



# Deliverable D6.1

## Pilot test and improvements

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REFURB

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# Contents

<b>CONTENTS</b> .....	<b>3</b>
<b>SUMMARY</b> .....	<b>6</b>
<b>INTRODUCTION</b> .....	<b>9</b>
<b>1 COUNTRY RESULTS FOCUSGROUPS</b> .....	<b>10</b>
<b>1.1 Denmark</b> .....	<b>10</b>
1.1.1 Introduction to the Danish focus group approach.....	10
1.1.2 Testing the offers and feedback received .....	14
1.1.3 Feedback received from focusgroups .....	18
1.1.4 Changes adapted to compelling offer .....	24
1.1.5 Danish recommendations for further roll-out .....	28
<b>1.2 Belgium - Flanders</b> .....	<b>29</b>
1.2.1 Profile focusgroups .....	29
1.2.2 Main feedback received .....	30
1.2.3 Changes made to compelling offers .....	32
1.2.4 Recommendations for further rollout.....	33
<b>1.3 Slovenia</b> .....	<b>34</b>
1.3.1 Profile focusgroup.....	34
1.3.2 Main feedback received .....	35
1.3.3 Changes made to compelling offer .....	35
1.3.4 Recommendations for further rollout.....	36
<b>1.4 Germany</b> .....	<b>36</b>
1.4.1 Profile focusgroups .....	36
1.4.2 Main feedback received .....	37
1.4.3 Changes made to compelling offer .....	39
1.4.4 Recommendations for further rollout.....	40

**1.5 Netherlands .....41**

1.5.1 Profile of focusgroups ..... 41

1.5.2 Main feedback received ..... 46

1.5.3 Changes made to compelling offers ..... 49

1.5.4 Recommendations for further rollout..... 50

**1.6 Estonia .....50**

1.6.1 Background information ..... 50

1.6.2 Profile of focusgroups and main feedback received ..... 52

1.6.3 Main feedback received ..... 53

1.6.4 Changes made to the compelling offer ..... 54

1.6.5 Recommendations for further rollout..... 54

**ANNEX 1 ..... 55**

**EPC PROOF PILOT DWELLINGS BELGIUM ..... 55**

**ANNEX 2..... 59**

**EPC PROOF PILOT DWELLINGS ESTONIA..... 59**

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## List of tables

Table 1 REFURB Focusgroups.....	6
Table 2 Changes made to REFURB compelling offers .....	7
Table 3 Overview of stakeholder participants in interaction 1 and 2 of the compelling offer in Odense .....	15
Table 4 Overview of stakeholder participants in interaction 1 of the compelling offer in Sonderborg .....	16
Table 5 Overview of participants in online focus group test of importance of gender (YF/EN).....	17
Table 6 Overview of participants in presentation of the first draft of the compelling offer for homeowners (YF/EN).....	17
Table 7 Overview of participants in presentation of the first draft of the compelling offer for homeowners (YF).....	17
Table 8 Feedback per stakeholder on costumer journey, business model and package solutions .....	18
Table 9 Interaction 2 - feedback per stakeholder on costumer journey, business model, package solutions.....	20
Table 10 Interaction 1 - feedback per key (supply) stakeholder .....	22
Table 11 Interaction 1 - interviews with homeowners.....	23
Table 12 Deeper interviews with YF-homeowners.....	24
Table 13 Overview of changes made (only specific comments on the first compelling offer with the two final offers: the in-door climate and the energy package, described in D4.4.....	26
Table 14 The additional input to the three additional nZEB packages .....	27
Table 15 Stakeholders focusgroup Belgium.....	29
Table 16 Main feedback from focusgroup Bostoën .....	30
Table 17 Main feedback from focusgroup Leiedal.....	31
Table 18 Changes made to compelling offers.....	32
Table 19 Stakeholders focusgroups Slovenia .....	34
Table 20 Focusgroup multiapartment buildings segment for Slovenian compelling offer .....	35
Table 21 Profile focusgroup Germany for the compelling offer for affordable housing .....	36
Table 22 Feedback from focusgroup1 for the German compelling offer .....	37
Table 23 Feedback focusgroup2 for the German compelling offer.....	38
Table 24 Changes made to German compelling offers based on the received feedback.....	39
Table 25 Main feedback received on compelling offers.....	48
Table 26 Changes made to Dutch compelling offers .....	49
Table 27 Profile of focusgroups Estonia.....	52
Table 28 Main feedback received focusgroup Estonia .....	53
Table 29 Key figures EPC reports Belgium pilot 1 .....	56
Table 30 Comparison EPC and nZEB- level.....	58
Table 31 Key figures from EPC pilot 1 Estonia .....	60
Table 32 Key figures from EPC Pilot 2 Estonia .....	63

## List of figures

Figure 1 Young Family leaflet – front and back pages.....	11
Figure 2 Empty Nester Family leaflet – front and back pages .....	11
Figure 3 The five Danish nZEB solutions/compelling offers .....	12
Figure 4 Compelling offer value creation and cost-benefit calculation for homeowners in rural areas.....	13
Figure 5 Storytelling in magazines and newspapers are key – photo-credit is given to Bolius.....	28
Figure 6 Pictures of focusgroup Camminghaburen.....	44
Figure 7 Pictures focusgroup Aldlân .....	45
Figure 8 Pilot 2 dwelling Estonia before renovation .....	65
Figure 9 Pilot 2 dwelling Estonia after renovation.....	66

## Summary

Deep renovations of the residential sectors buildings towards Nearly Zero Energy Buildings (nZEB) is lagging behind the European political ambitions for energy renovation. The overall REFURB project focuses on bringing forward solutions to solve the complex interplay between the supply side and the demand side of an NZEB renovation and bring forward “an offer one cannot refuse”, solutions targeting the residential sector.

The REFURB consortium has carried out focusgroups to create, test and improve the compelling offers for deep energy renovation (see D4.4). The compelling offers are targeted to a certain segment. Table 1 gives an overview of the target segments per REFURB country.

*Table 1 REFURB Focusgroups*

<b>REFURB country</b>	<b>Segment(s) to be targeted with compelling offer(s)</b>	<b>Examples of stakeholders in focusgroups (non- exhaustive list)</b>
Denmark	Young families (YF) Empty Nesters (EN)	Homeowners Building companies Contractors Installers Non- profit organisations Banks/ financial institutions
Netherlands	Young families (YF) Empty Nesters (EN)	Homeowners Building companies Contractors Installers Municipality Independent intermediaries
Belgium	Young families (YF) Empty nesters (EN)	Homeowners Local governments Building firms Architects Umbrella organisations for the building sector Research institutions
Slovenia	Residents multi apartments	Homeowners/ tenants Contractors Building firms
Estonia	Residents multi apartments	Homeowners/ tenants Organisation representing tenants Market players such as: Construction companies, real estate agencies, designers, architects, technical consultants
Germany	Affordable housing companies and their tenants	Representatives of cooperative and municipal housing companies Architects/ structural engineers

During the focusgroups meetings, main feedback was gathered from the relevant stakeholders. Table 1 gives an impression of the composition of the focusgroups, with examples stakeholders for each of the REFURB countries.

Each REFURB country made one or more changes to their REFURB compelling based on feedback received. A concise overview of the main changes per country is shown in Table 2. (see table 2. Changes made to compelling offers).

Table 2 Changes made to REFURB compelling offers

	Communication	Segmentation	Uptake compelling offer	Single point of contact	Technical aspects	Financial solutions
Denmark	<p>Naming compelling offers adjusted to address male/ female values</p> <p>Differentiate in communication channels YF and EN</p>		Differentiate compelling offer, from 2 to 5			
Belgium	<p>Address soft benefits of renovation to homeowner</p> <p>Better communication material</p> <p>Local/ regional government to create new leads</p>	Enlarge scope on segments	Lobby on compatibility compelling offer and new neighbourhood subsidy scheme	<p>Specialized profile of energy coach</p> <p>Clarify risks and responsibilities energy coach versus homeowners</p> <p>Broaden scope of energy coach; concept also available for others to use</p>	<p>Extension module can act as temporary living space</p> <p>Fine- tune pool of contractors</p>	Unburden homeowner also in financial solutions
Germany					<p>German Housing Association to host online for complex portfolio decisions</p> <p>District solutions overseen by consultant are promising</p>	
Netherlands						<p>Changes in funding compelling offer #3</p> <p>Improvements to ensure solid financial solutions compelling offer #1 and #2.</p>
Estonia				Institutionalize role of renovation advisor: oversees tendering process and provides QA	<p>Add requirements for ventilation</p> <p>Adjust calculations on energy performance buildings specifically aiming nZEB level</p>	
Slovenia					Homeowners are offered quality contractors	Better communication materials

Lastly, all REFURB country formulated recommendations for further development and market uptake of their compelling offers based on feedback received within the focusgroups. These recommendations can be used for the rollout within REFURB, in task 6.2 and deliverable 6.2 rollout plan.

This report, Deliverable 6.1, offers an evaluation report of the results of REFURB focusgroup meetings and addresses the following information per REFURB country:

- Profile of the focusgroup;
- Main feedback received;
- Changes made to the compelling offers;
- Recommendations for further development.

Deliverable 6.1 was coupled with Task 4.3 “Develop specific renovation packages” with the aim of achieving real-time testing of the acceptability of the compelling offers and, where needed, adapting their content based on feedback received. The compelling offers are described in full in Deliverable 4.4. In addition, for some dwellings, the before and after energy performance was validated by an independent EPC expert. Belgium and Estonia have both provided such EPC proof for a few of their pilot dwellings. A comparison was made between the energy performance as regarded in the EPC certificate and nZEB level.



# Introduction

Deep renovations of the residential sectors buildings towards Nearly Zero Energy Buildings (nZEB) is lagging behind the European political ambitions for energy renovation. The overall REFURB project focuses on bringing forward solutions to solve the complex interplay between the supply side and the demand side of a nZEB renovation and bring forward “an offer one cannot refuse” solutions targeting the residential sector.

Work package 6 is set up to test and ensure further rollout and transferability of the compelling offers designed within the REFURB project. WP6 consists of the following tasks, where this report is the deliverable for Task 6.1 on pilot testing and improvements:

- **Task 6.1: Pilot test and improvements**
- Task 6.2: Rollout plan
- Task 6.3: Analyse the transferability of the project’s results – transferability plan

Each compelling offer was designed to target a certain market segment, for example young families, empty nesters or residents from multi apartments. The REFURB consortium has carried out focusgroups to create, test and improve the compelling offers for deep energy renovation for their target segment(s). The focusgroups consisted of relevant stakeholders, matching the selected segments.

During the focusgroups meetings, the main feedback was gathered from the relevant stakeholders. If needed, the compelling offers were adapted based on feedback received. In addition, with the feedback received some recommendations for further development and market uptake of the compelling offers were compiled. Lastly, for some dwellings, the before and after energy performance was validated by an independent EPC expert. The energy performance afterwards was related to nZEB level. Belgium and Estonia have both provided such EPC proof for a few pilot dwellings.

Task 6.1 was coupled with Task 4.3 “Develop specific renovation packages” with the aim of achieving real-time testing of the acceptability of the compelling offers and, where needed, adapting their content based on feedback received. The REFURB compelling offers are described in full in Deliverable 4.4.

# 1 Country results focusgroups

Each of the REFURB countries has commented on the following aspects regarding the REFURB focusgroups. These are described in this section:

- General profile of the focusgroup(s)
- Most important feedback received
- Changes made to the compelling offers
- Recommendations regarding further rollout

## 1.1 DENMARK

### 1.1.1 Introduction to the Danish focus group approach

For Denmark, meetings with both the supply side and the demand side have taken place, to test the Danish compelling offer, in the preliminary draft version (spring 2017) and the definitive version (autumn 2017).

The first iteration (draft) compelling Danish offers were

- Targeted young-families (YF), focused on the indoor-climate and health issues
- Targeted empty nester families (EN), focused on energy savings and comfort

A leaflet introduction to both offers were created to enable discussions with the target segment and the associated stakeholders. See Figure 1 and 2 for the visual impression of the front and back pages of the leaflets, which were created in folded A5-format.

Promoting value creation of indoor-climate and package solutions in a get-it-done-in-one-step-approach. Providing also examples of the cost of finance (Figure 1).

Promoting value creation of a comfortable life and package solutions in a step-by-step approach. Providing also examples of the cost of finance (Figure 2).

### PAKKELØSNINGER TIL UNGE FAMILIER

	Pakke 1	Pakke 2	Pakke 3	Pakke 4
Udvælgelse	✓	✓	✓	✓
Byghøjder**	✓	✓	✓	✓
Isolering af fundament	✓	✓	✓	✓
Isolering af krybekælder***	✓	✓	✓	✓
Tagisolering	✓	✓	✓	✓
Bentvanguliv****	✓	✓	✓	✓
Varmepumpe med udstødsleder	✓	✓	✓	✓
Solceller (10 m <sup>2</sup> )	✓	✓	✓	✓
Vindstener	✓	✓	✓	✓
Søfanger (2,4 m <sup>3</sup> )	✓	✓	✓	✓

Energieffektivitet i forhold til almindelige: 45% 55% 75% 85%  
 Investeringstilskud, bl.a. energitilskud og håndværkerfradrag: kr 200.000 kr 200.000 kr 500.000 kr 600.000  
 Prisniveau ved 20 års driftsforventning udgjort af løst: kr 899 / m<sup>2</sup> kr 1.261 / m<sup>2</sup> kr 2.122 / m<sup>2</sup> kr 2.661 / m<sup>2</sup>

\* værdier for gennemsnitlige bygninger  
 \*\* standard byggeplan  
 \*\*\* med isolering  
 \*\*\*\* med isolering og vand til håndværkerfradrag af oplysnings, håndværker og energitilskud.

✓ isolering samt forbehold af tekniske væsentlige forhold  
 ✓ isolering

Udbydere for fjernvarmeområde

TRIVSEL  
 TRYGHED  
 PLADS TIL AKTIVITET  
 PAKKELØSNING

ØNSKER I MERE TID TIL FAMILIEN?  
 Ved at vælge en pakkeløsning får I renoveret færdig bolig og kan bruge tiden på familien.

Udbydere for fjernvarmeområde

Figure 1 Young Family leaflet – front and back pages

### TRIN FOR TRIN PAKKELØSNINGER

	Trin 1	Trin 2	Trin 3	Trin 4
Udvælgelse	✓	✓	✓	✓
Byghøjder**	✓	✓	✓	✓
Isolering af fundament	✓	✓	✓	✓
Isolering af krybekælder***	✓	✓	✓	✓
Tagisolering	✓	✓	✓	✓
Bentvanguliv****	✓	✓	✓	✓
Varmepumpe	✓	✓	✓	✓
Solceller (10 m <sup>2</sup> )	✓	✓	✓	✓
Vindstener	✓	✓	✓	✓
Søfanger (2,4 m <sup>3</sup> )	✓	✓	✓	✓

Energieffektivitet i forhold til almindelige: 45% 55% 75% 85%  
 Investeringstilskud, bl.a. energitilskud og håndværkerfradrag: kr 200.000 kr 100.000 kr 250.000 kr 600.000  
 Prisniveau ved 20 års driftsforventning udgjort af løst: kr 899 / m<sup>2</sup> kr 425 / m<sup>2</sup> kr 615 / m<sup>2</sup> kr 583 / m<sup>2</sup>

\* værdier for gennemsnitlige bygninger  
 \*\* standard byggeplan  
 \*\*\* med isolering  
 \*\*\*\* med isolering og vand til håndværkerfradrag af oplysnings, håndværker og energitilskud.

✓ isolering samt forbehold af tekniske væsentlige forhold  
 ✓ isolering

Udbydere for fjernvarmeområde

TRYGHED  
 KOMFORT  
 KLIMARIGTIGT  
 NEMT AT KOMME I GANG

ØNSKER DU AT NYDE LIVET MERE KOMFORTABELT?  
 Renover dit hus og slip for vedligehold.

Udbydere for fjernvarmeområde

Figure 2 Empty Nester Family leaflet – front and back pages

After testing these initial draft offers, based on the feedback, it was concluded that more specific packages (including pricing) and variants for complete packages targeting urban (district heating) and rural areas (with heat pumps) should be generated. The urban/rural-area separation to reflect that app. 66% of the Danish private homes are in areas supplied with district heating and app 34% of the homes being located outside district heating, enabling heat pumps to be the long-term solution.

Five nZEB solutions (see Figure 3) were created based on all-in-one solution/approach, including an a-la-carte offer enabling the homeowner to demand a more specific tailor-made solution, still within the scope of compelling offers. The all-in-one approach was generally adapted to secure a robust offer and installation and as very few (EN) home-owners confirmed the need for a step-by-step approach.



**CHOOSE THE OFFER THAT FITS YOU**

1. START-UP	2. INDOOR CLIMATE	3. ENERGY	4. COMFORT	5. A LA CARTE
Target group: Young families + Empty nesters	Target group: Young families	Target group: Empty nesters	Target group: Empty nesters	Target group: Young families + Empty nesters
Investment up to <b>€ 12.000</b> (No central heating)	Investment up to <b>€ 33.333</b> (No central heating)	Investment up to <b>€ 56.000</b> (No central heating)	Investment up to <b>€ 66.666</b> (No central heating)	Investment up to <b>no limits</b> (No central heating)
Save 15% on your energy bill - Pick the low-hanging fruits	Save 30% on your energy bill - Get better indoor climate	Save 70% on your energy bill - Get better indoor climate - Get a healthier home	Save 80% on your energy bill - Get better indoor climate - Get a healthier home - Produce your own energy	Save 80% on your energy bill - Get a healthy and environmentally friendly home - Get a safe home

Figure 3 The five Danish nZEB solutions/compelling offers

AAU Aalborg University created the technical solutions based on a step-by-step sequence of measures leading to the solution.

The sequence was determined/ranked by most energy-savings per invested EURO – per measure. The sequence was later challenged by the real-world experience of Sonderborg’s Charlie-coach leading to the five compelling offers described in the scheme.

Each set of packages address both Young families and Empty nesters by their value statement.

The INDOOR-CLIMATE package (package 2) mainly addressing the young families and the ENERGY (package 3) and COMFORT (package 4) are mainly targeted the Empty nester families. The START-UP (package 1) and the A-LA-CARTE (package 5) targeted both segments.

The detailed AAU studies of the cost/benefit of each offer is reflected in the below (Figure 4) table, showing the calculations for rural areas in Denmark. The table also reflects how the EPC will improve when implementing the offer.


OFFERS WITHOUT DISTRICT HEATING	Get started 	Indoor-climate 	Save Energy 	Comfort 	À la carte 
LED light*	✓	✓	✓	✓	Free choice between all offers step by step
Pipe-insulation	✓	✓	✓	✓	
Circulationpump	✓	✓	✓	✓	
Radiator thermostats	✓	✓	✓	✓	
Roof insulation	✓	✓	✓	✓	
Wall insulation	✓	✓	✓	✓	
New windows**		✓	✓	✓	
Mechanical ventilation		✓	✓	✓	
Insulation of crawl space floor***		✓	✓	✓	
HP-heat + water 6 kW integrated storage			✓ 	✓	
Insulation of ground floor - standard finish****				✓	
18 m <sup>2</sup> PV				✓	
Control of heatsource				✓	

\* LED light is calculated with investment and subsidy only and not energy savings

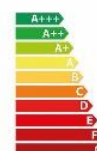
\*\* Applies for ordinary double-layer windows

\*\*\* Exclusive new floor price

\*\*\*\* Low price floor

 = Improved architectural value

Energy saving in a home with energy demands of 300 kWh/m <sup>2</sup> /year	Up til 15%	Up til 30%	Up til 70%	Up til 80%
EPC before renovation	G	G	G	G
EPC after renovation	F	F	C	B
Investment in EURO	7.403	29.183	51.943	62.370
Electronics (radio, tv etc)	1.333	1.333	1.333	1.333
Whitegoods (washing machine, dryer etc.)	2.893	2.893	2.893	2.893
<b>Total investment in EURO</b>	<b>11.629</b>	<b>33.409</b>	<b>56.169</b>	<b>66.596</b>



CALCULATIONS MADE BY AALBORG UNIVERSITY DURING THE REFURB PROJECT WWW.CO-REFURB.EU

THESE SAVINGS CAN ONLY BE ACHIEVED BY CORRECT ENERGY BEHAVIOUR

Figure 4 Compelling offer value creation and cost-benefit calculation for homeowners in rural areas

The investments in the five packages are estimated within the range €12,000 – €67,000. Two packages, the “start-up” package and the “indoor-climate” package provide energy savings of 15-30 % (shallow refurbishment), where the “energy” package, the “comfort” package and the “a la carte” give energy savings between 70-80 % (deep energy refurbishment).

All five Danish nZEB packages are included in the REFURB Deliverable D4.4 “Constituting the Compelling offers” Report. However only two have been described in detail, these are:

- **The indoor-climate package** – targeted the YF Young Families segment
- **The save-energy package** – targeted the EN Empty Nest families

The choice of offers therefore also reflect a continuity and focus loyalty towards the selected segments from the initial iteration until the final offers.

### 1.1.2 Testing the offers and feedback received

#### Supply side testing:

As mentioned above, the initial versions of the compelling offers were draft compelling offers focused on a package solution for young families and a draft compelling offer with a step-by-step approach for empty nester families.

The initial version was tested at two meetings with stakeholders in two localities, Odense and Sonderborg. The final five compelling offers were tested at a final meeting with the supply side – also in Odense.

- The initial draft compelling offers were presented and comments from the participants were received. The meeting was facilitated by CLEAN (joined by AAU and ZERO) and held with 12 stakeholders related to the private-public partnership Green Business Growth in CLEAN. The meeting was held in Odense.
- At the second meeting, the five final compelling solutions were presented, and comments were received. The meeting was facilitated by CLEAN (joined by AAU and ZERO) and held with 14 stakeholders related to the private-public partnership Green Business Growth in CLEAN. The meeting was held in Odense.
- A parallel supply-side focus group meeting was organized in Sonderborg, facilitated by ZERO. The group of three participants were all stakeholders already engaged in the ProjectZero ZEROhome program, including an energy advisor, a local bank, and a real estate agent. The focus group tested/discussed the initial draft versions of the compelling offers.

#### SUPPLY SIDE PILOT TEST PARTICIPANTS

In Tables 3-7 an overview of stakeholder participants in the pilot testing are shown. The Danish compelling offer has changed from 2 compelling offers, one to YF and one to EN, to the definitive version including 5 nZEB-packages for comfort and health designed for both young families and empty nester – out of which two have been described in detail and included in the REFURB D4.4 Report. The focus during the interactions/meetings were young families, because it was considered most challenging to motivate young families to carry out energy refurbishment. The young families are most challenged by lack of financing and other family priorities.

Table 3 Overview of stakeholder participants in interaction 1 and 2 of the compelling offer in Odense

SUPPLY SIDE	First pilot test of two compelling offers for either YF or EN  12 stakeholders (the supply side)	Second pilot test of one compelling offer with 5 nZEB packages for both YF and EN  14 stakeholders (the supply side)
Date/Place:	6. April 2017, Odense	18. September 2017, Odense
Banks	Middelfart Sparekasse, Kim Jensen, responsible for homeowner dwellings	Middelfart Sparekasse, Kim Jensen Broager Sparekasse, Morten Vestergaard Merkur Bank, Jesper Kroman
Building firms	ISOVER, Saint Gobain, Peter Hedegaard (producer of insulation products and windows)	ISOVER, Saint Gobain, Peter Hedegaard
Contractors	Ole Larsen & sønner by Anders Larsen (Carpenter, Energy craftsman and BetterHousing Adviser)	
	Rask og Rum by Ebbe Bernth (insulator, contractor and BetterHousing Adviser)	Rask og Rum by Ebbe Bernth (insulator, contractor and BetterHousing Adviser)
	Isoleringsgruppen by Torben Poulsen (insulator, energy craftsman and Better Housing Adviser)	
	Skovhavens VVS by Michael Sarma (installations, energy craftsmen and Better Housing Adviser)	Skovhavens VVS by Michael Sarma (installations, energy craftsmen and Better Housing Adviser)
Energy consultants	Keen Energirådgivning by Keen Nielsen (Energy consulting and Better Housing Adviser)	Keen Energirådgivning by Keen Nielsen (Energy consulting and Better Housing Adviser)  BetterHousing Advising, PeterDallerup
Energy companies		District Heating Funen, Dorthe Hindsgavl
Municipality		The Municipality of Middelfart
Industry organisation		Arbejdsgiverne by Carsten Essler Helmer
Real estate	Nybolig by Jacob Lyngfeldt	Nybolig by Jacob Lyngfeldt
Facilitator/presenter	CLEAN by chief project manager,	CLEAN by chief project manager,



	Lotte Lindgaard Andersen	Lotte Lindgaard Andersen
Facilitator/résumé	CLEAN by communication consultant Rikke Schak Toustrup-Jensen	
Presenter	University of Aalborg by Michal Pomianowski	University of Aalborg, Professor Per Heiselberg, Yovko Ivanov Antonov
Presenter	ProjectZero by director Peter Rathje	ProjectZero by director Peter Rathje

*Table 4 Overview of stakeholder participants in interaction 1 of the compelling offer in Sonderborg*

<b>SUPPLY SIDE</b>	<b>Supporting interviews in Sonderborg</b>
<b>STAKEHOLDERS</b>	<b>3 other key stakeholders</b>
<b>Interaction 1</b>	Two key stakeholders (bank and realtor) were interviewed to create a more holistic picture of the young family's decision making.
Date/Place:	March 2017/Sonderborg
Bank (name)	Broager Sparekasse, Pernille Beck (marketing communication)
Realtor (name)	Home, Sonderborg Merete Lund Brock (owner)
Energy advisor	Charlie Energy Charlie Lemtorp (owner)

#### **Homeowner side:**

Comprehensive interactions with the homeowner segment (young families and empty nesters) took place in Sonderborg during spring 2017. The interactions included:

- (1) Testing different response-profiles for male and female homeowner decision makers, using Facebook and differentiated language and images – hundreds of homeowners were exposed and 50+ responded positive and were invited for a free energy check. February 2017 in Sonderborg.
- (2) Interviews with 14 young families and 9 empty nester families were made during a homeowner fair in Sonderborg in March 2017.
- (3) Deeper interview/discussions with 8 young families (in their homes) were conducted by four sociologist and anthropologist students from Copenhagen University, combined with interviews with two key stakeholders (bank, real estate agent).



**DEMAND SIDE PILOT TEST PARTICIPANTS**
*Table 5 Overview of participants in online focus group test of importance of gender (YF/EN)*

<b>DEMAND SIDE</b> Interaction 1	Invitation to free energy checks 20 male respondents	Invitation to free energy checks 20 female respondents
Date/Place:	February 2017, Sonderborg	February 2017, Sonderborg
Stakeholders	Male home-owners addressed using Facebook advertising, male language/values and pictures.	Female home-owners addressed using Facebook advertising, female language/values and pictures.

*Table 6 Overview of participants in presentation of the first draft of the compelling offer for homeowners (YF/EN)*

<b>DEMAND SIDE</b> Interaction 2	<b>Presentation of the first draft to a compelling offer</b> <b>14 Young families</b>	<b>Presentation of the first draft to a compelling offer</b> <b>9 Empty nester families</b>
Date/Place:	4.- 5. March 2017, Sonderborg	4. – 5. March 2017, Sonderborg
Stakeholders	14 young families were interviewed at a homeowner exhibition fair in the outskirts of Sonderborg.  The interviews were based on presentation of the initial draft to a compelling offer – see above YF leaflet.	9 empty nester families were interviewed at a homeowner exhibition fair in the outskirts of Sonderborg.  The interviews were based on presentation of the initial draft to a compelling offer – see above EN leaflet.

*Table 7 Overview of participants in presentation of the first draft of the compelling offer for homeowners (YF)*

<b>DEMAND SIDE</b> Interaction 3	<b>Deeper interviews</b> <b>8 young families</b>
Date/Place:	11. March 2017/Sonderborg
Stakeholders	8 young families were visited and interviewed in their respective homes. They all have recently bought a new house/home or were planning in near future to move to a new house/home.

### 1.1.3 Feedback received from focusgroups

A concise description of the main feedback received from the focus group(s) is presented below. The feedback is given per stakeholders and topic.

#### SUPPLY SIDE: Stakeholders related to CLEAN Green Business Growth

##### Interaction 1

Presentation of the first draft to a compelling offer in Odense, April 2017, facilitated by CLEAN. The initial draft to a Danish compelling offer focused on an in-door climate compelling offer for YF and an energy reducing compelling offer for EN – for more details see above description of the leaflets.

The final compelling offer had five nZEB packages focused on comfort and health for both YF and EN. The focus on the meetings were the young families, because it is most challenging to motivate young families to carry out energy refurbishment. The young families are most challenged by lack of financing and other family priorities.

Agenda:

1. The purpose of the REFURB project
2. Presentation of each stakeholder and why energy refurbishment is important to you
3. The REFURB customer journey
4. The REFURB Business model
5. The REFURB Package solution
6. Conclusion – sum up – what to improve in the compelling offer

A template for facilitating the meeting was constructed before the meeting with special focus on getting input from the stakeholders on the REFURB concepts for customer journey, business model and package solutions. In the table below is presented the feedback per stakeholder and below the Table 8 a conclusion is presented.

*Table 8 Feedback per stakeholder on customer journey, business model and package solutions*

Debate questions	Customer Journey <i>Where are homeowners dropping out?  What do you do to keep homeowners on the track?</i>	Business Model <i>What do you do to sell?  Is the business model and a common secretary interesting?  Which economy structure is needed for keeping it interesting?</i>	Compelling offer <i>What do you think about the compelling offers with a package for YF and stepwise refurbishment for empty nesters? Which packages do your customers prefer?</i>
Banks	Economy is crucial for young families. They don't think energy. YF sometimes drop out because the total refurbishment budget frightens them. The bank advisers must be able to talk with homeowners about soft		The compelling offer with a number of packages are a good tool, to give homeowners an overview. Carefully consider the wording when promising a certain % of energy saving. Need for lifetime solutions.

	values to keep them on the track.		
Contractors	<p>In general, homeowners have more trust in local contractors (craftsmen) than advisers. Young families are very aware of what the house can be sold for if they invest in energy refurbishment. Therefore, the value of the energy label after refurbishment is an important argument.</p> <p>Important to split the offer, so the homeowners can choose and prioritize, and compose their own personal package</p> <p>Important to follow up on the offer within 2-3 days. Get a personal meeting with the homeowner to build trust.</p> <p>Use of subsidies and reduction on the tax bill are important to sell the small technical installations.</p>	<p>Social media can be used as a powerful platform for communication and selling. Share your positive experience online. A cooperation between different kinds of contractors, and a neighbour recommendation gives an extra sale.</p>	<p>Homeowners get critical, when they see prices on an offer. Important also to make a “A la carte” compelling offer, where homeowners compose the content in their own package.</p> <p>Do not include loan costs into the offer, - they depend on individual credit worthiness. Subsidies and reduction on the tax should be eliminated, - it can be different next year. Stop – go – policy.</p> <p>Indoor climate, health, comfort and less maintenance are the most important factor for YF.</p> <p>It is a huge task to explain that the energy reduction is depending on behaviour. It is possible to get a 5 % discount if 5-10 homeowners go together in a common tender.</p>
Building firms			<p>Good idea to include the value of the energy label in the compelling offers packages</p> <p>Façade solutions do not have a long lifetime, as they do not last 50-100 years, Solutions must relate to the fact, that families live an average 19 years in their house (can be used more).</p>
Real Estate	<p>We are the salesman, so we are talking as little as possible about potential energy refurbishment, because it might ruin our chance of selling the house.</p>		<p>We are not allowed to give the buyers advise, just ideas. Interesting to know about the energy savings. I have not sold houses with mechanical ventilation</p>
Energy consultants		<p>No money in energy advising. The energy consultants experience that homeowners will not pay for it.</p>	<p>The bank should demand a Better Housing Plan (long term energy investment plan) to give a favourable energy loan.</p> <p>Do not make it too complicated</p>

Between interaction 1 and 2 with the stakeholders (related to CLEAN Green Business Growth - from the supply side), the compelling offers have been adjusted and meetings with national building associations have taken place.

The agenda for interaction 2 - the second focus group meeting was:

1. Purpose of the project. Are the building and bank sector ready? What do the other partners from the building industry think is necessary to push the demand for deep energy renovation?
2. Energy check-ups as a condition for energy loan and a driver for Energy refurbishment
3. What does the revised compelling offer look like and why is it attractive?
4. What is needed to roll-out the REFURB model and point out a consortium?  
Perspectives in relation to the coming national energy settlement.

### SUPPLY SIDE: Interaction 2

Presentation of the revised final version, September 2017, of the five nZEB packages (including the two described compelling offers) in Odense, facilitated by CLEAN. The five nZEB packages for comfort, including the two compelling offers, focused on young families and empty nester were presented to stakeholders from the supply side. See Table 9.

*Table 9 Interaction 2 - feedback per stakeholder on customer journey, business model, package solutions*

Stakeholders	Business model	nZEB package solutions	Roll out of the REFURB model?
	<p><i>Is the building and bank sector ready?</i></p> <p><i>Can energy check be a condition for attractive energy loans?</i></p>	<p><i>What is changed and why is the revised package solutions now attractive?</i></p>	<p><i>What is needed to roll-out the REFURB model and make a consortium successful?</i></p>
Facilitator (CLEAN, AAU; PZ)	<p>The frame condition for energy refurbishment need to be improved in the national energy settlement, spring 2018</p> <ul style="list-style-type: none"> <li>- Use of energy label must be strengthened</li> <li>- Give municipalities the obligation to make energy saving plan for the private segment including practical organisation</li> <li>- Special mortgage loans for deep energy renovation</li> <li>- Bank sector shall have the possibility to demand an energy investment plan to give an attractive energy loan</li> <li>- Homeowners need to be awarded for a good energy standard</li> <li>- Keep the subsidies that</li> </ul>	<p>Updated packages to young families and empty nesters, where there is a window of opportunity. The message for both is "easy, safe and simple".</p> <p>Specific for YF: Room for activities, health, time, comfort. Value security. Package solutions dedicated to YF: start package, indoor package and a la carte package. Important especially for the YF to offer an energy coach.</p> <p>For EN: Comfort, Less maintenance, safety, energy. Package solutions dedicated to EN: energy solutions, comfort, a la carte.</p> <p>The gender is also important: Women: talk home/feelings Men: talk technic /house</p> <p>The compelling offers are composed so the low hanging fruits with the highest value for</p>	<p>It must be possible to lower the prices (cost) on the compelling offers if there are more houses on the same road. A commercial building consortium can hopefully benefit from the coming Danish national energy agreement renegotiated in spring 2018. However it is still very uncertain if energy efficiency will be supported by subsidies and improved taxes/frame conditions. In worst case all support will be on green energy supply.</p> <p>The municipalities need to play a bigger role in</p>

	allow to sell energy saving and withdraw expenses on the tax -bill.	money are chosen first. We need to change the way of communication too: Less maintenance and more comfort with energy advantages.	information and motivation for energy refurbishment in the first part of the costumer journey.
Banks	Interest-rate at 2,75% (Broager Sparekasse) or 5,75 % (Middelfart Sparekasse). Also loan to technically insolvent homeowners, as the amount of money to use is the determining factor for proving loans.		The financial institutions are an important window. Sell lifestyle/ architecture, by product with energy
Contractors		Homeowners want luxury, comfort and overview with smart gadgets.	
Building companies		The best window for refurbishment is when you buy a house. It is a paradox, that no authority controls if the contractor makes it clear to the homeowner, that there are Building Regulations for insulation (BR15 and BR18 – to come)	
Real Estate (realtor)		We sell on a holistic view on location, state of maintenance, over and under energy label D, necessary future investment.	
Energy Consulting	Crucial that the financial institutions create an interest at the homeowner, the bank is a key – entrance to create more demand for energy refurbishment	It is easier to sell renovation, if the homeowner stay in the house and it is a long-term investment.	Suggest an ESCO model. Green investment fund.
Energy supply			Can the new agreement energy saving be transferred to an operating company?

## SUPPLY SIDE: Interaction 2

Presentation of the first draft to a compelling offer in Sonderborg, facilitated by ProjectZero (see Table 10).

### Agenda:

1. The purpose of the interview
2. Questions
  - How to attract interest from homeowners?
  - Timing of joint intervention?

Table 10 Interaction 1 - feedback per key (supply) stakeholder

Stakeholder	Stakeholder meeting 10. March/Sonderborg	
	Attracting interest	Timing of joint intervention
A representative from a local bank in Sonderborg  Ms. Pernille Beck	The highly promoted and attractive ZEROhome-loan concept have created 250 established loans and been a success for the participating bank.  Important to present saving-data as improved comfort might be difficult to prove.  Facebook is a very powerful communication tool.	
A leading realtor in Sonderborg  Mrs. Merete Lund Brock	Ideal to address the energy retrofit as an opportunity after house-sale is completed	Conflict of interest in the realtor promoting EE before the house is sold.

#### DEMAND SIDE: How to address male and female homeowners

Invitation to join a free energy consultancy were presented using Facebook and addressing male and female homeowners.

Steps:

- Different Facebook advertisements addressing male and female audience were created
- The advertisements were advertised to a selected Facebook male homeowner audience respectively female audience, with a limited number (20+20) energy checks
- There was a visible count-down on the advertisement to stress the target group to sign up fast
- The applicants were contacted and visited by the energy consultants

The learnings from the Facebook advertisement were:

1. Facebook is a strong and fast responding media to contact homeowners
2. Male and female homeowners should be addressed using differentiated messages
3. The effect of these (easy) booked energy-checks were however limited and some homeowners did not even remember that they responded and signed up for an energy-check

**DEMAND SIDE: Interaction 1 to test the first draft of the compelling offer – focus on the communication/marketing materials**

The initial draft REFURB concept renovation brochures for young families and empty nester families were presented to YF and EN families visiting the homeowner exhibition in Hoerup in the outskirts of Sonderborg.

The homeowners were invited to join an interview, where they were asked specific questions about the concept brochures. The below table (Table 11) presents the learnings from the interviews on specific issues.

*Table 11 Interaction 1 - interviews with homeowners*

DEMAND SIDE	Presentation of the first draft to a compelling offer Young families 14 participants	Presentation of the first draft to a compelling offer Empty Nester families 9 participants
Date/Place:	4. – 5. March 2017/Sonderborg	4. – 5. March/Sonderborg
Male/female respondent	21% female, 43% male, 36% couples	56% female, 22% male, 22% couples
Family-type	93% couples, 7% singles	67% couples, 33% singles
Kids at home	79% answered yes	89% answered no
Use of social medias (priority)	Facebook, Instagram, LinkedIn	Facebook, LinkedIn
Use of other medias	Television (40%), Radio (40%), newspapers (20%)	Television (13%), Radio (25%), newspapers (63%)
Most important	Indoor-climate (#1), lower operational cost (#2), more space (#3)	Indoor-climate (#1), lower operational cost (#2), more space (#3)
Other feedback	<ul style="list-style-type: none"> <li>- Step-approach and packages sound good and easy</li> <li>- Images should signal the target group.</li> <li>- Pricing information is important</li> <li>- Brochure should be created for Facebook</li> </ul>	<ul style="list-style-type: none"> <li>- Packages and step-approach is important</li> <li>- Important to see the savings</li> <li>- Images of old people should be replaced by younger people</li> </ul>

**DEMAND SIDE: Interaction 2. Testing the knowledge, values and motives of Young families through deep interviews**

A student research team interviewed 8 families, young families, to understand their knowledge, values and motives for doing energy renovations (see Table 12).

Table 12 Deeper interviews with YF-homeowners

<b>DEMAND SIDE</b>	<b>Young families</b> 8 YF-families
Date/Place:	11. March 2017/Sonderborg
	<p><b>Questionnaire framework:</b></p> <ol style="list-style-type: none"> <li>1. Why did you decide to have the renovation?</li> <li>2. How many renovation projects have you done/are doing?</li> <li>3. Did you do them all at once?</li> <li>4. What were the project(s)?</li> <li>5. How much did it cost?</li> <li>6. Is it completed?</li> <li>7. Do you feel you are now saving money?</li> <li>8. Compare your energy bills before and after renovation.</li> <li>9. Do you feel you are now doing less harm to the environment?</li> <li>10. Do you feel your home is more comfortable?</li> <li>11. How is/was the relationship between the firm and you?</li> <li>12. Who provided the materials?</li> <li>13. What motivated you to get the audit and/or renovation?</li> <li>14. Did you participate actively/hands-on participated in any project?</li> <li>15. Were you more likely to participate in ProjectZero because it was a community/government associated project?</li> <li>16. If you were a customer and this was a business working directly with the contractor, would you still have participated?</li> </ol>
Opinions about energy efficiency	<p>Energy efficiency is not important to young families buying their first home, but it attracts increasing interest when they buy the second home, as they get more experienced.</p> <p>The families lack information about the cost and the payback-time and this kept them away from taking actions.</p> <p>Families are not aware of the environmental impact of their house/home.</p> <p>Aesthetics are important to the families and keep them away from installing solar panels on the roof.</p> <p>Main driver seems to be the opportunity to save money and improve comfort.</p> <p>Important to get the message out to community – focus on using social medias. Avoid using newspapers and traditional websites.</p> <p>Use case-stories from specific families to promote energy efficiency</p>

### 1.1.4 Changes adapted to compelling offer

The feedback from the focus groups of both homeowners and supply side was integrated in the compelling offer.



From the feedback we learned that package solutions are attractive to both homeowners and key stakeholders.

Instead of two packages – one designed for YF and one designed for EN. We learned that there is a need for both more robust and differentiated complete packages for specific target groups but also the possibility to compose the energy investments individually and a step by step approach.

The stakeholders from the supply side pointed out, that one solution does not fit all homeowners and very individual houses. The stakeholders pointed out, that the focus must be on comfort and in-door climate.

Furthermore, the constructors from the supply side noted, that it is very common, that homeowners get an offer from a contractor and when they see the price, they start to cut down the refurbishment, so it fits to their budget. Therefore, the number of packages was changed, so there were both small and big packages, -and the possibility for both a one-stop shop and a step wise approach.

The number of nZEB packages ended up being five:

- A start up-package that fits both YF and EN includes the low hanging fruits,
- an indoor-climate package that primarily addresses YF,
- a comfort package that addresses EN,
- an energy package that addresses EN and
- an “a la carte model”, that can attract both YF and EN, because homeowners can choose freely of the shelves and order what they want.

The packages have changed from only deep-energy refurbishment to include also shallow packages. The nZEB packages now include shallow packages (start-up) with 15% energy reduction and (in door climate package) with 30% energy reduction. Furthermore, deep energy refurbishment (in-door, comfort and a la carte) packages) are included with 70-80% energy reduction.

The order in which the technical measures are grouped into the different compelling offers has changed to a more pragmatic approach. This is in line with the order of implemented renovation measures by homeowners starting their energy costumer journey. For example, insulation from the outside is very cost effective, but in practice, it is not the first measure a homeowner chooses, because it is VERY expensive. The low hanging measures<sup>1</sup> are implemented first. The calculations for the compelling offers have been through many iterations. The compelling offers are composed of:

1. Theoretical energy saving calculation and initial renovation measures development
2. Technical solutions to renovate to nZEB
3. Price calculation of the technical solutions
4. Cost efficiency
5. Final development of group of measures/Steps examples

The two selected and (in REFURB D4.4) described compelling offers have been adjusted and no longer focus on pay-back time and monthly pay at a loan. Instead the focus is mainly on the value-creation: health, comfort, space for activities, time, security, economic value securing through energy refurbishment and a better energy label, good conscience.

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<sup>1</sup> insulation of heating pipes, LED and circulation pump and thermostats, insulation of the cavity wall and the roof

Each compelling offer shows: a total price plus the advantages with energy saving in % and better energy label, because of the feedback received that construction industry would like to stay away from visible price-indications.

Table 13 and 14 provide an overview of the changes made to the compelling offer.

*Table 13 Overview of changes made (only specific comments on the first compelling offer with the two final offers: the in-door climate and the energy package, described in D4.4*

<b>Compelling offer</b>	<b>Description of changes made based on main feedback received from focus group (s)</b>
<p><b>DK#1 - The Indoor-Climate Compelling offer.</b></p> <p><b>Described in the D4.4 Report.</b></p> <p><b>In the final compelling offer described as one of five packages in one compelling offer</b></p>	<p>The naming and the content of the compelling offer is based on feedback received especially from the YF-segment, but we learned that also EN consider indoor-climate important.</p> <p>The indoor-climate is addressing female values such a health, space and security for the family.</p> <p>In this package are included same initial investment as in the start package, see table 16, but also investments in new windows, mechanic ventilation and insulation of the floor.</p> <p>Promotion, using Facebook to reach YF-families combined with case-driven storytelling in traditional newspapers for the EN-segment seems to be efficient ways for step 1-2-3 customer journey communication.</p>
<p><b>DK#2 – The save-energy compelling offer</b></p> <p><b>Described in the D4.4 Report.</b></p> <p><b>In the final compelling offer described as one of five packages in one compelling offer</b></p>	<p>The naming and the content of the compelling offer is based on feedback received especially from the EN-segment. However, this compelling offer will also address the EN-segments strong interest in the comfort improvements.</p> <p>The save-energy compelling offer is addressing male values and important for attracting the male audience. Possibility to measure energy improvements for both energy saving and energy supply. In this package is included the same initial investments as in the start package, see table 12, but also investments in new windows, mechanic ventilation and insulation of the floor, heating pump</p> <p>Promotion, using Facebook combined with case-driven storytelling in traditional newspapers for the EN-segment seems to be efficient ways for step 1-2-3 customer journey communication.</p>

Table 14 The additional input to the three additional nZEB packages

Additional packages	Description
The start-up package	<p>The naming and the content of the compelling offer is based on feedback received from both the EN-and YF segment. The start package is a way to get started in the costumer journey.</p> <p>The start package includes LED, insulation of heating pipes, circulation pumps, thermostats, insulation of the roof and insulation in the cavity wall.</p> <p>Promotion, using Facebook combined with case-driven storytelling in traditional newspapers for the EN-segment seems to be efficient ways for step 1-2-3 customer journey communication</p>
The comfort package	<p>The naming and the content of the compelling offer is based on feedback received especially from the EN-segment. However, this compelling offer will also address the EN-segments strong interest in the comfort improvements.</p> <p>In this package are included the same investment as in the start package, but also investments in new windows, mechanic ventilation and insulation of the floor, heating pump plus insulation of the floor after an improved standard, solar cells and energy management of heating sources.</p> <p>Promotion, using Facebook combined with case-driven storytelling in traditional newspapers for the EN-segment seems to be efficient ways for step 1-2-3 customer journey communication</p>
The a la carte package	<p>The naming and the content of the compelling offer is based on feedback received especially from both the YF and the EN-segment with strong interest in an ambitious plan for indoor, energy and comfort improvements, but also the interest in composing the improvements step- by- step in the homeowner own speed.</p> <p>The comfort and save-energy compelling offer is addressing both female and male values. Possibility to measure energy improvements for both energy saving and energy supply.</p> <p>Promotion, using Facebook combined with case-</p>

	driven storytelling in traditional newspapers for the EN-segment seems to be efficient ways for step 1-2-3 customer journey communication
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### 1.1.5 Danish recommendations for further roll-out

Based on the main feedback received from the focus groups and discussions, the Danish recommendations for further improvement and uptake of the compelling offers are:

- Communication of health (indoor climate), comfort and energy benefits are important to attract attention from homeowners
- Important to communicate that energy refurbishment also means economic value securing of the property. An investment in the house is better than a negative interest in the bank
- Compelling offers help homeowners overview the solutions and its cost/benefits
- Municipalities frontrunners and private/public partnership consortiums should play a strong key role in getting homeowners started with the initial three steps of the customer journey
- The bank and the real-estate agent play important roles along the customer journey
- Challenges remains with creating a business case for a building consortium among local stakeholders and building suppliers
- Energy savings need same attention as green energy – they are often cheaper!
- Solid frame conditions and subsidies are required to help homeowners commit to nZEB renovations
- National energy policy must award homeowners to target high energy standards in their homes
- Facebook is key to reach especially young families - empty nester families can also be co-targeted by strong (traditional) storytelling in the local newspapers (see Figure 5).



Figure 5 Storytelling in magazines and newspapers are key – photo-credit is given to Bolius

## 1.2 BELGIUM - FLANDERS

### 1.2.1 Profile focusgroups

The Belgian partners organised four focusgroups for both Belgian compelling offers. For details on the compelling offers, please refer to D4.4. Table 15 shows the profile of the focusgroups:

- One focusgroup of professionals from the supply side for both of the compelling offers;
- Two focusgroups for the compelling offer of Bostoën for homeowners with an old dwelling who could be interested to renovate their dwelling (YF);
- One focusgroup with homeowners and potential end-users of the compelling offer of Leiedal (YF/EN).

*Table 15 Stakeholders focusgroup Belgium*

Stakeholders	Included in your focusgroup?
Banks	No
Homeowners	Yes: (lists of homeowners reported in milestone D6.1)
Local government	Yes (13 cities and municipalities that Leiedal groups)
Building firms	Yes: Bostoën, Recticel Insulation
Architects	Yes: NAV (Network Architects Flanders)
Umbrella organisations for the building sector	Yes: VEA (Flemish Energy Agency) Yes: CIR (Insulation Board) Yes: Essencia (multisector umbrella organisations in the field of chemicals and life sciences)
Research institutions	Yes: VITO Yes: VIVES
Other	Yes: Warmer-Wonen network of stakeholders. Regional energy savers team, regional association of welfare organisations, regional association of housing sector, social housing renting offices, social credit company, Flemish housing department, province of West-Flanders, grid owners.

## 1.2.2 Main feedback received

### Focusgroups compelling offer Bostoën:

In this section, a concise overview is given for the main feedback from focusgroup Bostoën (Table 16).

*Table 16 Main feedback from focusgroup Bostoën*

Stakeholders	Feedback received per stakeholder
Homeowners	<ul style="list-style-type: none"> <li>- Interesting to have an overall roadmap for the nZEB renovation of a dwelling that makes a staged renovation possible.</li> <li>- Add other renovation measures like stability issues or aesthetic issues to the roadmap because these elements are also important for homeowners when renovating.</li> <li>- Unburdening is important to convince homeowners to do a full renovation to nZEB.</li> <li>- Not only interesting for young families, but also for other segments.</li> <li>- Important to address homeowners who are already thinking of other renovation works (like bathroom renovation).</li> <li>- Very interesting to have a temporary house during renovation, can also be removed afterwards.</li> <li>- Suggestion to undermine not only the expandability, but also the adaptability of Jumatt modules in a later stage of life of the homeowners.</li> <li>- More information on possible grants from the government and unburdening in asking grants can be an asset.</li> <li>- A solution for the financing the nZEB renovation can be essential to convince homeowners to renovate their dwelling to nZEB.</li> <li>- Total nZEB renovation will take a lot of time.</li> <li>- Sometimes better to break down and to rebuild a new nZEB house?</li> </ul>
Professional stakeholders	<ul style="list-style-type: none"> <li>- Speed of creating new extension with Jumatt-module and this way having a temporary lodging is an asset.</li> <li>- Interesting to have an overall offer with roadmap.</li> <li>- Possibility to scale up at neighbourhood level.</li> <li>- Standardisation of renovation process can make renovation more cost efficient.</li> <li>- Architects are concerned about having enough freedom of design</li> </ul>

	<p>when using these standard solutions like the extension with nZEB Jumatt modules?</p> <ul style="list-style-type: none"> <li>- How much will it cost?</li> <li>- Adding an extra extension and thus making the house bigger is not energy efficient.</li> <li>- Will the performance of the nZEB renovation increase?</li> </ul>
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### Focusgroups compelling offer Leiedal:

In this section, a concise overview is given for the main feedback from focusgroup Leiedal (Table 17).

*Table 17 Main feedback from focusgroup Leiedal*

Stakeholders	Feedback received
Homeowners	<ul style="list-style-type: none"> <li>• Competitive offer (value for money), attractive offer</li> <li>• Be clearer about the services of the package (what is in – what not)</li> <li>• Be clearer about terminology of “nZEB”</li> <li>• More precise on value proposition (in communication)</li> <li>• Pool of contractors is an asset</li> <li>• The action-oriented approach is an asset (how-to, what to do next?)</li> <li>• Important that it is independent, but need to be clear what it means to be “independent”</li> <li>• Appreciate the long-term perspective for renovation (staged).</li> <li>• Added value of tool “myenergycompass.be”</li> </ul>
Local government	<ul style="list-style-type: none"> <li>• Very much needed service</li> <li>• Need to be aligned with existing local housing policy</li> </ul>
Building firms	<ul style="list-style-type: none"> <li>• What is the profile of the renovation coach? Will he bring added value for building professionals as well? Isn’t his task list too ambitious?</li> <li>• What are the selection criteria for the pool of contractors?</li> </ul>
Architects	<ul style="list-style-type: none"> <li>• These services risk being in competition with the services of the architects. But what about responsibilities? These are for architects</li> </ul>

	<p>legally settled. And what about guarantees?</p> <ul style="list-style-type: none"> <li>• How to create synergies with other building professionals? Can a pool of architects be created?</li> </ul>
Umbrella organisations for the building sector	<ul style="list-style-type: none"> <li>• Can energy savings be projected for homeowners?</li> <li>• Unburdening is a plus</li> <li>• Stakeholders can bring a lot of knowledge for the renovation coach</li> </ul>
Other	<ul style="list-style-type: none"> <li>• Approach can be more holistic not only on energy renovation of dwellings, also on “good housing quality”, safety, etc.</li> <li>• How to target low-income households with this offer?</li> <li>• Integrate with other mechanisms for neighbourhood renovation that are being developed and implemented by grid owners.</li> <li>• Added value of stepwise renovation plan</li> <li>• Importance of user behaviour as well</li> </ul>

### 1.2.3 Changes made to compelling offers

In this section, a concise overview of the changes made to the Belgian compelling offers (Table 18).

*Table 18 Changes made to compelling offers*

Compelling offer	Description of changes made based on main feedback received from focus group (s)
Compelling offer Bostoën	<ul style="list-style-type: none"> <li>- Research into targeting more segments for total nZEB renovation with total unburdening (besides from YF).</li> <li>- Addressing and building upon other drivers like aesthetics and upgrade of bathroom and kitchen to convince homeowners for renovation to NZEB.</li> <li>- Stress on fast replacement of existing extensions of the house in bad shape by an nZEB module that can serve a temporary housing. And stress on possible adaptation with other modules on the long term.</li> <li>- Adding also unburdening in looking for financial solutions.</li> <li>- Starting with one extension with nZEB Jumatt modules to have an example and start gathering ambassadors for further upscaling of renovations to nZEB.</li> </ul>
Compelling offer	<ul style="list-style-type: none"> <li>- Better communication material that is more to the point about the</li> </ul>



Leiedal: Renovation coach	<p>services (what to expect), more emphasis on the assets (e.g. unburdening).</p> <ul style="list-style-type: none"> <li>- Networking and lobbying that the renovation package is compatible with a new subsidy scheme for neighbourhood renovations.</li> <li>- Recruit a renovation coach with very specific skills, create a detailed profile for the renovation coach</li> <li>- Fine-tune the concept of “pool of contractors”, initiate the setup of a pool of architects ==&gt; enable cooperation with building sector</li> <li>- Allow homeowners to integrate non-energetic dimensions renovations in the services of the renovation coach</li> <li>- Rely on the partners, cities and municipalities for communication and the creation of business leads (recruit homeowners).</li> <li>- Also allow other organisations to make use of the services of the renovation coach, for other target groups (e.g. to coach homeowners that get a cheap loan from the regional social credit organisation)</li> <li>- Be clearer on risks and responsibilities between coach and homeowners (contract).</li> </ul>
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An external EPC expert has assessed the ‘before’ and ‘after’ energy use of Belgian pilot houses where a renovation package was implemented. These EPC results can be found in Annex 1.

#### 1.2.4 Recommendations for further rollout

- There is a need for introducing new concepts of compelling offers to speed up the renovation rates and the ambitions of homeowners towards nZEB-level. This is confirmed by the conversations with stakeholders in focusgroups. They welcome new concepts, and all are willing to contribute, to make them a success. But they also have questions, as not all things are clear in this stage of the renovation packages. So, there should be support for parties that are willing to do the R&D for the development of new compelling offers, as this requires an investment and is a risk (will it succeed or not?). Stakeholders need more room for testing new concepts before they can innovate.
- New concepts for compelling offers should be tested and discussed with stakeholders and potential end-users. This creates support and offers opportunities for new cooperation between stakeholders. E.g. if a compelling offer is oriented towards yet untouched homeowner segments (e.g. empty nesters), new coalitions of stakeholders must be created (e.g. the role of social welfare organisations will be different for this exemplary segment).
- To make nZEB-compelling offers successful, it is necessary that the demand is secured. This can be done e.g. by the government by imposing a certain level of energy efficiency to get all homeowners obliged to renovate their dwelling to nZEB.

- The unique selling proposition (and added value) of an innovative compelling offer must be clear. E.g. in case of the renovation coach, a description of function and profile is essential to explain stakeholders on this concept.
- A roadmap to an nZEB renovation is essential to ensure a staged nZEB renovation and to avoid lock-ins. This should be integrated in all compelling offers. Most homeowners carry out a staged renovation.
- Independent advice and unburdening is important to convince homeowners and to create trust.

## 1.3 SLOVENIA

### 1.3.1 Profile focusgroup

BSC Kranj organised two focusgroups for their compelling offer (Table 19). For a description of the compelling offer, please refer to D4.4.

Focusgroups Slovenia are divided in:

- One focus group of professionals from the supply side;
- One focus group for homeowners living in blocks of flats who could be interested to renovate their dwelling.

*Table 19 Stakeholders focusgroups Slovenia*

Stakeholders	Included in your focus groups?
Banks	No
Homeowners	Yes
Local government	Yes (Municipality of Kranj)
Building firms	Yes: (Terfas d.o.o.)
Architects	No. But building managers yes.
Umbrella organisations for the building sector	Yes: DOMPLAN (building management company)
Research institutions	No
Other	Representatives of homeowners

### 1.3.2 Main feedback received

The segment addressed with the compelling offer is multiapartment buildings. The main feedback received is shown in Table 20.

*Table 20 Focusgroup multiapartment buildings segment for Slovenian compelling offer*

Stakeholders	Feedback received per stakeholder
Banks	/
Homeowners	<ul style="list-style-type: none"> <li>-They are pleased with the ONE STOP SHOP OFFER, it will make procedures more efficient as long as they will have the opportunity to receive the subsidy from ECO fund;</li> <li>-They get to know the nZEB meaning and terminology;</li> <li>-Easier procedures of choosing the right building firm;</li> <li>-Less dependence on building manager.</li> </ul>
Contractors	-Easier procedure for homeowners, nothing different for them.
Building firms	<ul style="list-style-type: none"> <li>-Need adaptation to nZEB renovations;</li> <li>-With involving the new building approaches, which are closer to nZEB renovations, companies become more competitive;</li> <li>-Get to know the needs of the apartment owners personally;</li> <li>-Get to know about innovative and modern approaches of the renovations, but still there is not a clear guidance what should be the end result of the renovation in terms of savings.</li> </ul>

### 1.3.3 Changes made to compelling offer

Some changes were made to the compelling offer based on feedback received:

- Gathering homeowners with building companies, to exchange needs and visions of the renovation between these two sides;
- One stop shop allows information gathered and explained in a simple, understandable way;
- Quality contractors are being offered to the homeowners;
- Better communication materials can be/ are prepared.

### 1.3.4 Recommendations for further rollout

The following is recommended to enable further rollout:

- ECO FUND as a funding institution should provide compelling offer to all other stakeholders;
- Provide information to the homeowners about the safe investment in their apartment with the energy renovation, because of the increase of the price of their apartment;
- Provide information about better indoor climate and healthier environment;
- National or local public institutions should disseminate communication materials on renovations to convince the homeowners to start their renovation;

## 1.4 GERMANY

### 1.4.1 Profile focusgroups

Germany focussed on the segment of affordable housing (rental sector). The German compelling offer can be found in D4.4. The profile of the focusgroup is included in Table 21.

*Table 21 Profile focusgroup Germany for the compelling offer for affordable housing*

Stakeholders	Included in your focus group?
Banks	No
Homeowners	No
Contractors	No
Building firms	No
Representatives of cooperative and municipal housing companies	Yes: Antje Bitter (Management Board Member), Wohnungsbaugenossenschaft Wittenberg eG, Wittenberg Steffen Loup (Management Board Member), WBG Nordhausen eG, Nordhausen Karl-Heinz Schönfeld (Management Board Member), WBG Halberstadt eG, Halberstadt Lars Gomolka (Head of Portfolio Technology), GEWOBA AG Wohnen und Bauen, Bremen Ralf Schekira (Managing Director), WBG Nürnberg GmbH, Nürnberg Karl-Heinz Range (Managing Director), KSG

	<p>Hannover GmbH, Hannover</p> <p>Karin Grasse (Management Board Member), Wohnungsbaugenossenschaft Otto von Guericke eG, Magdeburg</p> <p>Berndt Erlenkötter (Management Board Member), Schwelmer &amp; Soziale eG, Schwelm</p> <p>For feedback loop:</p> <p>Steffen Foede (Management Board Member), Wohnungsgenossenschaft UNITAS eG, Leipzig</p>
Architects/Structural Engineers	<p>Yes, for feedback loop:</p> <p>Kai Lukowsky, Structural engineer, Halle</p> <p>Gösta Ahrens, Architect, Halle</p>

### 1.4.2 Main feedback received

Feedback was collected in two focusgroups moments: Focusgroup1 (Table 22) and Focusgroup2 (Table 23).

#### Focusgroup 1:

*Table 22 Feedback from focusgroup1 for the German compelling offer*

Stakeholders	Feedback received per stakeholder
<p>Representatives of cooperative and municipal housing companies (first round with general information, detailed talk on Online-Tool approach and room for further ideas)</p>	<p>The drivers, barriers and problems of housing companies with regard to energy renovations were comprised and collected in order to find out about the general background of the decision-making process in housing companies in relation to the compelling offer.</p> <p>The idea of developing an Online-Tool (also see D4.4) as an additional service, which makes it possible to insert important building data and receive information on renovation options, financing and funding possibilities, an estimation of expected energy savings and possibilities to pass on the renovation costs on tenants, was presented to the focusgroup in the course of the interviews and generally approved of. The interviewees also came up with some interesting</p>

	<p>ideas on usability, contents and possible data sources that can be used for further developing the concept.</p> <p>Since the interviews were part of an open-ended process, all statements of the interview partners were screened for ideas for additional services to complement the renovation package with and thus make it a compelling offer. In the end, two more services were created from the interview results: the first is a concept for a workshop or event, which brings together housing companies with relevant actors from their regions (local energy agencies etc.) and the supply side. It creates an opportunity to network and exchange experience with other housing companies as well as to be informed about technical developments regarding energy renovation. The second idea was to focus on district solutions. There are many districts in which the building stock is not only owned by one, but by two or more housing companies. If they, although being competitors, decide to cooperate in a district project, the best and most efficient renovation solution for a whole district can be found and put into practice. This applies to districts owned by only one company as well.</p>
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**Focusgroup 2:**

*Table 23 Feedback focusgroup2 for the German compelling offer*

Stakeholders	Feedback received
<p>Representatives of cooperative and municipal housing companies</p> <p>Architects/Structural Engineers</p>	<p>To test the three approaches developed from the interview output, experts were asked for their evaluation.</p> <p>The feedback on the three approaches for the compelling offer was differentiated. It turns out that the Online-Tool, despite all expected difficulties with realisation, is generally considered a useful and promising idea, which housing companies could use as a 'quick check' for pre-planning. For example, if they want to figure out, which potential renovation project is</p>

	<p>the best to pursue. It is important to note, that focus group as well as experts share the opinion, that the tool could never replace actual architects or planning services, once the renovation has been decided upon, but could be a very useful method to get an overview on renovation options and costs for a specific project or to compare different renovation possibilities.</p> <p>The idea of the Workshop/Event was not favoured by the experts, because the management of housing companies attends all kinds of events, workshops and fairs all the time. It is hard to create a concept of an event so unique, that it is really attractive for housing companies to attend. There are enough opportunities for networking and exchange of experience in the framework of other events that the management of housing companies will attend anyway. The channels of getting in touch with the supply side and other stakeholders like e.g. energy agencies or financing bodies, are considered sufficient.</p> <p>The idea of district projects was considered very promising by the experts. District solutions, in their opinion, will become more important in the future, as they have a great potential for reaching very efficient energy savings in many dwellings at the same time. The aspect of competing housing companies cooperating for a district solution was assessed to be challenging but useful.</p>
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### 1.4.3 Changes made to compelling offer

Changes made to the German compelling offer are discussed in Table 24.

*Table 24 Changes made to German compelling offers based on the received feedback*

<b>Compelling offer</b>	<b>Description of changes made based on main feedback received from focus group (s)</b>
Compelling Offer #1 - DE	Due to the feedback of the experts, it was decided to stop elaborating on the approaches of the workshop/event and to further pursue the development of business models for the online-tool as well as the district projects as additional

	<p>services for the compelling offer.</p> <p>The online-tool, according to interview partners, should best be hosted and provided by the German Housing Association (GdW) in cooperation with the development bank KfW. It could be useful for orientation and comparison of options in the initial stages of planning renovation projects and for portfolio decisions.</p> <p>Managing district projects is an activity that can be performed by consulting firms/planning offices in the sector of urban development or real estate management. This service provider could do all the initiating work, the moderation of the process and fulfil organisational task as well.</p>
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#### 1.4.4 Recommendations for further rollout

Recommendations for further rollout:

- The needs of housing companies differ fundamentally from those of private homeowners when it comes to energy renovation.
- The most important part for them is making responsible and sustainable decisions regarding their portfolio management. Once a renovation is decided for, the renovation process starts, which for most companies is part of their every-day-work.
- The technical measures taken in a specific building depend highly on the building typology and the specific circumstances, that is why the renovation package is to be considered as an example of a successful renovation project. Compliance with regulations, the possibilities of rent increase after the renovation is finished as well as the combination of technical measures (= renovation/ technical package) differs from project to project.
- There are some points in which additional services could help ensure cost efficiency and a high quality of the renovation results and enrich the renovation package to make it a compelling offer. The following two services were considered promising by the experts:
  - The Online-Tool described above help with portfolio decisions by giving a well-grounded estimation on the cost of a certain renovation project, as well as on expected energy savings, funding and rent increases. Being hosted by public, not profit-oriented bodies, this tool is credible and trustworthy. By using this tool, the decision-making process for housing companies could be simplified significantly.
  - Another promising additional service is the organization of district projects. Economies of scale can enable companies (or consortiums of companies) to realise ambitious and prestigious renovation projects.
- By strengthening the additional services, motivation for housing companies can rise which can stimulate them to start renovating more of their building stock.



## 1.5 NETHERLANDS

Focusgroups within the municipality of Leeuwarden consist of both the overall network of the municipality, which acts as an extended focusgroup that works towards accelerating NOM energy renovation within the private sector as well as dedicated focusgroups, which work on one-stop-offers for energy renovation, including the REFURB compelling offers. The selected segment for the Netherlands overall are the dedicated nZEB frontrunners, which are mostly empty nesters and young families. The description of the Dutch compelling offer can be found in D4.4.

### 1.5.1 Profile of focusgroups

#### Policy framework

In 2013, the Dutch national government<sup>2</sup> decided that the Netherlands must become energy neutral by 2050. In addition, the use of natural gas is to be phased out completely. Dwellings will have to become all-electric or an alternative heat source will have to be arranged for. Either way, it has become clear to all stakeholders that for the energy transition to succeed, deep energy renovation of the built environment will need to be considerably accelerated. At the moment, the speed of deep energy renovation is still not fast enough to meet the national goal.

Here, the national government sees a clear role for regional and especially local governments to speed up deep energy renovation. A municipality can engage its neighbourhoods/ streets/ citizens, can stimulate energy saving among its residents and can also work towards a certain ambition level concerning deep energy renovation for each of their neighbourhoods.

The municipality of Leeuwarden has fully embraced this role of facilitator in the energy transition. As facilitator, Leeuwarden very actively brings relevant stakeholders within the energy transition together. There have been ongoing talks with relevant stakeholders ever since. During the REFURB project, the municipality of Leeuwarden has considerably intensified this process of facilitating to stimulate (deep) energy renovation of residential dwellings, both rental as well as privately owned. Deep energy renovation projects have become more and more embedded in local and regional policy documents such as the LEA (Leeuwarder Energieagenda) and the Frisian Energy Strategy ([www.frieseenergiestrategie.nl](http://www.frieseenergiestrategie.nl)), including additional funding.

Given the above, the municipal network of stakeholders for NOM (NZEB) functions as an extended focusgroup for accelerating (deep) energy renovation of dwellings. The compelling offers, discussed earlier in REFURB D4.4 are ongoing innovative pilot projects positioned within the much larger municipal network, in other words within the extended focusgroup. These compelling offers receive or have received VNG process subsidies<sup>3</sup> and extra financial support from the municipality and the Province of Friesland to boost and promote them, considering their innovative character.

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<sup>2</sup> <https://www.energieakkoordser.nl/>

<sup>3</sup> <https://vng.nl/innovatieve-aanpakken-koopwoningen>

General REFURB lessons learned are also continually applied with the aim of accelerating the number of deep energy renovations of dwellings. That is why the large municipal extended focus group is an 'ongoing work in progress', with new stakeholders being added to the mix on a regular basis.

#### Forming of focusgroups

From the municipal network, groups of people with similar interest found each other (for instance: very active neighbourhoods in Leeuwarden, villages, frontrunners, ambassadors) and together formed focusgroups to discuss their wishes/ needs, current one-stop- shop offers and propositions for deep energy renovation. The municipality has facilitated this process, gathered all their experiences and remarks and steered actively towards the execution of (pilot) projects.

Within focusgroups it was first and foremost important that demand side (homeowners) and the supply side (installers, building firms/ contractors) could speak the same language and understand each other's point of view. There was a constant pragmatic sharing of ideas and experiences. What works? What does not work? All with a constant emphasis on accelerating deep energy renovation. The municipality was actively involved to bridge the gap between demand and supply and to work towards 'the holy NOM grail', a NOM (NZEB) solution that would appeal to all the homeowners within a neighbourhood.

Figure 1 shows a short photo impression of the meetings within some of the focusgroups in Leeuwarden.

#### **Focusgroup Camminghaburen:**

Stichting Nul op de Meter in Camminghaburen (Foundation NZEB neighbourhood Camminghaburen) in Leeuwarden consists of a group of enthusiastic frontrunners that will work as energy coaches to come to a NOM offer for their neighbourhood. The foundation was founded in 2017. Together with a professional advisor, local installer and building company, they have developed a concept NOM solution that is based on sustainable concepts divided in the classes bronze, silver, gold and platina. The first round of scans of the dwellings has already taken place. 75 homeowners signed up for a scan and the first assignment was issued at the beginning of October 2017 (update dd. October 2017).





*Figure 6 Pictures of focusgroup Camminghaburen*

### **Focusgroup Aldlân:**

In Aldlân (also a neighbourhood) the municipality of Leeuwarden has started its WENK project. WENK is Dutch for Wijkaanpak Energie renovatie koopwoningen, or in English: A neighbourhood itself, whom has decided on deep energy renovation. They receive professional process guidance from Procap. The municipality of Leeuwarden acts the process facilitator, actively bringing the demand and the supply side together. This private- public cooperation has proven to be very fruitful: Homeowners from Aldlân (Stichting Duurzaam Aldlân), a building company and an installer together developed a fitting one-stop-shop offer for deep renovation. Together, they have been able to lower its price to 35.000 Euros. Probably, some type of building- related financing (like an ESCO) will also be offered, for those who want it. The first pilot dwelling will be renovated in 2018.





*Figure 7 Pictures focusgroup Aldlân*

Due to the experiences with focusgroups, the Leeuwarder network of stakeholders has grown more and more.

Overall, the Leeuwarder network of stakeholders currently consists of (i.e. a non- exhaustive list):

- Homeowners: early adaptors, ambassadors, within energy cooperations, from villages/ local neighbourhoods. For instance:
  - o Leeuwarden, Camminghaburen; <http://nulopdemeter.eu/>
  - o Aldlân: <https://www.facebook.com/duurzaamaldlan/>
- Other Frisian/ Northern/ national municipalities;
- Province of Fryslân; <https://www.fryslan.frl/>
- Local installers;
- Various buildings companies;
- Umbrella organisations such as Bouwend Nederland <http://www.bouwendnederland.nl/> , SBUcurnet, <http://www.sbrcurnet.nl/>
- Larger Frisian building contractors/ building companies;
- The specific (local) alliances behind each of the three Dutch compelling offers (see D4.4);
- Financial institutions; Regionally: The Frisian Revolving Fund FSFE (Fûns Skjinne Fryske Enerzjy ([www.fsfe.frl](http://www.fsfe.frl))). Nationally: The Dutch Bank ([www.dnb.nl](http://www.dnb.nl) )
- Independent intermediaries (catalysts); Energiewerkplaats/ Network Duurzame dorpen (<http://energiewerkplaats.frl/> ), Buurkracht (<https://buurkracht.nl/> ), Procap (<https://www.procap.nl/> ) ;
- Stroomversnelling (<http://stroomversnelling.nl/> )
- Ministries; either direct contact or via national pilot projects for boosting the energy transition;
- Abe Bonnema Foundation (<https://www.abebonnema.nl/>)

### 1.5.2 Main feedback received

Within its role as facilitator/ stimulator, the municipality of Leeuwarden has learned important lessons from its focusgroups to reinforce the compelling offer:

- It is important to considerably invest in dedicated communication/ marketing to get citizens and eventually whole neighbourhoods, interested and involved in energy saving. This process can take years but is worth the investment. Local government has a clear role in the information phase of the Customer Journey, also because it builds trust;

- Once neighbourhoods start saving energy together, the municipality can also support the process of stimulating deep energy renovation on neighbourhood level;
- To reach net zero by means of a (staged) deep energy renovation, an alliance of relevant stakeholders (suppliers of installations, contractors, intermediaries, etc.) will automatically need to work together to ensure that this aim - net zero energy – is reached. This implies a need for quality of both process and product.
- Net zero level entails a certain quality of the work at hand. The Trias Energetica can be used as the leading principle for quality. Inferior quality would for instance be: Adding dozens of solar panels on the roof, while not replacing regular light bulbs for LED lighting or replacing energy guzzling machines for energy efficient ones. The municipality supports only NZEB products of good and proven quality.
- The holy grail of deep energy renovation to net zero level has yet to be found. There are several ways to close the gap between demand and supply, but none of them are the optimal one yet. Nevertheless, various bits and pieces from all existing one-stop- shop offers seem to work very well. We need to hold on to these;
- Current one-stop- shop offers (for net zero energy) are still too expensive for homeowners and therefore not compelling enough for the largest part. We need to facilitate the market to help lower the price. This can be done by creating more early adapters, i.e. by creating a certain ‘critical mass’;
- There is also a second potential financial barrier: The lack of financial arrangements/ solutions. Building- related financing (such as an ESCO construction) seems promising, but there are still some hurdles to be tackled here (see below);
- Quality is also defined in the eyes of the beholder. Whether or not citizens, neighbourhoods and villages see a one-stop-shop offer as a truly compelling offer, depends on the extent to which their wishes, expectations and needs are or can be met by the alliance (supply side);

Feedback related specifically at the innovative compelling offers is shown below. (Table 25):

Table 25 Main feedback received on compelling offers

NL- Compelling offer- 1	NL- Compelling offer- 2	NL- Compelling offer- 3
<i>Village ESCO</i>	<i>Going NOM together!</i>	<i>NOM- A la carte</i>
<p><b><i>From the point of view of the (local) energy cooperation and the Energiewerkplaats:</i></b></p> <ul style="list-style-type: none"> <li>- The local homeowners are very enthusiastic about this approach. There is a lot of sympathy for the social component of the offer and there is great trust in the local energy cooperation for its execution. An important prerequisite for this compelling to work, is having an active and thriving local energy cooperation.</li> <li>- We have joined the dwellings in Harkema and Baard to make this business case more solid. 11 dwellings in Harkema was a relative small number of dwellings. With efforts from the Energy workshop, we have successfully ‘moved’ our compelling offer to another village, the village of Baard (Baard is part of the municipality of Leeuwarden by Jan. 2018 because of municipal reform). In Baard we were able to gather another 80 homeowners to join in.</li> <li>- We are now trying to reach a solid business case for the 91 dwellings in total (Harkema and Baard combined). But we ran into a difficulty; financial institutions consider investing in the energy renovation of the 91 dwellings via an ESCO construction, to be a ‘high risk’ investment. Therefore, they calculate with a high interest rate and they are also demanding a ‘warranty’ from a (local) government to cover the subordinate debt. The high interest rate makes it difficult for us to reach a solid business case. We also need a (local) government that is able and willing to issue the warranty.</li> <li>- The business case will become solid more quickly, if we start with the ones with the biggest potential for energy saving first. These are</li> </ul>	<p><b><i>From the point of view of the building company that makes the modules:</i></b></p> <ul style="list-style-type: none"> <li>- We need a certain ‘mass’ of dwellings to get a solid business case among the private homeowners. So, what we need are increasing numbers of dwellings for deep energy renovation. This will also reduce the costs for the renovation within the private residential sector.</li> <li>-When homeowners ask their local contractor to do some maintenance or renovation work, there is clear window of opportunity to sell our prefab modules. We will take on the role of manufacturer/ provider of these modules.</li> </ul> <p><b><i>From the point of view of the local contractors (who were asked if they would be willing to (up-) sell the prefab NOM- modules:</i></b></p> <ul style="list-style-type: none"> <li>- We are a bit hesitant to (up-) sell these modules to our local customers. Our customers come to us because they trust us. They will become ‘suspicious’ if we try to sell them more than they are asking us for. This ‘forced upselling will cost us business’.</li> <li>- We are already doing a decent job based on current building regulations. Why aim for more if a customer does not want this!?</li> <li>- If a customer does ask us for a deep energy renovation, we can certainly manage and deliver as promised. We already have some good solid guidelines to hold on to. We can deliver a tailored solution.</li> </ul>	<p><b><i>From the point of view of an alliance partner that provides NOM advice, as part of an NOM alliance:</i></b></p> <ul style="list-style-type: none"> <li>- We, as providers, quickly see the technical solution within broad outlines. But it does not work this way for the customer. We need to fully engage with and explain our solution to the customers. This information phase of the customer journey is intense and time-consuming.</li> <li>- A customer might also have a very different idea on what kind of work has to be done. But their idea might not be the most cost- effective. It is important to keep an open dialogue with the customer.</li> <li>- It is also possible that customers still want to make changes during the execution phase. The NOM alliance needs to well organised and flexible.</li> <li>- More than 50% of our customers <i>are</i> female. Women often carry the project and make final decisions, so we need to adjust our communication to their needs. We will be sure to communicate less from solemnly a technical point of view and focus more on the ‘softer’ aspects of NOM solutions as well</li> <li>- We are very pleased with the (first) NOM subsidy round from the province of Fryslân. We have been able to gather many lessons learned by helping the customers that had applied for the NOM subsidy. We hope the Province of Fryslân will issue a second NOM subsidy round in the future. We also hope that the subsidy amount in this second round will be lowered from 9000 Euros to 6000 euros, so more homeowners can benefit from it.</li> </ul>



<p>the dwellings with a high energy use. In a bundle of dwellings, these 'big ones' can cover for homeowners that do not use so much energy. After all, a solid business case is needed to get any work done at all.</p> <p><b>From the of view of the banks/ financial institutions:</b></p> <ul style="list-style-type: none"> <li>- We usually deal with cases from companies that have a healthy cash flow and that make a certain profit. The energy cooperation has not got a lot of money in the bank and their aim is not on financial but on societal profit. This is not something we are used to (yet). We cannot take societal profit into account. We are willing to grant the energy cooperation the money if they arrange for a guarantee from a (local) government.</li> </ul>		
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### 1.5.3 Changes made to compelling offers

The compelling offers are all still 'ongoing', but as they are innovative offers obviously some changes have been made along the way, based on lessons learned (Table 26).

*Table 26 Changes made to Dutch compelling offers*

NL- Compelling offer- 1	NL- Compelling offer- 2	NL- Compelling offer- 3
<i>Village ESCO</i>	<i>Going NOM together</i>	<i>NOM- A la carte</i>
<ul style="list-style-type: none"> <li>- The dwellings for phase 1 and 2 were combined (Village of Harkema and village of Baard) to make a more solid business case. Now 91 dwellings are to be deeply renovation with the use of the energy. 80 dwellings (in Baard) of these lie within the boundaries of the municipality of Leeuwarden.</li> <li>- A director was hired to further boost the compelling offer and further professionalize the organisation;</li> <li>- The Nederlandse Bank (Dutch national overarching bank) is willing to lend the money to fund the initial investment (at low interest rate), but a guarantee from a governmental organisation is still mandatory.</li> </ul>	<ul style="list-style-type: none"> <li>- The original idea, where local contractors are to (up-) sell the prefab modules whenever there is a window of approach, has met resistance among local contractors. Local contractors do not (yet?) see the added value of this. They also fear losing business over it because they are asked to try and upsell these modules. The idea was abandoned for now;</li> <li>- They aim is still to create enough demand to boost the market among private homeowners. In an innovative approach, the WENK neighbourhood of Aldlân in Leeuwarden will be offered this compelling offer. The concept will be offered as an alternative 'mass' solution, next to the one-stop-shop offer that was developed with and</li> </ul>	<ul style="list-style-type: none"> <li>. This compelling offer is still going strong, but no longer receives funding from the VNG innovative programme.</li> <li>- A NOM solution a la carte (like this compelling offer) matches really well with the provincial NOM subsidy, as a certain amount of money is allocated that can be spend freely' on various measures; supporting the tailored approach for net zero energy renovations. The second round of provincial subsidy can therefore also be seen as an indirect boost for this (type of) compelling offer. Again, the municipality of Leeuwarden lobbied for both this first and second round of NOM subsidy.</li> </ul>

	<p>within the neighbourhood itself. Together with the homeowners in Aldlân, this compelling offer will be developed further. Also, regarding communication, the use of roadmap, etc.</p> <p>- In addition, the Abe Bonnema Foundation has made 'a pact' with the building company that produces the prefab modules. They are 'offering' homeowners of 100 dwellings in Leeuwarden the opportunity to deeply renovate their dwelling to net zero. The regional revolving fund FSFE is involved; some type of ESCO construction will probably be applied. Plans are not yet made concrete; it is unknown where, when, how and who.</p>	
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#### 1.5.4 Recommendations for further rollout

Based on experiences within the network and focusgroups:

- It is very important for a government to invest in a solid and consequent approach for the first four crucial steps of the customer journey, starting by spreading the message on the importance and benefits of energy saving (in short, the information phase). It is a very lengthy and intense process of targeted communication and marketing, but over time things fall into place and then the invest will surely prove to be very fruitful. The neighbourhood of Aldlân is living proof of that;
- A stimulating and facilitating municipal government can help to create 'synergy' within the boundaries of the municipality (the demand side) as well as the market for deep energy renovations (the supply side). Keeping an open dialogue with homeowners and stakeholders is key;
- It is good to have compelling offers that differ a lot from each other. Opting to stimulate and promote multiple and diverse types of compelling offers and approaches, enhances the level of success as it will increase the change that (certain aspects of) either one of them will appeal to a wide range of residents.

## 1.6 ESTONIA

### 1.6.1 Background information

In Estonia the second financing period opened approximately at the same time with the beginning of REFURB project. During the first financing period 2010-2014 about 500 multifamily houses with 15 000 dwellings were renovated. The executing agency for financing renovation of multifamily houses was and still is the KredEx Fund. This is to say that KredEx Fund bears all the responsibility of organizing and monitoring relevant activities and also carries supervising functions. KredEx Fund also establishes legal background for subsidising and renovating together with Ministry of Economy and Communication and orders studies to analyse and assess the results and consequences of renovation and subsidising.

There are all possible stakeholders involved in these studies – tenants and organizations representing them; market player such as construction companies, real estate agencies, designers, architects etc. Also changes in indoor climate and their impact on dwellers are included in these analyses.

Although in the period of 2010-2014 a lot of houses were renovated, there were some issues to be changed in future subsidies. Also, the renovation scheme with substantial subsidies was included in Energy Development Strategy 2030 as a measure to reduce energy consumption in housing sector.

The present financing period 2015-2020 will be followed with the same kind of scrupulous studying and analysing. As the process of renovating with the help of subsidising is rather rigorous and thus time consuming it is too early to conduct any studies yet. In fact, none of the buildings under monitoring has not yet entered construction phase. Still there are some possible early conclusions to be drawn.

Some of the most important of these studies:

Mikola, A., Hamburg, A., Kurnitski, J., Kalamees, T. (2017) Rekonstrueeritud korterelamute sisekliima ja energiakasutuse analüüs, Uuringu lõpparuanne. Tallinn University of Technology.  
[http://kredex.ee/public/Uuringud/Rekonstrueeritud\\_korterelamute\\_sisekliima\\_ja\\_energiakasutuse\\_analuu\\_s.pdf](http://kredex.ee/public/Uuringud/Rekonstrueeritud_korterelamute_sisekliima_ja_energiakasutuse_analuu_s.pdf). Analyses of Indoor Climate and Energy Consumption of Renovated Multi Family Houses. Final Report.

Kalamees, T., Kõiv, T-A., Ilomets, S., Mikola, A., Link, S. (2014) Sõpruse pst 244, Tallinn, korterelamu renoveerimisjärgne uuring. Tallinn University of Technology.  
[http://kredex.ee/public/Uuringud/Sopruse\\_pst\\_244\\_korterelamu\\_renoveerimisjargne\\_uuring\\_07.09.2014.pdf](http://kredex.ee/public/Uuringud/Sopruse_pst_244_korterelamu_renoveerimisjargne_uuring_07.09.2014.pdf). Post renovation study of Multy Family House on 244, Sõpruse Avenue.

Lauri, M. et al. (2014) Kortere lamute renoveerimisturu ülevaade ja perioodi 2010–2014 korterelamute rekonstrueerimistoetuse mõju analüüs. KredEx Fund  
[http://kredex.ee/public/Uuringud/Kortere lamute\\_analuu\\_030914.pdf](http://kredex.ee/public/Uuringud/Kortere lamute_analuu_030914.pdf). Review of Renovation Market and Analyses of Influence of Renovation Grant 2010-2014.

Kõiv, T-A., Hamburg, A., Mikola, A., Kiil, M., Tükia, A., Rohula, T., Silm, G., Palmiste, Ü. (2014) Rekonstrueeritud korterelamute sisekliima ja energiatarbe seire ja analüüs ning nende vastavus standarditele ja energiaaudititele. Tallinn University of Technology.  
[http://kredex.ee/public/Uuringud/Rekonstrueeritud\\_korterelamute\\_uuring.pdf](http://kredex.ee/public/Uuringud/Rekonstrueeritud_korterelamute_uuring.pdf). Monitoring and Analyses of Indoor Climate and Energy Consumption of Renovated Multi Family Houses and their Compliance to Standards and Energy Audits.

## 1.6.2 Profile of focusgroups and main feedback received

Table 27 Profile of focusgroups Estonia

Stakeholders	Included in focusgroup
<p><b>Focus Group A - Homeowners</b></p> <p>Representatives of Homeowners Associations of the houses to be renovated using reconstruction grant.</p>	<p>Agur Berg – chairman of homeowners association Aleksandri 12, Tartu</p> <p>Silvia Tärn – chairman of homeowners association Tiigi 7, Tartu</p> <p>Andres Lepp – real estate manager representing Pepleri 3, Tartu</p> <p>Anu Kalle – chairman of homeowners association Tiigi 21, Tartu</p> <p>Marko Mirme – representing homeowners association Tiigi 23, Tartu</p> <p>Helle Susi – chairman of homeowners association Kalevi 8, Tartu</p> <p>Roman Sommer – real estate manager, representing Kalevi 10, Tartu</p>
<p><b>Focus Group B – Service Providers</b></p> <p>Designers, HVAC engineers, technical consultants, contractors involved in executing renovation of houses using <b>reconstruction grant</b></p>	<p>Rivo Soo - Ropka Elamu OÜ</p> <p>Tõnu Jõesaar - Termopilt OÜ</p> <p>Senni Vels - Weidenberg AB</p> <p>Andres Lepp - Lepaprojekt OÜ</p> <p>Vladimir Schmidt - Invento OÜ</p> <p>Jüri Juntson - Juntson Haldus OÜ</p> <p>Indrek Pihtjõe - Varpo Grupp OÜ</p> <p>Tambet Türk – Soojustusprojekt OÜ</p> <p>Priit Kollom – Entronik OÜ</p> <p>Mihkel Urmet – AB TEMPT</p>

### 1.6.3 Main feedback received

Table 28 Main feedback received focusgroups Estonia

Compelling offer – Renovation grant	Main feedback from focus groups.
<b>Focus group A - Homeowners</b>	<p>The homeowners focusgroup was contacted along the process of renovation several times. Also, one to one consultations were held, and in a few occasions, general assembly of homeowners was addressed, and their questions answered.</p> <p>The main concerns of homeowners can be divided into two groups. The first set of problems is about lack of expertise. There is a lot of uncertainty as to procuring different services prior to actual construction works such as energy auditing and design.</p> <p>The second set of problems is about several aspects of quality control and diminished comfort during construction.</p> <p>The quality control aspect is emphasized in requirements and preconditions of reconstruction grant. It seems that communicating all the quality control features has been somewhat neglected by KredEx.</p>
<b>Focus group B – Service Providers</b>	<p>The main feedback was about technical feasibility of renovating houses from 1960-s to nZEB standards.</p> <p>Apart from several technical details there was a concern that current regulation “Methodology for calculating the energy performance of buildings” is not suitable for calculating low energy and nZEB buildings. In particular there are several energy consumption characteristics that need to be inserted as constants. As such they do not take into account technical and also social measures for conserving energy. In a situation where every kWh/m<sup>2</sup> is important, the differences may well influence decision on whether PV microgeneration is needed or not to achieve nZEB levels.</p>

	<p>Another topic of feedback was deliberations if on-demand ventilation is reasonable or not. It certainly makes sense energy wise but whether it is also cost-effective remains to be seen.</p>
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EPC proof of two example of pilot dwellings in the Tartu area can be found in Annex 2.

#### 1.6.4 Changes made to the compelling offer

Reconstruction grant is a complex document which involves inputs and coordination of different actors including financial and legislative and as such the document is not easy to change. There is however a list of proposals to KredEx and ministry of Economics and Communication:

- The role of technical consultant should be institutionalized more clearly. The role of the consultant in procuring services and quality control should be more emphasized, clarified and communicated;
- Current requirements do not provide for on-demand ventilation. As a result, it seems that ventilation systems are over dimensioned. These specific requirements should be reviewed and more specific.
- Methods of calculating energy performance of buildings should be critically reviewed if they are going to be applied to calculate nZEB buildings. Low energy buildings might need different, more precise and a more detailed approach.

#### 1.6.5 Recommendations for further rollout

Estonian recommendations only apply to renovation of multifamily houses:

- Organizing renovation “upside down” is justified if results are important. “Upside down” means to provide financing but only if the recipient commits to achieve specified results. A study conducted by *Arjakas et al* shows that with 40% subsidy and a goal to reach nZEB levels the fiscal payback time is two years.
- The role of the technical consultant is of utmost importance. Homeowners are usually not qualified to manage a demanding process of nZEB renovation. In our case, consultants are private entrepreneurs or legal persons. Local municipalities, through energy agencies or similar organizations, can also provide such support;
- Quality assurance is good to divide in two stages – firstly at the design phase and of course at the final inspection.

Unfortunately, no renovations of buildings were finished by the end of the project. Upon completion of construction works there are still steps to be taken to teach the tenants how to use their renovated house most efficiently. A lot of recommendations shall stem from the process of teaching, learning and monitoring as well as the tenants as also the characteristics of the building itself.

## Annex 1

# EPC Proof pilot dwellings Belgium

For four dwellings, the renovation coach carried out an EPC before and after a renovation (external expert) which can be found here.

An example description of one of these four dwellings is given below by means of example:

### **Pilot dwelling 1 (Elfde Julianalaan Kortrijk)**

- Characteristics of dwelling:
  - Terraced house
  - 904m<sup>3</sup> volume, heat loss surface of 444 m<sup>2</sup>
  - Built in 1930
  - Main volume + annex (later build)
  - Worn out at the moment it was sold.

#### Characteristics of homeowner:

- Young family of 3 (2 parents + 1 child)
- Bought the dwelling in 2015
- Family did not live in the dwelling during renovation, although moved to the dwelling when the renovation was not completed.

#### Renovation profile:

- Deep renovation (many measurements)
- Partly with contractors, but also many with DIY.
- Already undertaken one renovation (smaller house), thus having experience.
- Would not undertake such a project any more.
- Frustration because of bad experiences with some contractors. Happy with other contractors
- Renovation carried out without an architect (not obligatory)
- Feeling insecure about some measurements (e.g. cavity wall insulation of façade: fear of water infiltration), and therefore not carried out.

- Key figures from the EPC-reports:

*Table 29 Key figures EPC reports Belgium pilot 1*

	Before renovation	After renovation
<b>E-value</b>	294	91
<b>Net energy needs (kWh/m<sup>2</sup>), also called EPC-value</b>	261	96
<b>Average U-value</b>	2,55	0,80
<b>Characteristic annual primary energy use (MJ)</b>	452.868	139.930

Main measures:

Section	Measures
Front façade	No measurement
Rear façade	Insulation: from U-value 2,66 to U-value 0,18
Wall adjacent to neighbours left	Insulation: from U-value 1,92 to U-value 0,55
Wall adjacent to neighbours right	No measurement
Floor on ground	Insulation: from U-value 0,81 to U-value 0,20
Floor on cellar	Insulation: from U-value 1,56 to U-value 0,19
Pitched roof	Insulation: from U-value 6,18 to U-value 0,21
Flat roof	Insulation: from U-value 2,00 to U-value 0,14
Windows	Replacement: from U-value 5,20 to U-value 1,70 or 1,50
Door	Replacement: from U-value 5,00 to U-value 1,75
Ventilation	Before renovation: natural (no system) After renovation: mechanical (without heat recovery)
Heating	Before renovation: Individual heating devices per room, on gas. After renovation: high performance gas



	boiler, central heating + warm water
Renewable energy	Before renovation: none. After renovation: 4,5m <sup>2</sup> solar thermal

- Total cost of renovation: €84.811,48
  - Not exclusively costs for insulation measurements.
  - Also, other costs, e.g. electricity, structural works, finishing of walls & floors...
  - Subsidies: total €2.293,32
  - Difficult to estimate exact cost for energy measurements, because combined with general makeover of the dwelling.
  
- Real measured energy savings:
  - Energy use before renovation: unknown, dwelling has been bought and was uninhabited for 2 years
  - Energy cost before renovation: idem
  - Energy use after renovation: unknown, dwelling has not been fully inhabited for a longer period (no “normal use” for 1 year: not inhabited so long, abnormal use due to continuing the renovation while inhabiting the dwelling)
  - Energy cost after renovation: idem

### Quality control making use of the EPC (for pilot 1)

#### 1/ energy savings and cost savings

As it is impossible to measure the real energy savings before and after (see above). As a proxy, it is done based on the EPC. This will lead to an estimated cost saving:

- Before: 452.868 MJ = 125.796 kWh/year x €0,06/kWh = €7.547/year
- After: 139.930 MJ = 38.869 kWh/year x €0,06/kWh = €2.332/year

This means that there would be an estimated cost reduction on the energy bill of €7.547 – €2.332 = €5.215, or €435 per month. However, the figures seem to be high overestimations and not very realistic. It is already proved in other studies that the “characteristic annual primary energy use”-value is too theoretical, as it e.g. supposes a year-round heating of all rooms of the dwelling. Perhaps, what can be concluded is that the energy bill could be reduced with a factor  $7.547/2.332 = 3,2$ . But only in the case that the energy use profile remains the same (e.g. inhabited by a young family of 3, same heating of same rooms during a year).

## 2/ nZEB-level and energy performance

The EPC before and after can indicate whether the nZEB-level is reached. The observations in the EPC report after renovation must be compared with the official nZEB-definition for renovation (<http://www.energiesparen.be/ikBENOver/doelstellingen>):

- Option 1: all building parts (roof, wall, windows, floor, doors, heating) achieve a minimum isolation standard
- Option 2: the E-value or the “characteristic annual primary energy use”-value achieve a certain level

*Table 30 Comparison EPC and nZEB- level*

Option 1	Roofs: $U_{\max} = 0,24 \text{ W/m}^2\cdot\text{K}$	0,14; 0,21
	External walls: $U_{\max} = 0,24 \text{ W/m}^2\cdot\text{K}$	2,66; 0,18
	Windows and glazing: $U_{\max} = 1,5 \text{ W/m}^2\cdot\text{K}$ en glas: $U_{\max} = 1,1 \text{ W/m}^2\cdot\text{K}$	1,50; 1,70
	Doors: $U_{\max} = 2.0 \text{ W/m}^2\cdot\text{K}$	1,75
	Floors: $U_{\max} = 0,24 \text{ W/m}^2\cdot\text{K}$	0,20; 0,19
	Heating: high energy efficiency	yes
Option 2	E-value: max 60	91
	OR: Characteristic annual primary energy use-value: max 100 kWh/m <sup>2</sup>	96

Based on option 1, we could conclude that the dwelling does not obtain the nZEB-level. there are some windows that are not performing well enough, and the front façade should be insulated as well.

Based on option 2, we can conclude that the dwelling reaches the nZEB-level. Although it exceeds the max. E-value, the dwelling remains under the maximum characteristic annual primary energy use-value.

### Conclusion (for pilot 1)

- The renovation is a deep nZEB-renovation.
- We can conclude that the EPC before and after does allow to assess whether the renovation reached the nZEB-level.
- We can conclude that the EPC before and after does not allow to have a very realistic estimate of the real energy use before and after (and the energy bill before and after) but allows to estimate the factor of reduction of energy use (and energy cost).

## Annex 2

# EPC Proof pilot dwellings Estonia

### Pilot 1 (Tiigi 8, Tartu)

- Characteristics of dwelling:
  - Multiapartment building with 58 appartments
  - 10 546 m<sup>3</sup> volume, net floor area 2935m<sup>2</sup>, heat loss surface of 2646 m<sup>2</sup>
  - Built in 1961

#### Characteristics of homeowner:

- different typs of families
- all apartements are privately owned by inhabitants
- in 90% of apartements owners living inside, 10% tenants

#### Renovation profile:

- Deep renovation (many measurements)
- Renovation will be carried out with a consultant and by apartement association
- Before renovation technical design for deep renovation was composed and calculated energy performance certificate was composed

- Key figures of efficiency from EPC:

Table 31 Key figures from EPC pilot 1 Estonia

	Before renovation	Target after renovation
<b>Energy needs (kWh/m<sup>2</sup>), also called EPC-value</b>	270,5	89
<b>Net annual heat energy use (kWh/m<sup>2</sup>),</b>	177	24
<b>Net annual power energy use (kWh/m<sup>2</sup>),</b>	71	47
<b>Produced energy with PV (kWh/m<sup>2</sup>),</b>	-	12,2

- Main measures:

Section	Measure
Envelope, façade	Insulation: from U-value 1,15 to U-value 0,17
Floor on cellar	Insulation: from U-value 0,8 to U-value 0,35
Intermediate ceiling, attic	Insulation: from U-value 0,7 to U-value 0,08
Windows	Replacement: from U-value 2,20 to U-value 0,9
Door	Replacement: from U-value 2,00 to U-value 1,5
Ventilation	Before renovation: natural (no system) After renovation: mechanical with heat recovery
Heating	Before renovation: district heating for heating and partly gas devices per apartment and partly electrical boilers for hot water After renovation: district heating for heating and for hot water
Renewable energy	Before renovation: none. After renovation: 47 kW PV station on rooftop

- Total cost of renovation: € 1 100 000
  - Subsidies: total € 583 000
  
- Real, measured energy savings:
  - Energy use before renovation: based on real, measured data
  - Energy cost before renovation: based on cost of energy shown in invoices
  - Energy use after renovation: based on calculated energy performance certificate EPC. Calculated energy performance certificate is obligatory to have for renovations and can be in force up to 10 years. It is optional to have after renovation EPC based on real metered consumption data
  - Energy cost after renovation: based on real energy costs

### Quality control making use of the EPC (for pilot 1)

#### 1/ energy savings and cost savings

As it is impossible to measure the real energy savings before and after (see above). As a proxy, it can be estimated based on the EPC. This will lead to an estimated cost saving:

- Before:
  - Heat energy  $177 \text{ kWh/m}^2 \times 0,06 \text{ eur/kWh} = 10,62 \text{ eur/m}^2$
  - Electrical energy  $71 \text{ kWh/m}^2 \times 0,11 \text{ eur/kWh} = 7,81 \text{ eur/m}^2$
- After:
  - Heat energy  $24 \text{ kWh/m}^2 \times 0,06 \text{ eur/kWh} = 1,44 \text{ eur/m}^2$
  - Electrical energy  $47 \text{ kWh/m}^2 \times 0,11 \text{ eur/kWh} = 5,17 \text{ eur/m}^2$

This means that an estimated cost reduction on the energy bill is  $10,62 + 7,81 - 1,44 - 5,17 = € 11,81$  per squaremeter and in total cost savings are € 31 249 per year

The energy consumption savings are

Heat energy                    157 kWh/m<sup>2</sup>, in total 415,4 MWh per year

Electrical energy 24 kWh/m<sup>2</sup>, in total 63,5 MWh per year

It is already proved in other studies that the “calculated energy performance certificate”-value differs from measured real consumption data.

In Estonia, it is not obligatory to have EPC based on real consumption data. Its up to the owner to decide.

## **Pilot 2 (Aasa tee 1, Ilmatsalu, Tartu)**

- Characteristics of dwelling:
  - Multiapartment building with 18 apartments
  - 3283 m<sup>3</sup> volume, net floor area 1306 m<sup>2</sup>, heat loss surface of 998 m<sup>2</sup>
  - Built in 1972

Characteristics of homeowner:

- different types of families
- all apartments are privately owned by inhabitants
- in all apartments owners living inside

Renovation profile:

- Deep renovation (many measurements)
- Would not undertake such a project any more.
- Frustration because of bad experiences with some contractors. Happy with other contractors
- Renovation carried out by apartment association in cooperation with management company

- Before renovation technical design for deep renovation was composed

- Key figures of efficiency from EPC:

Table 32 Key figures from EPC Pilot 2 Estonia

	Before renovation	Target after renovation
<b>Energy needs (kWh/m<sup>2</sup>), also called EPC-value</b>	273	118
<b>Net annual heat energy use (kWh/m<sup>2</sup>),</b>	152	45
<b>Net annual power energy use (kWh/m<sup>2</sup>),</b>	68	39

- Main measures:

Section	Measure
Envelope, façade	Insulation: from U-value 1,5 to U-value 0,18
Floor on cellar	Insulation: from U-value 0,8 to U-value 0,35
Flat roof	Insulation: from U-value 1.7 to U-value 0,14
windows	Replacement: from U-value 2,20 to U-value 1,10
Door	Replacement: from U-value 2,00 to U-value 1,5
Ventilation	Before renovation: natural (no system) After renovation: mechanical with heat recovery
Heating	Before renovation: Individual heating devices per room, on electricity. After renovation: district heating + warm water, partly on solarthermal
Renewable energy	Before renovation: none. After renovation: 34 m <sup>2</sup> solar thermal

- Total cost of renovation: € 420 000

- Subsidies: total € 168 000
- Real, measured energy savings:
  - Energy use before renovation: based on real, measured data
  - Energy cost before renovation: based on cost of energy shown in invoices
  - Energy use after renovation: based on calculated energy performance certificate EPC. Calculated energy performance certificate is obligatory to have for renovations and can be in force up to 10 years. It is optional to have after renovation EPC based on real metered consumption data
  - Energy cost after renovation: based on real energy costs

### Quality control making use of the EPC (for pilot 1)

#### 1/ energy savings and cost savings

As it is impossible to measure the real energy savings before and after (see higher). As a proxy, it can be done based on the EPC. This will lead to an estimated cost saving:

- Before:
  - Heat energy  $152 \text{ kWh/m}^2 \times 0,06 \text{ eur/kWh} = 9,12 \text{ eur/m}^2$
  - Electrical energy  $68 \text{ kWh/m}^2 \times 0,11 \text{ eur/kWh} = 7,48 \text{ eur/m}^2$
- After:
  - Heat energy  $45 \text{ kWh/m}^2 \times 0,06 \text{ eur/kWh} = 2,7 \text{ eur/m}^2$
  - Electrical energy  $39 \text{ kWh/m}^2 \times 0,11 \text{ eur/kWh} = 4,29 \text{ eur/m}^2$

This means that an estimated cost reduction on the energy bill is  $9,12 + 7,48 - 2,7 - 4,29 = \text{€}9,61$  per squaremeter and in total cost savings are €9 590 per year

The energy consumption savings are

Heat energy 107 kWh/m<sup>2</sup>, in total 106,7 MWh per year

Electrical energy 29 kWh/m<sup>2</sup>, in total 28,9 MWh per year



It is already proven in other studies that the “calculated energy performance certificate”-value differs from measured real consumption data.

In Estonia, it is not obligatory to have EPC based on real consumption data. Its up to the owner to decide.

Before renovation (Figure 8)



*Figure 8 Pilot 2 dwelling Estonia before renovation*

After renovation (Figure 9)



*Figure 9 Pilot 2 dwelling Estonia after renovation*