23). As outlined in the section on the decision making process, such a qualification scheme could be very beneficial for decision makers in the implementation stage. Indeed, it has the potential to increase the knowledge and skills of building professionals and it could improve transparency with regard to building professionals.

Article 18 of the EED requires the promotion of the market of energy services and taking away legal and non-legal barriers in this market. This measure of the EED mostly applies for ESCOs targeting companies and public authorities. Households too could be covered by ESCOs, though. Therefore, this dissertation will investigate whether ESCOs could be a solution for EE in households (cf. infra).

Furthermore, Article 20 of the EED concerns financing facilities, an EE fund and several sources of financing. In the next chapter, this dissertation will assess the potential and the possible implementation of this measure.

Lastly, Article 7 of the EED lays down requirements about energy efficiency obligation (EEO) schemes. Currently, the Flemish Government has such a scheme in place, albeit with binding measures instead of a binding target. In the next chapter, it is assessed whether the existing scheme should be adapted.

5.4 Analysis of AS IS policy by means of the conceptual framework

In the previous section the AS IS policy in Flanders was benchmarked against the EU Energy Efficiency Directive. In the following three sections, the current policy on thermal retrofits in existing buildings is analysed by using the three perspectives from the conceptual framework of this dissertation. These perspectives are: the decision making process, barriers and priority groups. It has to be emphasized that impact and reach of the measures in the following analyses relies on estimation and personal judgement.

On the basis of this analaysis suggestions to improve policy are made. The most important suggestions are elaborated in the next chapter.

5.4.1 AS IS policy and stages in the decision making process

In this section, an analysis is made of the current policy measures in the framework of the decision making process. It is important that policy covers the entire process in order to facilitate a smooth flow through each stage for decision makers.

Policy measures are mapped in three different categories: information, financial incentives and regulation. This policy map is inspired by an example for Germany by Neuhoff et al. (2011a). Each government measure bears an indication of its estimated impact by means of the intensity of the colour.

The estimated impact is based on the reach and uptake (e.g. compulsory measures such as the EPC have a high uptake), breadth of the targeted audience (e.g. only underprivileged people or the entire population) and whether or not the measure stimulates EE in specific (e.g. the Flemish renovation subsidy also supports measures which are not specifically energy efficient). The width of the measure indicates on which stages of the decision making process the measure impacts. The result is displayed in Figure 10.

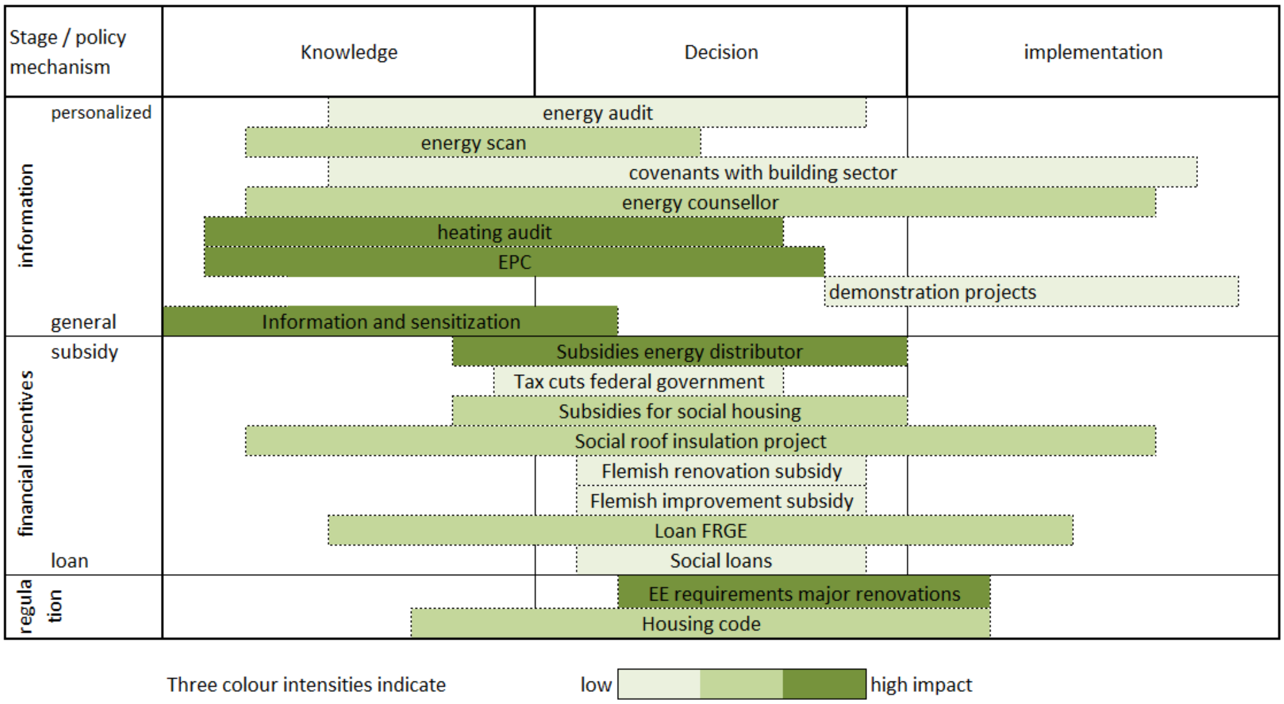

Figure 10: Map of current policy measures stimulating thermal retrofits in the decision making process.

It is interesting to see that four out of five high-impact measures give effect to European directives previous to the EED (cf. Appendix I). These measures are: heating audit, EPC, subsidies energy distributors, and EE requirements major renovations. However, the obligations on the energy distributors were introduced in Flanders before this was mentioned in any EU directive. Besides these high-impact measures, also energy audits give effect to EU policy. All in all, EU policy has an important impact on the current Flemish EE policy. The EU, moreover, leaves its MSs free in choosing its incentives to stimulate EE.

Information provision logically affects mostly the knowledge stage of the decision process. Financial incentives mostly affect the decision stage. Regulations are effective in the decision stage and part of the implementation stage as they force the building sector to gain the right skills.

There are a few policy measures which cover all three stages in the decision making process. Energy counsellors may be contacted throughout the decision making process. They can be a good supplementation to information and sensitization campaigns, and advice from building professionals. Until now, however, their reach is rather limited to the organization they work for. The social roof insulation projects are another interesting measure because a project coordinator guides landlords throughout the whole process. However, this measure is limited, to a rental situation where tenants are underprivileged. The same goes for the loans of the FRGE. If underprivileged people borrow money, they can benefit from support throughout the building process.

Another potentially important measure is advice through building professionals, stimulated by sector covenants. These could be of importance throughout the entire decision making stage, as outlined by Novikova et al. (2011b). Indeed, building professionals could advise people on thermal retrofit measures, even when they are performing other non-energy related measures. Until now, though, building professionals lack the skills and knowledge to do so. They are often specialized in their own small field and lack the incentive to offer EE measures (adverse selection). This is described in the barriers in the implementation stage.

Overall, there is the lack of government support in the implementation stage. Indeed, it is hard to find a building professional with the right skills and qualifications. In this regard, a qualification scheme seems very important.

Another issue is lack of a high-impact information instrument which gives personalized advice, which is most important in the decision stage (cf. supra). Energy counsellors are a useful measure, but their reach is generally limited to the own organization. An energy audit could be very effective, but has low success because of the high price. Energy scans, on the other hand are limited to underprivileged people and give limited advice on thermal retrofits. The covenants with the building sector could be of high impact, as explained before. Also demonstration projects could have a higher impact. For now, though, they are only targeted at the specific sectors of social housing and schools.

5.4.2 AS IS policy and barriers

In this section, an analysis is made of the current policy measures and how they influence the barriers affecting thermal retrofit decisions. The goal of this section is to reveal which barriers remain largely unaddressed.

Policy measures are mapped in three different categories: information, financial incentives and regulation. Barriers are mapped into four categories as explained above. This policy map is inspired by an example in the Action plan of the energy renovation plan of VEA (2011). Each government measure bears an indication of its estimated impact on a barrier. A single (double) addition sign means that a policy measure has (high) impact on a measure. As in the previous analysis, the estimated impact is based on the reach and uptake, the breadth of the targeted audience and whether or not the measure specifically stimulates EE decisions. To see whether or not a measure affects a barrier, one or more questions were asked per barrier. These questions can be found in

Appendix III. The result is displayed in Figure 11.

Barriers / policy measure		knowledge		decision						implementation			policy			
		Lack of knowledge	Imperfect information	Low priority	bounded rationality	Financial barriers	hidden costs	split incentive	multi-family buildings	building process	knowledge and education professionals	Structure building sector	Energy price distortion	Fragmentation of authority	Discontinuity and lack of transparency	Administrative load
information	energy audit	+	+	+												
	energy scan	+	+	+												
	covenants with building sector	+	+	+						++	+					
	energy counsellors	+	+	+						+	+					+
	heating audit	+	+	++				+			+	+				
	EPC	+	+	++				++								
	demonstration projects									+	+					
	Information and sensitization	++	++	+						+	+	+				+
financial incentives	Subsidies energy distributor			++		++		+								
	Tax cuts federal government			++		++		+								
	Subsidies for social housing			+		+										
	Social roof insulation projects	+		+		+	+	++								+
	Flemish renovation subsidy			+		++										
	Flemish improvement subsidy			+		++										
	Loan FRGE	+				++	+	+								+
	social loans					+										
regul ation	EE requirements major renovations			++						+	+				+	
	Housing code	+		++				++	+						+	

existing measures high impact on ++ impact on + no impact on

Figure 11: Matrix of policy measures and how they impact barriers in different stages.

When regarding the matrix above, it seems that some barriers remain (largely) uncovered by government policy. A first barrier is bounded rationality. This barrier is inherent to people's way of thinking and is very hard to influence. The barrier of hidden costs is another barrier which is hard to overcome. Building activities inherently entail investments of time and inconvenience. Policy measures which involve personal guidance, such as the social roof insulation projects and the loans of the FRGE, help to reduce the time investment.

The decision-process in multi-family buildings is a tricky problem. Currently there is not a single policy measure addressing this barrier in specific, only the requirement of roof insulation in the housing code could have indirect influence. This is striking as 35% of the residential floor space in Belgium lies in apartments (Building Performance Institute Europe (BPIE), 2011). In 2010, there was a study of BECO (2010a) which proposed a set of measures, but until now there has not been any action upon this advice.

Furthermore, the structure (scattered and non-transparent) of the building sector is only marginally addressed by two measures. Building teams could tackle the scattered and specialized structure of the building sector (Minaraad and SERV, 2012). These building teams are a cooperation of experts in different disciplines of building activities (e.g. a general contractor, a carpenter, a pipefitter, an architect etc.). Until now, though, there has been little uptake of building teams.

Furthermore, policy measures remain mostly unaddressed. Energy price distortions and fragmentation of authority are not positively influenced by a single policy measure. To overcome these barriers, political commitment is required. Concerning the barrier 'discontinuity and lack of transparency', the two measures in the regulation category are positive signs that stability and transparency are possible in policy making. Regarding continuity and transparency of financial support, improvement is required, though. Furthermore, 'administrative load' and 'knowledge and education of building professionals' are not addressed by any high impact measures.

Lastly, some measures address a high number of barriers. Upgrading these measures by expanding their scale or priority group could have a large impact. These measures are covenants with the building sector, energy counsellors, social roof insulation projects and the loans of the FRGE.

5.4.3 AS IS policy and priority groups

In this section, an analysis is made of the current policy measures and how these measures address different priority groups. On the one hand it is important to target the upper middle class and recent owners to bring about market diffusion of deep retrofits. On the other hand, underprivileged people, elderly owners, landlords and recent owners should be targeted because they lag behind in the uptake of EE measures.

In the next chapter, possible improvements are proposed. Policy measures are mapped in three different categories: information, financial incentives and regulation. This policy map is inspired by an example in the 'Action plan of the energy renovation programme' of VEA (2011). Each government measures bears an indication of the extent to which it targets a specific priority group (and the barriers linked to this priority group). The result is displayed in Figure 12.

	Target group / policy measure	Upper middle class	Recent owners	Underprivileged people	Elderly owners	Landlords
information	energy audit	+				
	energy scan			++		
	covenants with building sector		+			
	energy counsellors	+	+	++	++	+
	heating audit	+	+	+	+	+
	EPC		++	+		++
	demonstration projects					
	Information and sensitization	+	+	+	+	+
financial incentives	Subsidies energy distributor	+	+	++	+	+
	Tax cuts federal government	+	+		+	+
	Subsidies for social housing			+		
	Social roof insulation projects			++		++
	Flemish renovation subsidy	+	+		+	
	Flemish improvement subsidy	+	+	+	+	
	Loan FRGE	+	+	++	+	+
	social loans		+	++		
regul ation	EE requirements major renovations	+	++			
	Housing code			+		++

specifically targets	++
also targets	+
does not affect	

Figure 12: Matrix of policy measures and how they target priority groups.

When assessing this matrix, one can see that there are no specific measures for the upper middle class. Indeed, most sources state that the existing measures are enough to make them invest. It is questionable, though, whether these measures are also enough to make them implement deep retrofits on a large scale to launch deep retrofits in the market.

The group of recent owners, who are renovating a house anyway, is covered by a wide range of measures, although there are few specific measures targeting this group. As mentioned before, their priority for their scarce financial resources is principally not on EE. A possible solution towards this problem is proposed later.

There are six policy measures which specifically target the priority group of underprivileged people. In effect, this is the group which is subject to most barriers. Still, it remains hard to convince and enable underprivileged people to undertake thermal retrofits. The financial barrier remains one of the most important issues.

The priority group of elderly owners is hardly addressed in a targeted way. Only one measure does so: there is an energy counsellor in Neos, an organisation for elderly people. This group consists of a substantial amount of people. Furthermore, life expectancy is steadily increasing and, due to increasing societal health care costs, there will be an increasingly important trend that older people will live longer at home. Therefore, it seems necessary to tackle their inertia. On the one hand to ensure that they live in homes of high EE quality. On the other hand, because the moment they move out of their house (either because they die or go to a home for the elderly) will come later and later in people's life. In that regard, the moment when new people move into the home and (thermally) retrofit the home will also become later.

Lastly, there already are a few specific measures for landlords. The EPC is a market mechanism in order to increase priority for EE of landlords. Furthermore, the social roof insulation projects are an effective way to increase EE in rental houses. This measure is targeted, though, on rental houses with underprivileged tenants. Inslegers (2013) remarks, "sometimes, a landlord does not always know whether or not his/her tenant falls into the category which fulfils the conditions of the social roof insulation projects." The EE requirement in the housing code is an important first step. Additional measures to target this group seem necessary, though.

Subsidies and tax incentives constitute the main part of financial incentives. They are indeed important in stimulating priority and revealing financial barriers. All of these subsidies (except for the social roof insulation projects) and tax incentives are ex-post financial stimuli. They are settled after the investment has been made. For priority groups subject to financial constraints – especially underprivileged people – this is a major shortcoming of these premiums. In the case of tax cuts, it might be that underprivileged people don't pay taxes. Furthermore, in the case of the Flemish renovation subsidy, the threshold of 10.000 euro might be too high for underprivileged people. With regard to loans, there is no large scale loan for people to finance thermal retrofits in a low-cost way. The loans of the FRGE are in principle open to all priority groups, although the awareness about this is low.

The EE requirements for major renovations are very important, for example for young building owners who renovate anyway. Many smaller renovation activities are not covered by these requirements, however. The reach of these requirements could be widened.

5.5 Conclusion

The Flemish government has most authorities with regard to EE policy in Flanders. Flanders can influence policy making in Europe via the European Council. Moreover, Flanders has to implement European policy. For this process, there is a lack of formal coordination mechanism between the regions in Belgium. Europe has a substantial influence on Flemish policy regarding EE. Europe imposes the use of some important information and regulatory instruments. It mostly leaves Flanders free in choosing the appropriate incentives.

In Flanders, the two most important policy framework targeting thermal retrofits of existing buildings are the ‘Energy Renovation Plan’ and the ‘Action plan for almost energy neutral buildings’. The former targets cost-efficient high-impact measures and laggards. The latter affects renovation activities for which a building permit is required. Such houses have to comply with the standards of new houses.

The AS IS policy in Flanders was benchmarked against the new EU Energy Efficiency Directive (EED), which has to be implemented over the coming months and years. This EED is a logical outcome of the European climate and energy framework. Other important directives are the Energy Performance of Buildings Directive (2002 and 2010) and the Energy end-use efficiency and energy services directive (2006). &The EED retakes and elaborates a large part of the requirements of Directive 2006/32/EC. In that regard, not all measures need to be implemented. Important new measures are the long-term strategy (article 4), the EE obligations (Article 7), the certification and qualification scheme (Article 16), the promotion of ESCOs (Article 18) and the proposed financing facilities (Article 20).

The analysis from the conceptual framework proved important. With regard to the stages of the decision making process, it is mostly the implementation stage which remains uncovered. Logically also the barriers in the implementation stage remain largely unaddressed. Furthermore, the barrier in multi-family buildings and policy barriers remain largely unaddressed. Few measures address specific priority groups. The upper middle class, elderly owners and to a lesser extend recent owners and landlords especially need additional specific measures.

6 TO BE policy in Flanders

In the previous chapter, AS IS policy was analysed in two ways. On the one hand, it was benchmarked against the requirements of the recent EU Energy Efficiency Directive (EED). On the other hand, it was analysed by means of the conceptual framework of this dissertation. Both of these analyses resulted in suggestions for possible policy improvements.

Both a number of improvements to existing policy measures and a number of new policy measures were proposed. These suggestions are elaborated in this chapter. Together with the AS IS policy situation, they form the TO BE policy situation. This chapter assesses the impact of these potential improvements by analysing TO BE policy through the conceptual framework.

For reasons of clarity, proposed policy measures are ordered as either originating from EU EED or from the analysis of the conceptual framework. For some of these measures, this classification was arbitrary, as the need for these measures was revealed in both of these analyses. Furthermore, in both of these categories, a distinction is made between new policy measures and adaptations to existing policy measures.

6.1 Suggestions from the EU Energy Efficiency Directive

In the previous chapter, AS IS policy was benchmarked against the recent EU Energy Efficiency Directive. It was assessed which of the measures proposed in the EED would complement current policy. In this section, these measures are elaborated.

The first section postulates an umbrella for other measures with a long-term strategy and a number of general principles. These principles form a framework for future policy. In effect, they are also reflected in the concrete proposals for specific policy measures in the following sections.

6.1.1 New policy measures

6.1.1.1 Vision and long-term renovation strategy

The EED demands the development of a long-term renovation strategy. Moreover, an analysis of the existing barriers in Flanders should be performed and an indicative EE target should be put forward.

In effect, a clear vision is necessary to determine the right level of ambition, to translate this to concrete quantitative goals and to eventually gear policy measures to these goals and to one another. In this regard, it seems necessary to take into account future requirements. Also an analysis of relevant barriers, as is performed in this dissertation, is necessary to develop a long term strategy.

At the European level, there are energy and carbon roadmaps towards 2050 (European Commission, 2011c, 2011d). These roadmaps state that energy use in buildings will have to be cut back radically in order to attain the necessary 90% cut in GHG emissions for the building sector. Existing buildings should become nearly zero energy buildings by 2050. The Flemish government seems to overlook these (indisputable) targets. Until now, only 2020 has been taken as the time horizon for crafting policy. This results in an insufficiently ambitious policy (Minaraad and SERV, 2012). Hermelink and Müller (2010, p.20) underline this. “It is important to do projections till 2050, as projections till only 2020 may be misleading and suggest an inadequate strategy.” Certainly, a first indicative EE target for 2020 is a good start, when determining this target, a longer time horizon should be kept in mind.

In this regard, Germany is an important example. Neuhoff et al. (2011a) explain. “The German government has committed to reducing the primary energy demand of buildings by 80% by 2050.” Furthermore, it set a number of milestones which state quantitative energy reduction goals at various points in time. In this regard, the rate of thermal retrofits and the depth of those retrofits are of crucial importance. According to the data hub of the Building Performance Institute Europe (BPIE) (2011), the current renovation rate in Belgium is 0.75%, which is far from the required 2.5-3%, stated by Staniaszek et al. (2013). Also the depth of retrofits should increase. Upgrading both these factors requires making a long-term renovation plan. This is exactly what is required by the new EED (Article 4). A crucial element of such a plan will be how true market change can be reached. Holmes (2013) explains in an interview. “Future policy should be a coherent story for investors and building owners which drives market change.”

Apart from the pledge for a clear future vision, certain principles for future policy should be kept in mind. These principles target the revealed policy barriers. They are based on insights of the author, conducted interviews and policy reports.

1. Use carrots and sticks. Policy makers are scared to death of imposing regulatory measures. These measures are the most effective way, though, to force laggards towards thermal retrofits. In order to make tighter regulation acceptable, government should introduce regulation gradually while enabling people to make thermal retrofits on very favourable terms and providing

sufficient information. In this regard, there should be special attention for priority groups which are constrained by financial and other barriers. The uptake of EE requirements in the housing code is an example of good policy with carrots and sticks.

2. Do it right first time. If a major renovation is made, it should be a deep thermal retrofit in order to avoid lock-in. Regulation is one factor to impose this. Also, deep thermal retrofits can be encouraged by linking the level of support measures (height of subsidies, level of interest) to the depth of the renovation. Lastly, quality of work is also very important to ensure that each retrofit is optimally implemented.
3. Transparency. If a policy measure is introduced, it should state how long the measure will be in force and how it will be abolished. In this regard, it seems appropriate for support measures to reduce the level of support towards its date of demolition.
4. Selectivity. Support measures should be selective towards the priority groups who really need it. Thus, support measures should be targeted towards trendsetters, people in a decisive change moment (e.g. buying a house) and priority groups who need additional support in order not to lag behind. Increased selectivity will keep costs of measures under control.
5. Coordination. When implementing policy, it should be assessed which actor is best placed in the policy field to implement the policy measure. The Flemish government should coordinate this. There is also a need for a formal mechanism to coordinate the implementation of EU legislation in the three regions.
6. Integrate housing and EE policy. EE and structural quality of buildings cannot be separated. Investing in the EE quality of a building which deserves to be demolished is throwing money down the drain.

6.1.1.2 Certification and qualification scheme for building professionals

On several points in this dissertation, it was argued that a certification and qualification scheme seems an important complementary measure. Firstly, such a scheme is an important information instrument in the implementation stage of the decision making process. Moreover, from the policy-barriers analysis from the conceptual framework, it was clear that the poor knowledge and skill level of building professionals and the structure of the building sector – firstly, the building sector is very specialized but scattered; secondly it is hard for potential customers to compare building professionals regarding quality and other dimensions – remain largely unaddressed by policy. Furthermore, the building process generally underemphasizes EE. A certification and qualification scheme could be a solution for both barriers. Also during the conducted interviews, there was much momentum for a qualification and certification scheme. Many interviewees saw such a scheme as one of the first priorities for policy makers. Until now, there is only a certification scheme for placers of cavity wall insulation (Vermeiren, 2013).

The EED as well requires implementing member states (MSs) to implement such a scheme, but it leaves MSs free in assessing whether this is necessary. The arguments above plead for such a scheme.

How should such a scheme be implemented? Matthys (2013) and Garcia Audi (2013) both explained in an interview that the 'BUILD UP skills' programme (cf. supra) of the EU should be a starting point to design training and education for building professionals. In this programme, a set of competences is stipulated for each type of building professional. These skill profiles should be the starting point to design both (secondary) school education curricula and ex-post trainings for working building professionals. A uniform exam (per specialization) should give the right to a certificate of energy efficient building professional. This exam could be integrated in the final exams of secondary schools.

Bearing the barriers of the building sector in mind, in these education and training programmes, the formation of building teams should be stimulated to decrease the lack of coordination among building professionals. Moreover, it would be beneficial for each building professional, regardless of his/her specialization, to know the basics of other building specialisations (Matthys, 2013). This would increase coordination in the retrofitting process and decrease mistakes regarding the integration of different building components. Furthermore, building professionals could suggest energy efficient techniques outside of their own field of specialization to potential decision makers.

The sector federation of different building specializations should be involved to design and implement the training scheme. Bouwunie, for example, already has a running training of 'energy aware contractors'. Government and sector federations could formalize arrangements in covenants (cf. infra). Garcia Audi (2013) outlines the roadmap. "Ideally, the entire building chain should be certified. At first, though, more urgent professions should be targeted." Bonnarens (2013) explains that needs are highest in Flanders for placers of external wall insulation, cabinet work and floor insulation.

Bonnarens (2013) thinks "the goal should be to make certification obligatory in the long run." Matthys (2013) points to the right of work. "One cannot justify that an experienced building professional loses his/her job because he/she doesn't have a certificate." Bonnarens (2013) explains that building professionals should have the choice. “Either they are certified; or they ask an inspector to certify the separate jobs they do. At the beginning, though, government could stimulate the scheme by only granting subsidies for certified work. The market mechanism would do the rest.”

A proper enforcement scheme is necessary (Minaraad and SERV, 2012). Bonnarens (2013) explains: “such a quality certificate is one of the only tools with which regular building companies can differentiate themselves from moonlighting building professionals.” In that regard, it is necessary that the certification scheme doesn’t lose its credibility because of a loose enforcement. Regular and targeted controls are appropriate. Furthermore, the certification scheme should be individual. Bonnarens explains for the training of energy aware contractors. “It is not enough that the chef has taken training in order to certify an entire company. Also the employees should have the knowledge necessary for the certificate.”

Lastly, these certification schemes should be communicated to potential decision makers, so that the structure of the building sector turns more transparent. It could even be a line of thinking that local energy and housing shops refer planning households to certified building professionals. This is already the case in the Netherlands (McKinsey&Company, 2009).

6.1.1.3 ESCOs in the residential sector

The new EED emphasizes the use of ESCOs. Particularly in Article 18, the EED orders MSs to promote the use of ESCOs by providing information and several other measures. Other Articles of the EED also contain provisions to stimulate the market of ESCOs. In effect, the concept of ESCOs could be an interesting mechanism to finance EE measures. This section assesses ESCOs as a solution in the residential sector in Flanders.

Concretely, a building owner asks an ESCO to estimate and implement energy saving opportunities in his/her building. The ESCO finances and executes the investment. The ESCO receives a loan mostly from external financers. Holmes (2013) states the following regarding financing. “ESCOs essentially are not financiers. Their main field of expertise is transforming buildings to a higher level of EE. The provisions which refer to financing facilities in the EED form an ideal tandem with ESCOs. Central EE funds could supply financing and ESCOs could execute investments in an optimal way.” The ESCO guarantees a predetermined volume of energy savings. The resulting energy savings are shared by the ESCO and the customer. In this regard, the ESCO is both a very effective mechanism to implement and to maintain energy saving measures (eu.ESCO, 2012). It avoids wasting energy.

Residential ESCOs could be an effective way to tackle a number of important barriers. It could be a way for decision makers to improve the EE of their home without paying a high upfront cost. Secondly, it would lessen a part of the hidden costs because the ESCO is responsible throughout the entire building (and maintenance) process. Lastly, residential ESCOs are promising with regard to the barriers in the implementation stage. ESCOs are specialized in building activities regarding EE. In this regard, they could be one single, integrated actor in the decision stage which gives absolute priority to EE with high levels of skills and knowledge.

The Belgian ESCO market is much smaller than other European markets such as the German market (Vanstraelen and Madam, 2013). In turn, the European market is only a fraction of the US market, where the concept is much more developed. The energy distributors Eandis and Infrax both have an ESCO branch which targets public buildings of municipalities. Also, there is a federal ESCO named Fedesco which was founded by the federal government in 2005 in order to make federal buildings more energy efficient. In 2012 a similar Flemish public ESCO was founded, named Vlaams EnergieBedrijf (Minaraad and SERV, 2012).

Until today the majority of ESCOs have improved EE in companies and public institutions. Residential ESCOs are still in their initial phase (eu.ESCO, 2012). This is because there are a number of barriers which impede the use of ESCOs in the residential context. Firstly, the transaction costs in residential buildings are much larger than in companies or public institutions. Essentially, the problem is the small scale of projects in the residential sector. In this regard, transaction costs are caused by intensive contact with different building owner and the heterogeneity of dwellings (eu.ESCO, 2012). Le Gentil (2013), CEO of eu.ESCO, explains in an interview. “The size of residential projects is too small compared to the potential savings.”

Furthermore, the generally used verification protocol, necessary to prove that the energy savings have taken place, is very difficult to transmit to the residential sector. Le Gentil (2013) explains. “It is difficult to guarantee savings. The ESCO may ask households to maintain a temperature of 19°C, but cannot enforce this. A lot of effort should be invested to explain the use of EE equipment and to make people aware of their behaviour.” Moreover, there is a lack of stability in the residential sector. People may move out of their house before the contract with the ESCO has finished. Another problem is that customers don’t know, understand or trust the ESCO business model. Lastly, the split incentive also impedes the uptake of ESCOs (Vanstraelen and Madam, 2013).

A possible solution to tackle transaction costs could lie in project bundling. Vanstraelen and Madam (2013) of Fedesco explain in an interview. “To increase profitability, one could bundle thermal retrofitting of 100 similar homes together.” Van Dyck (2012) confirms: “neighbourhood renovations could be an interesting track.” Bieseman and Tanghe (2013) state in an interview.” The social housing sector might be appropriate because of the uniformity of buildings.” According to Le Gentil (2013) experiments in the social housing sector are already running in France, Italy and the UK. Vanstraelen and Madam (2013) explain a possible way of working. “ESCOs could perform thermal retrofits as subcontractors of social housing company. These companies could raise the rent at the rate of the energy savings.” Social housing companies could also influence the behaviour of the residents.

Apartment buildings might also be interesting. Vanstraelen and Madam (2013) temper expectations to perform entire retrofits. “It is very hard to convince everyone in an apartment building to participate in such a project.” This is discussed in the section about barriers in multi-family buildings. Le Gentil (2013) thinks the common area of big residential multi-family buildings could be interesting, though. “The central heating system and lighting of corridors are large enough in scale to have potential for ESCOs.” Vanstraelen and Madam (2013) think: “for these common parts, ESCOs would not have to convince all the owners of an apartment, but could target the property manager.”

To put it briefly, ESCOs could be a viable mechanism in apartments and social housing. But what could a government do to stimulate this innovative model? First of all, the information measures stimulating ESCOs proposed by the EED seem appropriate. The development of a standard contract for the residential market would be very beneficial (Le Gentil, 2013). Furthermore, the provision of information about these businesses could decrease the knowledge barrier.

The foundations of Fedesco and Vlaams EnergieBedrijf and the ESCO branch of the energy distributors are good steps to introduce the idea of ESCOs to the market. They are a knowledge base which can be deployed to start targeting the residential market. Fedesco has a knowledge centre on ESCOs. Vanstraelen and Madam (2013) further argue that public ESCOs (energy distributors, Fedesco and Vlaams EnergieBedrijf) could take up the role of market facilitator. “These facilitators could lead potential customers to private ESCOs.” Indeed, ESCOs could become specialized implementers of thermal retrofits, if necessary providing financing.

eu.ESCO (2012) thinks there is an urgent need to develop new business models to target the residential sector. Governments could encourage creativity and innovation to do so. Vanstraelen and Madam (2013) think that pilot projects could be an instrument for experiments. Currently, there is a pilot project on thermal retrofitting in the school sector. Starting a project in the residential sector seems interesting. Vanstraelen and Madam (2013) further argue: “opening subsidies to ESCOs could increase attractiveness of the residential market for ESCOs.” Lastly, Vanstraelen and Madam (2013) argue the following. “Currently there is still some uncertainty about the role of the energy distributors within the ESCO market. As it becomes more clear which markets they will target in the future and how, specific opportunities could arise in the residential or social housing sector too, in particular in multi-dwelling configurations.”

6.1.1.4 Financing facilities

Implementing the measures proposed in the directive and achieving targets for deep thermal retrofitting will cost a lot of money to governments. Therefore, the EED proposed a number of financing mechanisms. Erica Hope (2013) explains in an interview. “Financing facilities are the missing link in the EE story.”

An interview with Ingrid Holmes, programme leader of the E3G project on low-carbon financing, yielded a number of interesting ideas. Holmes (2013) proposed three main sources of financing which could be combined with one another.

A first line of action is already in practice in Germany. There, the government development bank, KfW, plays a key role. Holmes (2013) explains. “Because KfW is backed by the government, it can lend money very cheaply on the international market. KfW lends this money further to commercial banks. These banks have their customer interfaces up and running.” This mechanism could be a possible way to implement the green loans suggested further. It would require the foundation of a government investment bank.

Secondly, Holmes (2013) underlines the importance of the European sources of financing which are proposed in the EED. “The European budget 2014-2020 reserved 20% for climate and energy. But also the EU structural fund could be a possibility for Flanders to receive money from.”

Lastly, Holmes (2013) further explains the potential of an EE fund. “Such a fund could be a powerful mechanism to attract private capital, for example of big institutional investors. The government could contribute junior capital to the fund, which is the smallest part and which bears the risk. Senior capital could be provided by big investors and would be riskless.” Holmes further explains what requirements are needed to trigger such large scale private capital. “Big private investors need to have guarantee for demand of investments in EE. Therefore development of the deep thermal retrofit market is necessary. In this regard policy should stimulate innovators, early adopters and early majority. Governments need to bring a story with a well-designed policy program. These could be coherent packages of time limited carrots and future sticks." Indeed, Holmes is an advocate of requirements for thermal retrofits. "The most effective way for governments is imposing regulation and requirements."

6.1.2 Adaptations to existing policy measures

6.1.2.1 Energy efficiency obligation schemes

Energy efficiency obligations (EEOs) are an effective way to overcome barriers to EE with households (Lees, 2012). By means of EEOs, governments force energy distributors (or retailers) target their customers with strategies to help them use less energy. The costs of these measures can be spread over the company's customer pool in the billing tariffs. If they fail to reach a target, the company incurs penalties.

In Flanders, EEOs have been in place since 2002. They address the energy distributors Infrax and Eandis, which are former public enterprises. At first the Flemish energy distributors targeted low hanging fruit. Guido Claes (2013) from Infrax explains in an interview. "We started off by providing small measures such as water saving shower heads. Since the end of the 1990s we also target the building shell."

The EEOs in Flanders at first had a binding energy savings target. Each energy distributor thus could decide on which measures it would implement in order to attain this target. Claes (2013) explains in an interview. "Too much effort was used to prove that those targets were reached. There were hairsplitting discussions about differences in calculation methods between the different distributors." Schaerlaekens (2013) further explains. "To reach their targets, energy distributors could freely choose their measures. This resulted in a crisscross of different incentives in different regions." All parties agreed to move from an obliged energy savings target towards an obliged set of measures. Since January 2012, the energy distributors Eandis and Infrax are forced to give a number of subsidies to stimulate thermal retrofits, perform the social roof insulation projects and provide information.

The EED puts forward EEO schemes with binding targets instead of binding measures. All involved parties in Flanders agreed in the conducted interviews, though, that the current system of obliged measures for the energy distributors should be kept. In effect, the EED leaves room to governments to take other policy measures to attain the same target of 1.1% per year. Claes (2013) states the following about this.

“The targets before 2012 were higher than 1.5% per year, so it should not be a problem to comply with the EED’s requirements.” Verbeeck and Dreesen (2010) also show that the energy distributors in Flanders systematically brought about much higher energy savings than required by the targets.

In short, all arguments plead for keeping the current EEO system which stipulates obliged measures instead of an obliged energy saving target.

6.1.2.2 Energy audit

Energy audits were required by Directive 2006/32/EC. Thus, energy audits are currently in place in Flanders. The new EED emphasizes the cost-effective aspect of these energy audits.

The conceptual framework revealed that energy audits have a high potential in the knowledge and especially the decision stage of the decision making process. In effect, personal advice on potential retrofit activities is very convincing. Especially for the laggard categories, personal and tailored communication is important (cf. supra). Claes (2013) explains why the audits have not been a success. “The current energy audits are too time intensive, and thus expensive, to be successful.” In effect, they cost around 400 euro (VEA, 2013a) and are not tax deductible since 2012. Therefore, energy audits ignore laggards, because these priority groups are often restrained by financial barriers. Energy scans, though, form a low-cost alternative but are only targeted towards underprivileged people.

One possibility would be to subsidize these audits. Another option would be to find a balance between price and thoroughness. In effect, by making the energy audits less vigorous, the price could go down. Vermeiren (2013) further explains. “Another option would be to make such an energy audit a required step in decision making process by linking subsidies or loans to the audit.” This is currently the fact in Germany and Wallonia.

Vermeiren (2013) further explains in an interview that “there is not much awareness about energy audits because communication about them has been rather limited.” Indeed communication is important. The proposed local energy and housing counters could be an essential link to lead households towards these audits.

6.2 Suggestions from the conceptual framework

Based on the analysis by means of the conceptual framework, a number of suggestions for improvement were made. A selection of high-impact improvements is elaborated hereunder. On the one hand, it seems appropriate to introduce a number of new policy measures. On the other hand, existing policy measures could be adapted to increase their impact.

6.2.1 New policy measures

6.2.1.1 Local energy and housing counters

The analysis of priority groups has revealed that there is a need for a large-scale instrument which offers personal guidance. This is especially the case for underprivileged people and elderly people. VEA (2011) acknowledges that these people can't be reached through traditional channels. They need accessible information, substantial financial support and personal guidance throughout the whole building process. Also landlords could substantially benefit from such a measure (Samenlevingsopbouw Antwerpen, 2011). The analysis of Rogers' (2003) communication channels showed that the less change-oriented groups require interpersonal communication in order to undertake action. Also the EED underlines the importance of informing and even empowering consumers.

Energy counters could be a possible solution. Such energy counters are local offices where people can ask all kinds of questions regarding energy, EE options and the thermal retrofitting process. In this way, people receive personal advice with high credibility. In Wallonia, the Netherlands and Brussels there are counters in place which take up energy issues as their main or one of their fields of expertise (Smeuninx and CEDUBO, 2010). There was also a study in Flanders about local energy counters. In effect, the policy document of Van den Bossche (2009) mentions the intention to evaluate this concept. Vermeiren (2013) explains the following in an interview. "A few years ago there was enthusiasm for this idea. Eventually the planned experiments were not executed. The idea was shelved."

However, the benefits of local energy counters are numerous. Samenlevingsopbouw Antwerpen (2011) presents a possible design for these energy counters. They see energy counters as a one-stop-shop with a front office and a back office. People in the front office are adapted to the priority group and act like counsellors who pass on questions and issues to the right people in the back-office. These front officers are 'account managers' who make sure their 'customer' gets the answer or guidance he/she needs. In the back office, there are employees from different organisations with different fields of knowledge who can be consulted for various issues.

Samenlevingsopbouw Antwerpen (2011) thinks the energy counters should be imbedded in the existing 'housing shops' (Dutch: woonwinkel), as housing and energy issues are closely related. This would be another step towards the integration of the policy fields of energy and housing. Of course there should be expert advice on energy, EE measures, thermal retrofits, support measures, the process of planning, implementation and ex-post administration. Samenlevingsopbouw Antwerpen (2011) thinks that these local energy and housing counters should be highly integrated with organisations targeting priority groups, official institutions such as VEA, the providers of subsidies (the energy distributors), social welfare centres (Dutch: OCMW) and the local municipalities, and technical experts. Schaerlaekens (2013) states in an interview that "also the FRGE should be integrated in this concept." Indeed, access to low-cost finance seems very important. Gathering all these stakeholders could create synergies resulting in new ideas, better coordination and larger impact.

Above all, these local energy and housing counters should be approachable for the priority groups of underprivileged people and elderly people (for free). At the same time they could be of value to landlords, recent owners and highly educated or high income households. More advanced services could be paying for these latter three priority groups in order to keep these counters viable.

To launch this new concept, a communication campaign targeted towards the most important priority groups is necessary. Energy counsellors, social organizations and other civil society organisations should be involved in such a campaign. Ideally, each municipality should have an energy and housing counter. These counters should respond to the barriers and needs outlined above. The information provided should be clear and understandable in order to decrease perceived complexity (cf. supra) about technical issues, but also about government policy and requirements. In this regard, it should also decrease the administrative load placed on priority groups.

Vermeiren (2013) clarifies the potential of such energy and housing counters. "On the basis of the energy value in the EPC, officers of these counters could personally ask owners of low EE quality houses to make an appointment." Van Dyck (2012) explains in an interview: "people with an appropriate education could guide households in drafting a step-by-step plan." This could help many people to decrease (perceived) hidden costs. Inslegers (2013) thinks this could also be a solution for landlords. "Landlords need personal guidance. Preferably someone else would take over all inconvenience by designing and implementing a plan to retrofit the house." As illustrated above, such a personal guidance would also be very beneficial for elderly people.

6.2.1.2 Green loans

From the policy-barriers analysis, a need for low-cost financing for thermal retrofits became apparent. Currently, underprivileged people can benefit from a number of social loans and from the loans of the FRGE. For a larger audience, there are no low-cost loans available. From 2009 until 2011 there were the federal green loans (FOD Financiën, 2012). These loans were part of the green revival package of the federal government. The FRGE and commercial green loans could create a synergy together. The FRGE could target the specific audience of underprivileged people, whereas green loans could target the wider audience.

In principle, the FRGE provides loans for everyone. Underprivileged people, though, benefit from personal guidance and don't have to pay interest costs (VEA, 2013b). Van Dyck (2012) states the following. "In principle, the FRGE primarily focuses on underprivileged people. It should be easier to reach this priority group through this channel." Especially if the FRGE would be integrated in the local energy and housing counters, it would be the ideal instrument to reach underprivileged people (Samenlevingsopbouw, 2010; Schaerlaekens, 2013). Vermeiren (2013) argues the repayment period should be made longer. "Five years to repay a loan often is too short for underprivileged people." In any case, there has to be more communication about the FRGE. Bieseman and Tanghe (2013) state: "the loans of the FRGE are not widely used yet, because they are not well known."

Furthermore, the FRGE should be supplemented by a new green loan. "In the UK, Germany and Estonia, green loans are already available", states Erica Hope (2013) in an interview. This green loan would supply low-cost financing for thermal retrofits and other EE measures. Experience from the earlier green loans in Flanders has learned that commercial banks are the right partners to provide these loans. Claessens and Ledeganck (2012) state the following in an interview. "The green loans were a success because they were well announced. Commercial banks simply are more experienced to do so." Commercial banks could reach a much wider audience than does the FRGE. Moreover, energy and housing counters could refer to the involved financing institutions. Currently, there are already voluntary agreements with Triodos and Belfius to give advantages to the owners of newly built energy efficient houses. Schaerlaekens (2013) states the following. "Both banks are willing to also include deep thermal retrofit activities in these beneficial loans. Currently, though, it is hard to determine what should be the criterion to determine whether a house has undergone a deep thermal retrofit."

The arrangement of the earlier green loans was as follows. Households could contract a loan with a commercial institution. The government paid 1.5 percentage points of the interest. The remaining interest costs were tax deductible (40%). The government should be careful, however, not to place too high administration costs on the banks. Bieseman and Tanghe (2013) explain: “the total interest percentage of the earlier green loans increased, because of a higher administrative load.” Also, these green loans could stimulate deep retrofitting by linking the interest percentage to the amount and the depth of retrofit activities, like in Germany (Neuhoff et al., 2011a).

6.2.1.3 Tackling the split incentive

The split incentive is one of the most complicated barriers. In the analysis of BECO (2010b), a set of measures was proposed which could jointly target the split incentive. Above, it has already been proposed to tighten the EE requirements in the housing code. This would force landlords to attach more attention to EE. To ensure these requirements are met, a number of additional stimulating measures seem appropriate.

One of the first issues BECO (2010) discusses is the facilitation of voluntary agreements between landlords and tenants. Van Dyck (2012) explains in an interview that one could “encourage landlords to invest by allowing them to increase the rent pro rata with the energy savings.” In this regard, the tenant should agree with such an increase of the rent. To stimulate this, a number of legal barriers should be abolished. These legal barriers restrict the possibility for landlords and tenants to come to an agreement.

Also, currently there is scarcity on the rental market. Demand is too high for supply. This results in a high price for houses of low structural and EE quality. Sharpening regulation for landlords bears the risk that the rental market will become even tighter. To widen the rental market several options are possible. Starckx (2013) explains the following. “Government has treated the rental market in a stepmotherly way. Fiscal policy favours ownership and subsidies were not open for landlords for a long time. This has tightened the rental market.” Right now, most subsidies can also be granted to landlords, but government policy should stimulate people to put a house up for rent instead of to sell a house. Inslegers (2013) argues that by abolishing the ‘housing bonus’ (Dutch: woonbonus) government could kill two birds with one stone. “The money of the housing bonus, which now handicaps the rental market, could be used to stimulate the rental market. A revision of inheritance taxes, the cadastral income or the real estate tax could all give the rental market room to breathe.” Another possibility would be to increase the amount of places in the social housing sector (BECO, 2010b).

6.2.1.4 Targeting the barrier of multi-family buildings

From the policy-barriers analysis it seems that there are no measures specifically targeting the difficult situation in multi-family buildings (cf. supra). In 2010 BECO (2010a) conducted a study on this measure. Acting upon this study could be a first step.

The report suggested stimulating a reserve fund in apartments, from which investments could be made. Independent information was also very important. Therefore, a (subsidized) audit seemed necessary to deliver independent information in order to convince the general assembly of joint owners. Lastly, VEA and BECO (2010) explain that it should be ensured that apartments could benefit from subsidies. In this regard, a particular subsidy for multi-family buildings, or at least a revision of the current scheme, seems appropriate.

In the previous analysis it was revealed that the housing code also affects multi-family buildings. Enforcing the proposed housing code (cf. supra) more actively in multi-family buildings, could be an important stimulus.

6.2.2 Adaptations to existing policy measures

6.2.2.1 Pilot and demonstration projects

Currently, there are pilot and demonstration projects in the social housing sector and the school sector for new buildings (Vlaamse minister van leefmilieu natuur en cultuur, 2013). In 2012 a project on passive social houses was finished. In this project, there were five existing houses which were renovated to passive standards. Most past and running demonstration projects, though, are aimed at the construction of new buildings. Moreover, the current demonstration projects are targeted towards the specific sectors of social housing and schools.

To put it briefly, the impact of demonstration projects could be much larger. Firstly, more pilot- and demonstration projects are necessary which target deep thermal retrofitting. There is a need for this, explains Jan Schaerlaekens (2013) in an interview: “existing houses have to be transformed, but until now, there is little technological and administrative experience.” In this regard, such project cases should be carefully documented.

Secondly, existing and future pilot and demonstration projects should be open for a wide audience of architects, building professionals and households. On the one hand, this would require an information campaign on a larger scale. Such an information campaign could inform on the materials used, the techniques and the building processes. On the other hand, information campaigns could emphasize the possibility of visiting these demonstration projects, for example with guidance from an expert.

This information is essential for building professionals, to tackle the barrier of knowledge and education (Economidou et al., 2011). In this regard, such demonstration projects could be set up as semi-education centres.

Furthermore, demonstration projects seem necessary for innovators and early adopter households to make them adopt deep retrofits on a wide scale. Demonstration projects could help to take away uncertainty by increasing trialability. In effect, Rogers (2003) mentions that individuals first want to try an innovation on a small scale. Thermal retrofits, however, cannot be tested on a small scale. This trial can be substituted by "trial by others" (Rogers, 2003, p.177) in which the decision maker can gain information of a peer who has already implemented the innovation. In this regard, demonstration projects in the context of a real-life occupied house might work best. Information provided by peers will improve credibility.

In addition, the priority group 'recent owners' could be targeted. This priority group could receive personal guidance throughout the building process and additional funding from the government to implement deep thermal retrofits. In addition, such projects could be the setting for experiments with very innovative techniques. In return, it could be required for the occupants to open their houses for other decision makers on regular moments during a certain period. People who think of performing deep thermal retrofits could gain personal advice from peers in such projects. Well-designed project tenders could ensure that these demonstration projects are sufficiently geographically dispersed.

6.2.2.2 Covenants with the building sector

Building professionals are a much consulted and highly trusted source of information and advice for people in the decision making process (Novikova et al., 2011b). They influence decision makers throughout the entire decision making process. Their advice can have a high impact. Novikova et al. (2011b) state that various kinds of building professionals, who perform checks and repairs, are important sources of advice and information. Currently, there are covenants with the federations of sectors directly involved in the building and renovation process (cf. supra). These covenants prescribe the federations to stimulate their members to advise customers on subsidies and tax advantages, to inform on application procedures for government support and to suggest energy saving alternatives.

Until now, however, there are a number of barriers impeding such high-impact advice, as described above. In short, building professionals lack knowledge and incentives to suggest energy efficient solutions to customers. In this regard, a new set of covenants seems opportune. Renewed covenants could increase cooperation between the government and sector federations. Indeed, sector federations seem best positioned to increase awareness and knowledge about thermal retrofitting with their members. They could also be the right partner for the government to improve the building process which currently does not stimulate EE.

Such covenants could stipulate a specified number of certified building professionals each year. They could further formalize, enforce and perhaps remunerate advice by building professionals to households. Additionally, the formation of building teams could be stimulated by sector federations such as Bouwunie and Vlaamse Confederatie Bouw.

6.2.2.3 Housing code

The implementation of EE requirements regarding roof insulation in the Flemish housing code is one of the best practices in Europe regarding EE requirements on existing houses. On top of that, it is a first step towards the integration of policy on housing and EE. Obligating thermal retrofitting on existing houses is necessary to attain the goals stated in the Flemish Energy Renovation Programme. The clear communication and the increasingly tightened requirements combined with financial support measures are exemplary for further policy.

In this regard, it seems opportune to widen the scope of these EE requirements to other high-impact thermal retrofit measures. Geert Inslegers (2013) mentioned the following in an interview. “The requirements on roof insulation are a chance to implement other requirements.” Inslegers proceeds. “Also double glazing and energy efficient boilers [explicit goals in the Energy Renovation Programme] should become a requirement in the housing code. It would be much more clear and effective to implement these three measures at the same time.”

Indeed, it is strange that the other key measures of the Energy Renovation Programme 2020 were not included in the housing code. Schaerlaekens (2013), who works in the cabinet of minister Van den Bossche, explained the following in an interview. “It is not impossible that these measures will be included later. For now, we made the assessment that it would put too much pressure on landlords. Roof insulation is relatively cheap. Replacing windows and boiler requires more financial resources. This could push landlords out of the rental market, making this market even tighter." Hendrickx et al. (2011) counter these arguments by stating that energy saving measures should be one of the landlord's duties.

Therefore, this dissertation proposes to include double glazing and high efficiency boilers in the housing code to avoid tenants being confronted with disproportionate energy bills. It also seems necessary to enforce this by sufficient control measures (Minaraad and SERV, 2012).

6.2.2.4 Energy counsellors

The measure 'energy counsellors', has a wide-reaching coverage. It affects all three stages in the decision making process, targets six barriers and affects all priority groups. Increasing the number of energy counsellors could increase its impact. Especially laggards (recent owners, underprivileged people, elderly people and landlords) benefit from personal and tailored advice.

Vermeiren (2013), the person responsible at VEA for energy counsellors, explained the following in an interview. "Large organizations can target their members in an adapted way."

A possibility to increase the impact of this measure could be to introduce an energy counsellor in an organisation for landlords. AES (Algemeen Eigenaarssyndicaat) is an organisation which targets owner-occupants, landlords and joint owners. An energy counsellor in this organisation could target both the split incentive and the situation in multi-apartment buildings.

Also, energy counsellors could be systematically introduced in the organisations with which government has a covenant (cf. supra). These energy counsellors could ensure the implementation of the covenants in their sector. Indeed, covenants and energy counsellors could have a mutually enforcing functioning.

6.3 Analysis of TO BE policy by means of the conceptual framework

In the previous sections of this chapter a number of improvements to current policy were suggested. Together with the current policy, these improvements form the TO BE policy situation. This situation is analysed by the conceptual framework in the following sections.

For reasons of clarity, the improvements proposed in the previous sections are listed below in Table 7 according to the policy category and the order they are depicted in the conceptual framework. It is indicated whether a measures was inspired by the benchmark of AS IS policy against the EED or by the analysis of AS IS policy in the conceptual framework. Some proposed measures (listed in Table 8) are too vague or are composed of different measures. These measures will not be regarded in the analysis of TO BE policy. However, this doesn't mean they are not important. Also energy efficiency obligation schemes are not explicitly included in the TO BE policy, because no adaptations to the current scheme are required.

Table 7: Proposed measures according to their policy category

Category	Name	New measures or adaptation of existing measure	Resulted from
Frameworks and plans	Vision and long-term renovation strategy	New policy measure	Benchmark EED
Information	Energy audit	Adaptation of existing policy measure	Benchmark EED
	Local energy and housing counters	New policy measure	Analysis conceptual framework
	Covenants with building sector	Adaptation of existing policy measure	Analysis conceptual framework
	Energy counsellors	Adaptation of existing policy measure	Analysis conceptual framework
	Pilot and demonstrations projects	Adaptation of existing policy measure	Analysis conceptual framework
	Certification and qualification for building professionals	New policy measure	Benchmark EED
Financial incentives	Residential ESCOs	New policy measure	Benchmark EED

	Green loans	New policy measure	Analysis conceptual framework
Regulation and requirements	Housing code	Adaptation of existing policy measure	Analysis conceptual framework

Table 8: Adaptations or new policy measures which are not mapped

Category	Name	New measures or adaptation of existing measure	Resulted from
Set of measures	Tackling the split incentive	New policy measure	Analysis conceptual framework
	Targeting the barrier in multi-family buildings	New policy measure	Analysis conceptual framework
Others	Financing facilities	New policy measure	Benchmark EED
No adaptations suggested	Energy efficiency obligation scheme	Adaptation of existing policy measure. The analysis showed that the current system in Flanders should be kept.	Benchmark EED

6.3.1 TO BE policy and stages in the decision making process

In this section, the policy map in Figure 10 is revisited. The concept of the map is the same, though now the measures inspired by the EED (shades of orange) and the analysis by means of the conceptual framework (shades of blue) are included.

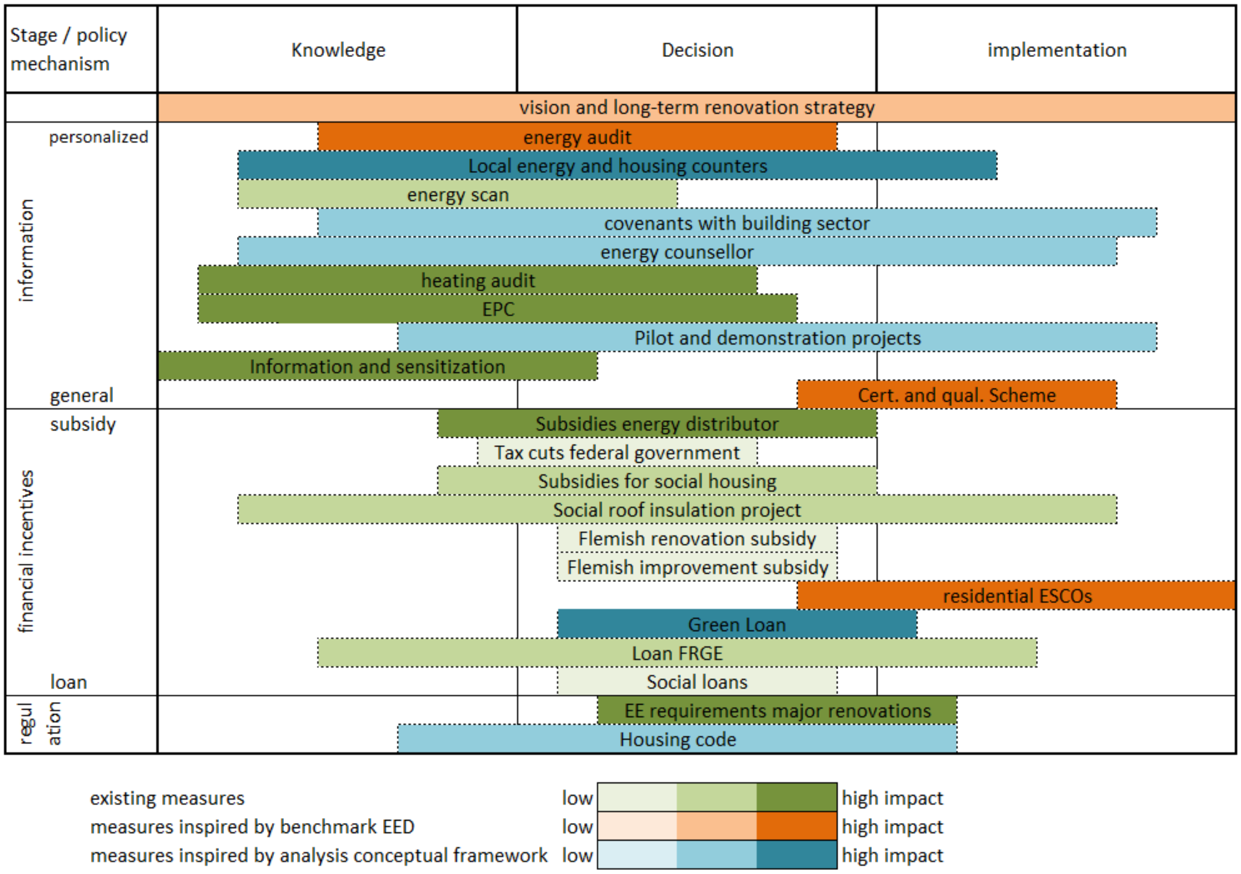

Figure 13: Map of existing and proposed policy measures in the decision making process.

When regarding the stages of the decision making process, one can see a number of improvements in the policy map. The improvements suggested by the EED seem very important, but should be complemented by a number of other measures, as revealed in the AS IS analysis.

Firstly, a certification and qualification scheme and residential ESCOs could fill the gap in the implementation stage. A vision and long term strategy with regard to thermal retrofits could further streamline a coherent package of policy measures. It has the potential to increase coordination and determine an appropriate level of ambition.

The local energy and housing counters could have a central coordination function in the entire set of policy measures. They could provide information throughout the decision making process and lead decision makers to the right actors. Financial incentives seem to be more balanced. Subsidies and tax cuts are complemented by a high-scale low-cost loan.

Lastly, one can see that a number of measures have increased in impact or reach throughout the decision making process. These are: energy audits, covenants with buildings sector, and demonstration projects.

6.3.2 TO BE policy and barriers

In this section, the policy map in Figure 11 is revisited. The concept of the map is the same, though now the measures inspired by the EED (shades of orange) and the analysis by means of the conceptual framework (shades of blue) are included.

	Barriers / policy measure	knowledge		decision						implementation			policy			
		Lack of knowledge	Imperfect information	Low priority	bounded rationality	Financial barriers	hidden costs	split incentive	multi-family buildings	building process	knowledge and education professional	Structure building sector	Energy price distortion	Fragmentation of authority	Discontinuity and lack of transparency	Administrative load
	Vision and long term renovation strategy												#	#	##	#
information	energy audit	##	##	#												
	Local energy and housing counters	**	*	*		*	*	*								*
	energy scan	+	+	+												
	covenants with building sector	*	*	*						**	**	*				
	energy counsellors	*	*	*				*	*	*	*					*
	heating audit	+	+	++				+			+	+				
	EPC	+	+	++				++								
	Pilot and demonstration projects	*	*							*	**					
	Information and sensitization	++	++	+						+	+	+				+
	Cert. and qual. Scheme									#	##	##				
financial incentives	Subsidies energy distributor			++		++		+								
	Tax cuts federal government			++		++		+								
	Subsidies for social housing			+		+										
	Social roof insulation projects	+		+		+	+	++								+
	Flemish renovation subsidy			+		++										
	Flemish improvement subsidy			+		++										
	Residential ESCOs					##	##		#	##	##	##				
	Green loan			*		**										
	Loan FRGE	+				++	+	+								+
	social loans					+										
regulation	EE requirements major renovations			++						+	+				+	
	Housing code	*		**				**	**						**	

existing measures	high impact on	++	impact on	+	no impact on	
measures inspired by benchmark EED	high impact on	##	impact on	#	no impact on	
measures inspired by analysis conceptual framework	high impact on	**	impact on	*	no impact on	

Figure 14: Matrix of existing and proposed policy measures and how they impact barriers in different stages.

The policy map in Figure 14 emphasizes the importance of the proposed policy measures even more clearly. The proposed measures target barriers which were previously unaddressed. Some barriers remain difficult to address, though.

The barriers in the information stage would be covered in a more effective way by energy audits and the local energy and housing counters.

ESCOs and local energy and housing counters together could be important to tackle hidden costs. Counters would centralize all information in one location which decreases searching and information costs. ESCOs could result in an improvement with regard to hidden costs incurred by the execution of the building activities. Furthermore, also the situation in multi-family buildings could be partly mitigated by energy counsellors and residential ESCOs. Of course, the additional measures proposed in 'Targeting the barrier of multi-family buildings', could play a major role.

The barriers in the implementation stage would be covered in an effective way by residential ESCOs and certification of building professionals. Furthermore, scaling up covenants in the building sector, demonstration projects and energy counsellors could be better targeted towards these barriers.

Lastly, policy barriers could be tackled by the development of a vision and a long-term strategy. Abolishing these barriers will require courage and persistence of policy makers, though.

6.3.3 TO BE policy and priority groups

In this section, the policy map in Figure 12 is revisited. The concept of the map is the same, though now the measures inspired by the EED (shades of orange) and the analysis by means of the conceptual framework (shades of blue) are included.

	Target group / policy measure	Upper middle class	Recent owners	Underprivileged people	Elderly owners	Landlords
	Vision and long term renovation	##	##	#	#	#
information	energy audit	#	##	#	#	#
	Local energy and housing counters	*	*	**	**	*
	energy scan			++		
	covenants with building sector	*	**	*	*	*
	energy counsellors	*	*	**	**	**
	heating audit	+	+	+	+	+
	EPC		++	+		++
	Pilot and demonstration projects	**	**			
	Information and sensitization	+	+	+	+	+
	Cert. and qual. Scheme	#	##	#	#	#
financial incentives	Subsidies energy distributor	+	+	++	+	+
	Tax cuts federal government	+	+		+	+
	Subsidies for social housing			+		
	Social roof insulation projects			++		++
	Flemish renovation subsidy	+	+		+	
	Flemish improvement subsidy	+	+	+	+	
	Residential ESCOs	##	##	#	#	#
	Green loan	*	**		*	*
	Loan FRGE			**		
	social loans		+	++		
regulation	EE requirements major renovations	+	++			
	Housing code			*		**

existing measures	
specifically targets	++
also targets	+
does not affect	
measures inspired by benchmark EED	
specifically targets	**
also targets	*
does not affect	
measures inspired by analysis conceptual framework	
specifically targets	##
also targets	#
does not affect	

Figure 15: Matrix of existing and proposed policy measures and how they target priority groups.

A first observation is that the measures proposed in the EED mostly cover, directly or indirectly, the entire spectrum of priority groups. Furthermore, the EED places emphasis on market transformation with regard to deep thermal retrofits. Indeed, the EED stimulates the priority group of upper middle class and especially recent owners. This is important, because in the current policy these groups are not really targeted.

Some measures inspired by the AS IS analysis also cover all priority groups. Furthermore, it is important that these measures target the three other priority groups (underprivileged, elderly people and landlords).

Underprivileged people were targeted by a wide range of measures in the AS IS situation, but it remained hard to convince them. The local energy and housing counters could be the missing link because of the personal guidance in such counters. For elderly people too this personal guidance could be important to convince them. Furthermore, additional measures towards elderly people seem important.

The priority group of landlords remains difficult to address. The tightened EE requirements in the building code are important, but further stimulating measures in line of the social roof insulation projects seem appropriate. Furthermore, the measures proposed in 'Tackling the split incentive', could play an important role.

Lastly, the synergy between the loans of the FRGE and the green loans, targeting the rest of the other priority groups seems interesting.

6.4 Conclusion

The benchmark of AS IS policy against the EU Energy Efficiency Directive and the analysis of the AS IS policy situation in the conceptual framework resulted in a number of suggestions to improve policy. In this chapter, some of these improvements were elaborated.

Firstly, the measures inspired by the EED are elaborated. A long-term vision seems necessary to determine the right level of ambition today. Moreover, future policy should comply with a number of principles in order to target the existing policy barriers. A certification and qualification scheme could tackle important barriers in the building sector. ESCOs could be an interesting mechanism to tackle many important barriers of decision makers in social housing of apartment buildings. The government could stimulate the development of ESCOs in the residential sector by encouraging new business models, running pilot projects and opening subsidies towards ESCOs. Furthermore, a number of financing mechanisms could be tapped to obtain the necessary financing. These are a government investment bank, EU-wide sources, and an EE fund. Besides these new measures, a number of possible adaptations are regarded. The EED proposes an energy efficiency obligation scheme with binding targets. For Flanders, it seems appropriate to keep the current, well-functioning system. Lastly, energy audits should be made cheaper or should be made an essential step in the decision process.

Secondly, the measures inspired by the analysis of the conceptual framework are described. A number of new policy measures are proposed to fill gaps in current policy. Local energy and housing counters could be the missing link in policy for laggards. Green loans could be an important source of low cost financing for EE investments. Moreover, the split incentive and the situation in multi-apartment buildings should be targeted by a set of policy measures. The policy measures of pilot and demonstration projects, covenants, EE requirements in the housing code and energy counsellors could be scaled up in order to increase their impact.

The impact of these suggestions for improvement is assessed by means of the conceptual framework. The new measures proposed by the EED all prove very important, especially in stimulating upper middle class and recent owners. Nevertheless, the measures from the EED should be complemented by further measures in order to target all priority groups. Local energy and housing counters could have a key role in providing information and leading decision makers towards other measures. Together with energy audits and other improved measures, they could effectively target barriers in the knowledge stage.

Moreover, barriers in the building stage are tackled in a more effective way by covenants, pilot and demonstration projects and a certification and qualification scheme. Multi-apartment buildings, landlords and policy barriers remain hardly addressed and ask additional action.

7 General conclusion

Flanders is the second most energy intensive region in Western Europe. As such, there is a large unrealized potential to increase energy efficiency. One fifth of this potential (in Belgium) can be realized by retrofitting existing residential buildings. Increasing energy efficiency in existing buildings has a wide range of environmental, economic and societal benefits, not to mention energy system benefits. The appropriate method to realize this potential is by executing deep thermal retrofits of existing buildings. This encompasses a thorough renovation of the thermal envelope and the space heating system. These deep thermal retrofits cost-effectively reduce the annual heat consumption by 70%.

Because it is cost-effective to realize the vast potential in existing buildings, government should do everything to stimulate thermal retrofits. Therefore, the research question of this dissertation was the following. *How can policy improve energy efficiency in existing residential buildings in Flanders?*

To answer this research question, a unique conceptual framework was constructed to assess policy from three intertwined perspectives.

Firstly, the decision making process with regard to thermal retrofitting was elaborated. This gives a good insight into the decision maker's internal motivation to execute thermal retrofits. Subsequently, the decision maker goes through the knowledge, decision and implementation stage. It is important that each of these stages is covered by policy measures to guarantee that decision makers flow through the decision process as smoothly as possible.

Secondly, it is investigated which barriers prevent decision makers in each stage of the decision making process. These constraining factors complement the internal perspective of the decision making process. Barriers can be categorized according to barriers affecting the knowledge, decision and implementation stage. Lastly, a number of barriers concern policy. Each of these barriers is an opportunity which policy should seize with appropriate measures in order to increase energy efficiency in homes.

Thirdly, priority groups are identified which deserve special attention. The upper middle class and recent owners should be targeted in order to diffuse deep thermal retrofits. Furthermore, elderly people, underprivileged people, landlords and recent owners should be targeted to make them implement a number of high-impact measures which are already present in most houses.

In Flanders, most authorities on energy efficiency in buildings lie with the Flemish government. The influence of the EU on Flemish policy is substantial, though. The Energy Performance of Buildings Directive (2002 and 2010) and the Energy end-use efficiency and energy services directive (2006) made

Flanders implement a number of important regulatory and information instruments. In 2011, the EC launched a series of policy documents looking at 2050. The new Energy Efficiency Directive (EED) of 2012 is the logical legislative outcome. Many policy measures proposed in the EED are already in place, because they were proposed in earlier directives.

When analysing the AS IS policy situation by means of the conceptual framework, a number of shortcomings became apparent. Firstly, policy has shortcomings in covering (the barriers of) the implementations stage. Moreover barriers regarding policy and multi-family buildings remain mostly uncovered. Furthermore, the upper middle class, elderly owners and to a lesser extend recent owners and landlords need additional specific measures.

7.1 Policy recommendations

Certain measures proposed in the EED are a valuable complement to Flemish policy. On the basis of the analysis of the AS IS policy situation by means of the conceptual framework, there are a number of suggestions for potential policy improvements.

The following new policy measures were proposed. The tag 'EED' indicates whether this measure is proposed in the EED.

1. (EED) Determine a vision and long-term renovation strategy, bearing in mind a number of important principles.
2. Implement local energy and housing counters as a one-stop-shop regarding energy and housing.
3. (EED) Implement a certification and qualification scheme for building professionals.
4. Introduce green loans providing low-cost capital for thermal retrofits to a wide public.
5. Explore and stimulate the possibility of residential ESCOs.
6. (EED) Explore various sources of financing.
7. Target the split incentive and multi-family buildings with complete, composite policy packages.

The following improvements of existing measures were proposed.

1. Focus demonstration projects on deep thermal retrofitting. Communicate to professionals and decision makers.
2. Introduce additional energy counsellors in specific organisations.
3. (EED) Make existing energy audits cheaper or integrate them in the decision making process.
4. Retailor the covenants with the building sector to stimulate advice from building professionals.

5. Add additional obligations regarding energy efficient glazing and boilers in the housing code.

The analysis from the TO BE policy map, implementing suggested improvements, showed that the measures from the EED all prove very important, but need to be complemented by the other proposed measures in order to target all priority groups. Multi-apartment buildings, landlords and policy barriers ask for additional action.

7.2 Limitations and suggestions for further research

The analysis above is a broad analysis, aiming to give an overview of policy measures, attempting to elaborate some policy proposals briefly. There was not enough time and space, though, to do this in depth for each measure. All of these measures will have to be elaborated further.

Furthermore, even though 19 interviews were conducted, additional stakeholders may have been heard. Separate data of Flanders could not always be found. Instead data of Belgium was used.

Furthermore, additional empirical research should be performed to get a proper view of the importance of stages, barriers and priority groups in Flanders. Indeed, in the analysis above it was not possible to objectively distinguish what barriers, stages or priority groups deserve most attention. The conceptual framework, moreover, would be significantly improve if an objective, quantitative method would be developed in order to measure the impact of policy measures on stages, barriers and priority groups. In the analysis above this impact was estimated by means of qualitative methods.

Moreover, it could be interesting to benchmark Flemish policy against leading EU countries such as Germany and Denmark. In addition, the opportunity of residential ESCOs in Flanders should be explored in further research.

Lastly, as mentioned before, this dissertation is limited in scope. On the one hand this limits the validity of this dissertation. On the other hand, these limitations supply interesting opportunities for future research. Firstly the analysis is geographically limited to Flanders. Belgium is divided in different regions with different policies. The Flemish energy efficiency policy is different from the Walloon and the Brussels policy. It seems interesting to take into account these three policies at the same time. Also, this dissertation doesn't take into account municipal policy because of its heterogeneity. Secondly the analysis is limited to the residential sector. Other important energy consuming sectors are industry and transport. A joint analysis of these three subfields is another track for future research. Thirdly, the analysis is limited to energy use in existing buildings. Even though, the vast share of potential energy savings lies in existing buildings, policy makers should regard both new and existing buildings at the same time. Fourthly, the analysis is limited to thermal retrofits targeting the building shell and heating system. Lighting, appliances and behaviour of occupants are other important determinants of energy consumption in buildings. It could be interesting to use the conceptual framework to analyse policy in these fields. Fifthly and lastly, the analysis is limited to the policy situation and state structure as of May 2013. At the time of writing, uncertainty persists about the interpretation of the so-called October 2011 'Butterfly Agreement'. Future division of authority thus could not be regarded. Future research could investigate what the optimal division of authority should be.

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Appendices

Appendix I: Elaborate description AS IS policy measures in Flanders

Information

Name of measure	Description	Driven by European policy?
Energy audit	An energy audit is a thorough assessment of the energy performance of a building. It is non-compulsory available for households through recognized experts. These experts were trained and certified by the regional government (Flanders, Wallonia, and Brussels). The audit means to reveal priorities to improve the energy performance of the building (De Smet and Bachus, 2011). The audit looks at the building envelope, the heating system and other important thermal issues. This is an expensive instrument (+-400 euro) for households and has not been a success.	Energy end-use efficiency and energy services directive (2006)
Energy scan	An energy scan is a shallow scan of the building to see how a building could save energy in different ways. A few small EE measures may be installed (VEA, 2013b). The occupants receive a report with tips to save energy and suggestions for implementing thermal retrofits. These energy scans are free and are part of the public service obligations of the energy distributors. They are reserved for underprivileged people.	
Covenants with building sector	The Flemish government came to an arrangement with sector associations of the glass industry, insulation industry, building professionals and natural gas suppliers to push their members to inform (information on government support, EE options etc.) their customers on EE (VEA, 2011). Advice of building professionals is potentially very important, but for now there are still a number of	

	barriers in the building sector which impede qualitative advice (cf. supra).	
Energy counsellors	Energy counsellors are people employed by NGOs and sector federations who are paid by the government (Vlaamse minister van leefmilieu natuur en cultuur, 2013). They are the contact point for questions related to energy saving measures for their association. Also, they organize projects and information sessions on EE. Currently there are energy counsellors for households in an environmental organization (BBL), a social organization (Samenlevingsopbouw Antwerpen), an elderly association (Neos) and a general household organization (Gezinsbond). Also, there are energy counsellors in an association for building professionals (Bouwunie) and architects (NAV). These energy counsellors, however, primarily focus on the members of their organization rather than on the entire population.	
Heating audit	A heating system older than 15 years is obliged to undergo a heating audit. This heating audit should be executed by a certified expert. The heating audit results in a report with advice on replacing the heating system or on increasing the performance of the heating system. This audit is meant to speed up replacement of old heating systems (Vlaamse minister van leefmilieu natuur en cultuur, 2013). The heating expert also gives advice on government support measures and on other possible ways to save energy.	EPBD (2002)
Energy Performance Certificate (EPC)	The EPC is a certificate which informs about the energy performance of a building. It is drafted by a certified energy expert (VEA, 2011). The EPC shows the theoretical energy consumption (kWh/m²) on a coloured spectrum. Also the EPC displays a number of (standard) suggestions to improve the energy performance of the house.	EPBD (2010)

	Existing houses, which are displayed for sale or for rent, need to have an EPC and display the energy value in the advertisement. In this regard, the EPC is meant as a market instrument which influences demand and price of houses according to their energy performance.	
Demonstration projects	The Flemish government subsidized several experiments in the social housing and school sector to build passive or nearly zero energy buildings (Vlaamse minister van leefmilieu natuur en cultuur, 2013). In 2012 a first pilot project was completed on passive houses in the social housing sector. Here, five houses were renovated to passive standards. With regard to schools, another project aims to develop an ESCO model to thermally retrofit schools. The bulk of demonstration projects, however targets to gain sector experience in the construction of new buildings. Until now, there has not been much communication with decision makers about these projects.	/
Information EE and sensitization	VEA, the Flemish Energy Agency, performs targeted communication about the benefits (financial and environmental), specifications of and support measures for EE measures (Vlaamse minister van leefmilieu natuur en cultuur, 2013). Energy renovation is one of the four important themes of communication. The following priority groups are distinguished: • builders and renovators • tenants and landlords • professionals (architects, energy experts etc.) • companies A diverse set of communication channels is used to reach these priority groups: • media campaigns	/

	• free publicity • brochures • VEA's website • energy calculator tool on website VEA • news letters • presence on building fairs • educational material • …	

Financial incentives

Name measure	**Description**	**Driven by European policy?**
Subsidies energy distributors	The energy distributors (Eandis and Infrax) grant subsidies for roof and loft insulation, wall insulation, floor or basement insulation, for the placement of energy efficient glazing in substitution for single or double glazed windows, for heat pumps and sun boilers (VEA, 2013b). The subsidies are 50% higher for underprivileged people. Also, subsidies are awarded to underprivileged customers for the placement of condensing boilers. Energy distributors are forced to stimulate EE by public service obligations since 2002. This fulfils the suggestion in the EU directive of 2006. Energy distributors have to offer subsidies and complementary information.	Energy end-use efficiency and energy services directive (2006)
Tax cuts federal	Since 2012 the biggest part of federal tax cuts has been abolished. Only the installation of roof insulation is still	/

government	supported by a tax cut of 30% (VEA, 2013b). The installed roof insulation has to meet EE requirements.	
Subsidies for social housing	On top of the subsidies of energy distributors, there are a number of additional subsidies for the social housing sector (Vlaamse minister van leefmilieu natuur en cultuur, 2013). These subsidies cover replacement of glazing, EE heating systems, optimization of collective heating systems, sun boilers and heat pumps.	/
Social roof insulation projects	Rental houses on the private market with underprivileged occupants can make use of the social roof insulation projects (VEA, 2013c). The Flemish government and the energy distributors give a very high subsidy which covers most of the costs for the landlord. On top of that, a project promoter gives guidance to both tenant and landlord, performs the preparation and the execution of the building activities and deals with the administrative load for the subsidies. In that regard the landlord does not have to do anything, except pay the (small) remaining cost. In return, the landlord cannot raise the rent and does not cancel the contract. The social roof insulation projects are coordinated by the energy distributors.	/
Flemish renovation subsidy	The Flemish renovation subsidy supports renovation activities with a value of more than 10.000 euro for buildings older than 25 years (RWO, 2012a). Also, there are (rather broad) income boundaries. Private landlords cannot use this premium; owners who let their house via a social letting office can. The subsidy has EE requirements for cabinetwork and heating systems. For renovations of other parts of the house, there are no EE requirements, but in the framework of larger renovation activities, thermal components are also covered (Vlaamse minister van leefmilieu natuur en cultuur, 2013). The rational is that support for EE measures is covered by other subsidies. This	/

	subsidy originates from housing policy.	
Flemish improvement subsidy	The Flemish improvement subsidy is another subsidy granted by the Flemish housing policy for buildings older than 20 years (RWO, 2012b). It has tighter income boundaries than the Flemish renovation subsidy. Private landlords cannot use this premium; owners who let their house via a social letting office can. Roof insulation (if included in a general roof replacement), external joinery, external wall insulation and condensing boilers among other measures are supported via this premium. However, there are no EE requirements for these measures.	/
Loan FRGE	The FRGE (Fund to Reduce Global Energy costs) is a federal institution and issues loans at a maximum tariff of 2% for energy saving investments (VEA, 2013b). Landlords can also make use of this loan. The Flemish government pays the interest cost for underprivileged people. This latter priority group also receives support throughout the building process. The maximum loan is 10.000 euro. The loan should be paid back within 5 years.	/
Social loans	Underprivileged people contract a loan at favourable terms to buy or renovate a house (VEA, 2013b). There are three institutions which offer such loans: VMSW (Vlaamse Maatschappij voor Sociaal wonen), VWF (Vlaams Woningfonds) and EKM (Erkende Kredietmaatschappijen). The former two institutions determine the interest rate on the basis of income and number of children. There are no requirements on the renovation activities or on EE.	/

Regulation and requirements

Name measure	Description	Executing European

		policy?
EE requirements major renovations	The requirements on energy performance and indoor climate (Dutch: EPB-eisen) stipulate minimal levels of EE for the construction of new buildings and major renovations of existing buildings. Bonnarens (2013) states that about 57% of renovations are major renovations, for which these EE requirements count. The following building activities to existing buildings are subject to these requirements[2]: • Construction of new buildings[3]; • Renovations in the framework or building activities which need a building permit (or which need to be reported); • The building permit or report concerning buildings which are heated or cooled for people. Each two years the requirements are made more stringent. The current requirements postulate: • A maximum energy value or E-value[4] (Dutch E-peil) for the living units. Currently this value is E70. This value is revised regularly – it was tightened in 2012 and will be tightened in 2014. • A maximum K-value[5] for the entire building.	EPBD (2010)

[2] The following activities are excluded from building requirements:

- Building activities with regard to electricity, heating and insulation
- Replacement of windows

Source: VEA (2013d)

[3] New buildings are the main target group of these building code requirements. The fact that new buildings all have to comply with relatively stringent EE norms makes these materials and techniques more common, used and well-known.

[4] The E-value indicates the overall energy performance of a building, including appliances heating, cooling, lighting and other fixed installations (VEA, 2013e).

[5] The K-level indicates the overall thermal conductivity of a building. The lower the K-level, the less heat is lost (VEA, 2013b).

	• Maximum U-values or minimum R-values[6] for partition structures and components of the building shell • Minimum requirements for ventilation • Maximal net energy need of 70 kWh/m² Also these energy requirements apply for social housing. Social housing projects even have to anticipate on the more ambitious requirements of the next period (Vlaamse minister van leefmilieu natuur en cultuur, 2013). This means that social houses which are built today have to comply with the requirements which apply in 2014 (E60 instead of E70).	
Energy-performance requirements in the Flemish housing code	The Flemish housing code formulates a number of health, safety and housing quality norms. In principle, these requirements apply for all houses; in practice they are only enforceable on a wide scale for rental houses and houses for sale (Bonnarens, 2013). From 2013 onwards the housing code also has a section on energy performance requirements (Vlaamse minister van leefmilieu natuur en cultuur, 2013). More specifically, the report on housing quality will also concern roof insulation. From 2015 onwards, a lack of roof insulation will start to have (gradually increasing) consequences. In 2020, a lack of roof insulation will be enough to declare a house unfit for human habitation. The communication and transparency around this policy measure are exemplary for further policy.	/

[6] The U-value is the heat transfer coefficient and R-value is the thermal resistance of specific construction parts (VEA, 2013b). The lower the U-value, the lower the heat loss. The lower the R-value, the higher the heat loss.

Appendix II: Elaborate description of articles of EED relevant to EE in existing residential buildings

Energy efficiency targets (Article 3)

Article 3 of the EED (European Parliament and European Council, 2012) begins with the following (p.12): "Each Member State shall set an indicative national energy efficiency target […]." When setting this target, MSs must take into account the EU's overall energy consumption target and national circumstances. The Commission will assess whether the sum of these targets is enough to achieve the EU's overall target. The deadline to submit this target is 30 April 2013.

Building renovation (Article 4)

Article 4 of the EED (European Parliament and European Council, 2012, p.13) reads as follows. "Member States shall establish a long-term strategy for mobilizing investment in the renovation of the national stock of residential and commercial buildings, both public and private."

In order to craft this strategy MSs must

- make a status quo of the national building stock
- identify cost-effective approaches for (deep thermal) renovations

This will result in

- "policies and measures to stimulate cost-effective deep renovations of buildings, including staged deep renovations" (p.13)
- "a forward looking perspective to guide investment decisions of individuals" (p.13).

Lastly, MSs must estimate the expected energy savings resulting from this strategy. The deadline to submit this strategy is 30 April 2014. Experts designated this article as one of the key measures of the EED.

Energy efficiency obligation schemes (Article 7)

Each MS has to set up an energy efficiency obligation (EEO) scheme. Such a scheme forces energy distributors or energy retailers to achieve energy savings with their final customers by implementing EE measures. MSs must impose on these companies a cumulative end-use energy savings target by the end of 2020. "That target shall be at least equivalent to achieving new savings each year from 1 January 2014 to 31 December 2020 of 1.5% of the annual energy sales to final customers" (European Parliament and European Council, 2012, p.15). This annual target of 1.5% is weakened by a number of loopholes to 1.1% annually (Euractiv, 2012). These loopholes allow the MSs to include energy savings in other sectors (ETS-sectors and energy transformation sector) and other time periods to be regarded for the target of 1.5%.

The EED also stipulates the requirement of a control and verification scheme. Obliged parties must report once a year on the achieved energy savings. MSs may also opt to take policy measures of their own which result in cumulative energy savings of 1.1% annually.

This idea was introduced in the Energy end-use efficiency and energy services directive (Directive 2006/32/EC). The measure was not compulsory, though. At that time, there were already EEOs imposed on the energy distributors in Flanders. These are still in place today (cf. supra).

Energy audits and energy management systems (Article 8)

The EED further states the following in article 8 (European Parliament and European Council, 2012, p.17): "Member States shall promote the availability to all final customers of high quality energy audits which are cost-effective and carried out in an independent manner by qualified and/or accredited experts according to qualification criteria." The audits must comply with transparent and non-discriminatory minimum criteria. MSs must also "develop programmes to raise awareness among households about the benefits of such audits through appropriate advice services" (p. 17). Lastly, the EED suggests promotion of the implementation of recommendations from these energy audits with appropriate policy measures.

Metering (Article 9)

Article 9 of the EED (European Parliament and European Council, 2012) repeats a requirement from Directive 2006/32/EC to provide competitively-priced individual meters for energy "in so far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings" (p.18). Moreover, multi-apartment buildings must have individual meters in place as often as possible.

The EED makes further determinations for the playing field for smart meters. The implementation of smart meters was required by Directives 2009/72/EC and 2009/73/EC, if assessed economically reasonable and cost-effective. With regard to these smart meters, the EED lays down requirements regarding security and privacy, the use of the information by the customer or third parties, and potential regarding production of renewable energy. Also, the design of these meters must regard benefits of EE for the consumer.

Billing information (Article 10)

Article 10 provides a number of guidelines regarding energy billing. It partly repeats the requirements of Directive 2006/32/EC that billing information must be accurate and based on actual consumption where technically possible and economically feasible. Also, customers must be able to access complementary information on consumption.

The EED further requires that customers can demand that billing information is made available to an energy service provider (European Parliament and European Council, 2012). Also, the EED contains requirements on electronic billing, the timing and format of bills.

Cost of access to metering and billing information (Article 11)

Article 11 of the EED (European Parliament and European Council, 2012) contains new provisions regarding the costs of metering and billing. Final customers must receive their bills free of charge. Also, customers must have access to consumption data free of charge. Furthermore, the EED states that in multi-apartment buildings, costs for billing must be as low as possible.

Consumer information and empowering programme (Article 12)

Article 12 starts as follows (European Parliament and European Council, 2012, p.19): “Member States shall take appropriate measures to promote and facilitate an efficient use of energy by small energy customers, including domestic customers.” The EED furthermore gives guidelines about these ‘appropriate measures’. Fiscal incentives, access to finance and subsidies, information provision and exemplary projects. Also the EED suggests engaging consumers and consumer organizations in the possible roll-out of smart meters.

Availability of qualification, accreditation and certification schemes (Article 16)

Article 16 of the EED (European Parliament and European Council, 2012, p.23) reads as follows. “Where the Member State considers that the national level of technical competence, objectivity and reliability is insufficient, it shall ensure that, by 1 January 2015, certification and/or accreditation schemes and/or equivalent qualification schemes, including, where necessary, suitable training programmes, become or are available for providers of energy services, energy audits, energy managers and installers of energy-related building elements.” The EED further underlines that such schemes must be transparent and reliable. Therefore, these certification schemes must be made publicly available.

Information and training (Article 17)

Article 17 of the EED (European Parliament and European Council, 2012, p.23) states the following. “Member States shall ensure that information on available energy efficiency mechanisms and financial and legal frameworks is transparent and widely disseminated to all relevant market actors, such as consumers, builders, architects, engineers, environmental and energy auditors and installers of building elements.” Also, the EED states that MSs must provide information to possible financing institutions such as banks. Furthermore, the EED states that MSs must establish appropriate market conditions for market operators to provide adequate and targeted information on EE. Also, consumers must be provided with information on benefits and EE options. Lastly, the European commission shall support EU-wide platforms to exchange best-practices and inform citizens.

Energy Services (Article 18)

Many provisions in the EED are made about the ‘energy service market’ or providers of ‘energy services’. Companies which provide energy services are called ESCOs (Energy Service COmpany). The concept of ESCOs is elaborated in a separate section. Article 18 of the EED explicitly requires MSs to promote the energy service market (and thus ESCOs). The EED requires MSs to provide information on energy service contracts and support measures for energy services. Furthermore, MSs must provide a list of ESCOs and may encourage quality labels. Also, MSs must encourage the use of ESCOs in the public sector.

MSs must further encourage the energy service market by communicating on points of contact where customers can find information on ESCOs. Also, MSs must remove regulatory and non-regulatory barriers for ESCOs and must enable market intermediaries.

Other measures to promote energy efficiency (Article 19)

In Article 19, the EED (European Parliament and European Council, 2012) requires MSs to "evaluate and if necessary take appropriate measures to remove regulatory and non-regulatory barriers to energy efficiency" (p. 24). The EED explicitly emphasizes the importance of the split incentive and multi-family buildings. The EED gives further suggestions about which policy instruments could be used for this goal.

Energy Efficiency National Fund, Financing and Technical Support (Article 20)

In Article 20, the EED proposes a number of ideas about financing the required investments in EE. Page 25 of the EED reads as follows. "Member States shall facilitate the establishment of financing facilities, or use of existing ones, for EE improvement measures to maximise the benefits of multiple streams of financing." The commission must assist MSs in setting up financing facilities and technical support schemes. The EC must also facilitate the exchange of best practices among MSs.

Furthermore, the EED suggests that member states set up an Energy Efficiency National Fund which must support national EE initiatives. Several sources could contribute to this fund (e.g. revenues from annual emission allocations). Also energy retailers and distributors could fulfil the requirements of the energy efficiency obligations by contributing to this fund.

Also, in paragraph 50 to 54 the EED suggests the use of funds allocated to EE in the multiannual financial framework, the use of several other European funds and several other European financial institutions and mechanisms.

Lastly, the EED suggests ideas on how these funds could be used. Firstly, public money could be used to trigger private investments. Also, public money could be used to support training and certification programmes.

Appendix III: indicative questions matrix government measures and barriers

Barrier	Question?
Lack of knowledge	Does this measure help decision makers gain knowledge regarding energy use and thermal retrofits?
Imperfect information	Does this measure give consistent information or a complete overview of information? Does this measure provide a reference source to check other information? Makes information more specific, personalized, vivid, simple and available close in time?
Low priority	Makes decision makers see the importance of thermal retrofits (emphasizing benefits etc.)? Makes EE more important in taking building decisions?
Bounded rationality	Helps breaking routine behaviour? Gives concrete decision tools?
Financial barriers	Provides loan? Reveals the cost of the investment?
Hidden costs	Decreases the time needed, the inconvenience etc. throughout the building process?
Split incentive	Gives incentive to landlord to invest? Reveals regular barriers?
Multi-family buildings	Makes the decision process towards thermal retrofits easier in multi-apartment buildings?
Building process	Makes building professionals or architects promote thermal retrofits?
Knowledge and education professionals	Enhances knowledge and skills regarding thermal retrofits of architects, building professionals and financiers? Enhances skills of building professionals about thermal retrofits?
Structure building sector	Stimulates holistic approach in building process? Makes building professional market more transparent?
Energy price distortion	Decreases energy price distortions?
Fragmentation of	Increases coherence between regions, between other policy fields? Decreases

authority	crisscross of incentives?
Discontinuity and lack of transparency	Increases stability and transparency of policy?
Administrative load	Decreases the administrative load?