Increasing awareness and adoption of low-carbon technologies through demonstration homes

Testing installation of technologies through demonstration exemplars

Produced for the Triple-A project: Stimulating the Adoption of low carbon technologies by homeowners through increased Awareness and easy Access

Project No. 2S02-029

With the financial support of

Authors and contribution from

NAME	ORGANISATION
Francesca Baylis	KCC
Erwin Mlecnik	TU Delft
Minyoung Kwon	TU Delft
Marianne de Snoo	City of Rotterdam
Oubbol Oung	City of Rotterdam
Lina Nurali	City of Antwerp
Coen Vos	City of Breda
Kémal M'Foungoulie	PSEE Hauts-de-France
Ighor Van de Vyver	City of Mechelen
Bart Van Camp	EOS Oostende
Annick Vercruyce	EOS Oostende

Contents

1. Introduction

Background

The Interreg 2 Seas project "Triple-A" aims to increase Awareness, create easy Access and thus increase the Adoption of low-carbon technologies by homeowners of single-family houses. The approach is largely focused on local authorities supporting the customer journey and includes:

- providing information on websites (WP1).
- helping homeowners understand and monitor energy consumption by providing home energy management systems (HEMS) (WP2).
- engaging residents through pop up consultancy (WP3).
- testing the installation of different technologies in demonstration exemplars (WP4).

Local authorities in the 2 Seas region face the common challenge to stimulate homeowners to adopt low-carbon technologies, which is crucial to achieve regional and EU targets for reduction of CO_2 emissions. Nearly 50% of the final energy consumption in the European Union is used for heating and cooling, 80% of which is used in buildings. The member states of the European Union therefore strive to ensure that the building stock, which accounts for approx. 36% of total EU CO_2 emissions, is carbon-neutral by 2050. This is linked to the necessary efforts of local authorities to renovate their building stock with regard to energy efficiency and the use of renewable energy sources (See also the European Energy Performance of Buildings Directive, additions 2018).

About 50% of the dwellings in the project partner regions consist of single-family (terraced and (semi) detached) housing in the owner-occupied sector. Thus, there is an enormous potential to reduce CO_2 emissions by stimulating homeowners to adopt low-carbon technologies. However, it can be very difficult to implement effective programmes for retrofit and to engage homeowners to undertake these works. One approach to this is the use of demonstration homes.

Who is this document for?

This document is aimed at interested parties including local authorities, businesses, consultants, and other stakeholders who would like to see an increase in (the adoption of) low-carbon technologies.

What is the purpose of this document?

Amongst other objectives, the Triple-A project aimed to install demonstration exemplars of a variety of low-carbon technologies to increase awareness and adoption of these (building/construction) technologies by homeowners. Through this, the adoption of low-carbon technologies became normalised and created ambassadors for the technologies who can influence other homeowners. This document aims to outline the process used to implement these demonstration homes and provides examples and guidance from the experience of the project partners.

The demonstration exemplars implemented ranged in their approaches but were grouped into four different types:

- Model A: Utilising new and innovative technologies.

- Model B: Whole house or nearly-zero carbon retrofit.
- Model C: Large scale or community wide mass retrofit.
- Model D: Longer term phased retrofit.

These models were explored using a structured approach, taking into account various aspects. These stages are discussed in more detail throughout this document, which includes the lessons learnt at each stage:

- Identifying suitable target areas in 8 local authority regions for single-family home renovations
- Exploring citizen segments in target areas and related engagement opportunities
- Identifying suitable financial incentives for engaging single-family homeowners
- Testing installation of technologies through demonstration homes
- Evaluating CO_2 reduction of demo exemplars and awareness raising

Customer Journey

Triple-A aims to help residents throughout the customer journey and thus increase adoption.

Awareness	•Becoming aware of low-carbon technologies
Attitude	•Changing attitudes around low-carbon technologies
easy Access to advice	•Gaining interest in low carbon technologies •Becoming active in looking for low carbon technologies
easy Access to solutions	•Considering options •Selecting suppliers and installers
Aid during implementation	•Financing for low carbon technologies
Adoption	•Installing the technology •Experiencing and utilising the technologies
Acknowledgement afterwards	•Seeking service •Sharing experiences •Wanting more

1.1. Process

Identifying suitable target areas in 8 local authority regions for single-family home renovations

The first stage of implementing the demonstration homes was to identify the target areas for these installations. All partners developed a target area analysis based on a customer segmentation approach with criteria specific to their areas. A range of criteria were considered by different partners, including:

- **Household Energy Use or current carbon emissions.** This was based on the information available, for example in the UK homes have Energy Performance Certificates.
- **Index of Multiple Deprivation Data, income, or fuel poverty data.** Depending on the funding available, different circumstances could be targeted. If funding is available, those who most need help can be prioritised but if none is available then able-to-pay residents can be targeted.
- **Existing installations of low-carbon technology.** This could help determine the suitability of the installations for those home types. If there has been a lot of renovation already there may be less demand, but similarly if there have been no installations there may be a lack of interest.
- **Primary energy use.** Depending on the installations taking place, these could be more effective on certain energy types. For example, homes with heating that uses electricity may find greater benefit from solar PV panels.
- **Tenure type and percentage of different tenures.** There could be additional challenges but also additional benefits depending on the tenure.
- **Household characteristics/ Market segmentation data.** This could help inform the likely demand or interest in the project.
- **Evidence of the area having political support for the scheme or engagement with the Triple-A project.** Areas that have already invested in the project, who have support or who are observers are more likely to engage with the exemplars.
- **Population demographics.** Some partners used this data to determine the number of residents in an area aged over 65 or below 12 who may be especially vulnerable to the cold, and therefore more interested in low-carbon renovation and insulation.
- **Property age/period.** This could help determine the likelihood that households can have Low-Carbon technologies and which types they may be eligible for, for example cavity wall insulation or solid wall depending on the building construction.
- **Moving intensity**: Homeowners who move regularly are less likely to be engaged in the neighbourhood, so unlikely to invest in the neighbourhood or the house.
- **Uniformity of houses**. Houses built in the same style and time period allow the opportunity for collective renovation.
- **Plans for public space works.** This could present the opportunity to link a collective renovation to planned works.
- **Other local schemes.** Other schemes in the area give the opportunity for joined up working and better engagement.
- **Attachment of the house.** Collective terraced or semi-detached houses could be suitable for repetitive or collective renovation.

- **Previous research.** Some partners already had additional information from previous projects or schemes.

Different criteria were selected depending on the local area, the funding available and the type of demonstration exemplar being considered. Following the selection of criteria, potential areas were scored based upon these to identify the most effective target areas.

Case study: Rotterdam segmentation of the population to select pilot areas

To define its target areas for Triple-A, Rotterdam used its municipal database to determine which districts and, within those districts, which neighbourhoods contained most owner-occupied, terraced houses built before 1990. This selection, purely based on numbers, led to Prins Alexander and IJsselmonde as Rotterdam's target areas for this project.

After the two districts were selected that would be Rotterdam's Triple-A target areas, these two districts were further analysed in order to determine what were the most promising parts of the districts, so that the efforts could be focussed on these specific neighbourhoods. Because the areas to be analysed are now reduced in size, data on the smallest possible scale (within the boundaries of privacy protection) were obtained from the municipal databases. The data were expanded with data showing residents' age category (residents older than 65 years are less inclined to take measures), household size (single-person households are less inclined to take measures) and attitude towards sustainability (using the lifestyle segmentation according to the Five shades of greener model (Motivaction); the 'dutiful' and 'responsible' segments are most likely to take measures). These data were combined to find the neighbourhoods and even building blocks that met multiple criteria at once. This has been done by overlaying maps based on those data. It turned out that Prins Alexander had many more favourable parts than IJsselmonde, due to the characteristics of the population.

Since it was evident that not only residents with a positive attitude towards sustainability would be met, especially in IJsselmonde, Rotterdam thought of ways to communicate about energy saving measures to the different lifestyle segments, using the Business Model Canvas. Even though it is difficult to bring these different approaches into practice - one does not always recognize a person's lifestyle at a glance - it did serve to become aware that it is not useful to have one standard message derived from one's own point of view. Instead, it is important to listen carefully and try to link the message to values that become apparent in the conversation.

In this case, characteristics of the population including lifestyle segmentation did not influence the selection of the target areas on district level, simply because it was still too complicated and time consuming at the first stages of the project. However, in new projects, these data can help policy makers to choose areas for campaigns with the highest expected success rate, or to choose a location for a pop-up consultancy centre. Also, communication strategies can be tailored to different audiences in order to reach them better. Triple-A definitely offered Rotterdam a learning opportunity to make better use of its available data in projects.

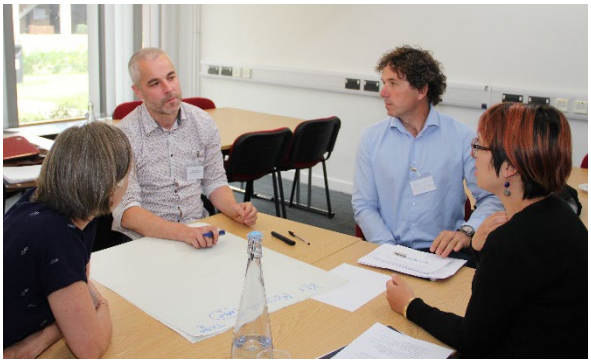
What worked well with this approach:

- Allowed better targeting of our target audiences.
- Enabled a neighbourhood approach for similar house types.

Lessons learnt:

- The factors used are very specific to the partner so will depend entirely on what you want to get from the demos and who you want to reach.

Exploring citizen segments in target areas and related engagement opportunities



Following this, an engagement strategy was developed through a partner workshop (shown in the photo on the right). Each partner chose to focus on a different target audience and so had different engagement strategies. These strategies considered multiple factors. Firstly, workshop participants identified several principles for good communication, which were highlighted for use throughout the project:

- Engagement must be targeted to your audience to allow better tailoring of your message, efficient spending of budget, and to avoid falling into specific communication habits that become less effective over time. See table 1.
- Understand the motivations and barriers of your audience.
- Engagement is very resource intensive and needs 3-12 months to generate demand.
- The offer to homeowners must be clear, consistent, and simple to understand.
- Training local homeowners and community representatives to act as ambassadors can help encourage other residents to get involved.
- Offers should be unique and different to other schemes for the best impact.
- Offer energy advice locally through pop up consultancy centres(see Output 3), as face-to-face contact is more effective than cold acquisition.
- Try and engage residents emotionally, especially emphasising visually the advantages and not just the practical implications.

A workshop was used to develop an idea of the possible citizen segments in target areas and the key messages that would be effective for these audiences. These segments are not mutually exclusive, and homeowners can fall into multiple categories and so benefit from multiple messages. These segments and the key messages identified for these are summarised in table 1.

Table 1: Description of different target audiences and the key messages for these audiences

Target audience category	Description	Key messages
Young families	Potentially high energy users who may be receptive to piloting technologies that could save them energy and money.	"No hassle improvements to your home" "Save money on your energy bills" "Increase the value of your home" "Improve your living comfort and health"
Empty nesters	With children who have recently left home, these	"Make a safe investment for your property"

	homeowners may want to renovate their existing home and may have some savings to make the property more comfortable. Alternatively, these homeowners may want to move to a new home and make energy upgrades during this process	"Make a socially responsible investment" "Make energy improvements to your home – in stages" "Saving energy and money, it's the 'smart' thing to do" "Grow your assets" "Increase the value of your property" "Increase your comfort"
Existing adopters	These homeowners have already adopted one low-carbon technology and may be willing to trial other technologies. These homeowners may be early adopters of technologies.	"Increase the financial value of your property" "Increase your thermal comfort" "Improve the appearance of your home" "Be an ambassador for your community"
Major life changes	These homeowners are experiencing change, for example moving home due to a new job or looking to sell their property due to a change in circumstance. These homeowners may be receptive to emotional messages.	"Renovate and improve each rooms of your home". Examples: "Recover heat in your kitchen and bathroom" (through a more efficient boiler" "Improve the thermal comfort of your living room and bedrooms" (through insulation and ventilation) "Save water and energy in your garden" (by rainwater harvesting) "Save money and energy for your car (by installing an electric vehicle charge point)" "Use your energy when you need it most by storing it (battery storage)" "Generate your own energy" (Solar PV)
Highly educated, financially successful	These homeowners may have some disposable income to invest and may be more willing to take a risk. These homeowners may also be more environmentally conscious and willing to trial technologies for their environmental benefits.	"Increase the value of your property" "Make no fuss, easy to install, energy upgrades to your home" "Create a healthier internal living environment" "Be a front-runner in your neighbourhood" "Save energy and the environment"
Receptive to renovations in their neighbourhood	Word of mouth and visually seeing what renovations a neighbour has made, can make homeowners more willing to undertake the	"Go see what your neighbour is doing" "Recommend a friend"

	same renovations. These homeowners would therefore be more receptive to the wider roll-out of these technologies, rather than the initial pilot targeting. These homeowners may be receptive to emotional messages with reference to their status within a group	
Fuel Poor	These homeowners struggle to pay their energy bills and may be vulnerable to the effects of living in a cold home as a result.	"Save money to heat your home" "Generate your own electricity for free"

According to our experience, the following questions can be used to determine a specific engagement strategy

1. **Which engagement methods should be employed?** these were based around four categories: Face-to-Face; Media/Press; Publications; Social Media
2. **What is the Aim of this Method?** (E.g., is the method purely to give information? Do you need to gather information? Do you want commitment or sign-up from the homeowner?)
3. **Which audience is this addressing?** Each method should target one of the seven Target audiences (table 1)
4. **Who should deliver this engagement method?** (E.g., Local authorities themselves, resident champions)
5. **How can we evaluate the success of this engagement method?**
6. **What is the initial next step needed to kick-start this engagement method?**
7. **Does this engagement method have a cost implication?** If so, how intensive? (E.g., financial, staff, other)

What worked well with this approach:

- Engaging residents through champions and other invested residents is effective
- Including financing options in these communications helps increase awareness.
- Considering your target audience allowed far more tailored communication

Lessons learnt:

- Must be sure not to just focus on technical advice and include other aspects of the installations.
- Open home events are difficult to put together but very satisfying when they work well.
- If your target audience is a working homeowner, face-to-face events and sessions should be held in evenings and weekends, as well as during the day, to cater for homeowners who work during the day.
- Press and social media should be used cautiously. It is not the most targeted way of reaching specific audiences unless using specialised press and channels. It is advisable to include the benefits and a call to action - to capture the attention of busy homeowners.
- When encouraging whole house retrofit, be aware that it is an ambitious form of retrofit, so ensure the staff have sufficient technical knowledge to be able to provide advice.
- Diversify your channels if you have multiple target audiences. The things that work for one audience won't necessarily be as effective for others.
- Some people will be better engaged through peer-to-peer communication, whether through events or through using ambassadors. Don't forget to utilise this resource.
- Unless partners can resource telephone enquiries, they should be cautious in using telephone as a communication method across a large area.
- Smaller pilots should avoid having too many channels of communication to resource and concentrate on managing a few channels effectively.

Identifying suitable financial incentives for engaging single-family homeowners

All partners then considered the finance and funding available to underpin the delivery of their demonstration exemplars. There can be many local differences according to local authority regions, see Annex 1, summarising the financial incentives at the initial stages. Financial incentives were also updated throughout the project as the offer changed. Finance and funding were defined different for the sake of the project.

FUNDING: is a monetary contribution to the cost of measures that does not need to be repaid. It will typically take the form of a grant provided to the resident by another party, for example the local authority (through Triple-A, or other sources).

FINANCE: is (effectively) a loan or other monetary mechanism which requires repayment over an agreed period of time, and at a specific cost (interest rate). Even where finance is being provided at zero cost (i.e. a 0% interest rate) it should be classed as 'finance' and not 'funding'. Finance could be provided by a bank or other financial institution (e.g. mortgage provider) but also other regulated third parties including local authorities.

Different monetary incentives were available depending on the region, with some having very little funding available but others have multiple types at their disposal. The funding methods available across the partners were:

Individual subsidies

- from a range of sources including energy grid operators, energy companies, central and local government.

- These covered a range of measures, including insulation, glazing, heat pumps, electricity, replacement boilers, first time central heating and solar water heaters.
- Some had specific conditions such as renovation subsidies for older properties. These were up to 10,000 euros for different measures, but the properties had to be at least 30 years old.
- Some had incentives for multiple measures, such the BENO-pass subsidies for multiple measures or total renovation being completed.

Group subsidies

- Neighbour subsidies that provided incentives for multiple neighbours renovating at the same time, scaling up the more neighbours participated.

Property tax incentives

- This included a reduced rate of property tax for a 5-year period following renovation.
- The rate of discount depended on the property type and the scale of renovation.

Added tax incentives

- These covered installation costs for solar panels and insulation.

The financing options employed by different partners mainly centred around using energy savings to finance investments, loans from private banks or loans from the local authority. There were also options for renting the Low-Carbon technologies.

Details of the funding and finance used by different partners are shown in appendix A.

What worked well with this approach:

- Providing more information on financing options helps residents make decisions.

Lessons learnt:

- Requirements and eligibilities can change quite regularly so need to be monitored.

1.2. Implementation of demonstration exemplars

Description of demo types

The demo types were split into four categories. Each partner has a different model for their pilot projects based on their political support, population type, and local schemes already in place that could be linked to. Despite the different models, these were organised into four groups of demo type described below:

1. Model A: Utilising new or innovative technologies; this was looking at the use of battery storage systems when combined with solar panels to increase their effectiveness.
2. Model B: Whole house or nearly zero carbon retrofit; this often included a range of measures to make the house as energy efficient as possible.
3. Model C: Large scale or community wide mass retrofit; this included group buying schemes or whole neighbourhood approaches

4. Model D: Longer term phased retrofit; for this model, the measures tended to vary but there were often only one of two measures being installed each time depending on the circumstances of the homeowner. This model included some more resident-led models to drive renovation and more engagement before the measures were installed.

A summary of the model types and carbon savings achieved per partner are shown below:

Project Partner	Name and type of demo exemplar and model	Number of implemented tests, pilots, demo actions and feasibility studies in this demo exemplar	Carbon savings achieved in this demo exemplar/ tonnes per annum
City of Antwerp	B	54	56.6
City of Breda	D	134	138.9
Kent County Council	A	10	14.0
City of Mechelen	A + B	18	17.5
PSEE Picardie	B, C,D	622 (B=61, C=62, D=499)	2,378.0
City of Rotterdam	A, B, C, D	1,261 (A=4, B=21, C=187, D=1049)	817.7
EOS Oostende	C	363	249.0
TOTAL NUMBER		2,462	3,671.7

STANDARDISED CONTRACTS AND PROCUREMENT

Procurement varied between partners, with some choosing to do the whole process themselves and others choosing to collaborate more with business and consultancies. There was also a difference in how involved partners were with the customer journey, with some choosing to make the introduction of homeowners to installers and others guiding homeowners through the full process of the installation.

To simplify the procurement and contract process for demonstration homes, partners developed standardised key points for contracts across regions. The key considerations were:

Relationship and Responsibilities: It is of vital importance to have absolute clarity in this regard, especially where any funding is being provided by third parties. Providing

funding and recommending particular contractors can lead to a duty of care which each partner needs to carefully consider:

1. Who is in contract with whom, and on what basis?
2. Which services are being provided?
3. Who defines whether works completed are fit for purpose? i.e. Who signs off the work and contract?
4. Are there additional duty of care issues which partners should be aware of?

Funding and Finance: Each of the retrofit models will require a different combination of funding/finance to enable implementation, and how that flows between the different stakeholder needs to be fully understood. In particular, the resident needs to agree to this process and it therefore needs to be appropriate and attractive:

1. Who is paying whom, what and by when?
2. How does the flow of funding work?
3. What is the trigger point for payment?
4. Who is responsible for payment and what happens if payment is not made?
5. Who carries the risk associated with non-payment?
6. How will repayments – if used – be collected?
7. Are the terms and conditions of funding and/or finance separate to the main contract, or included within it?
8. Is the model and associated funding contracts State Aid compliant?

Descriptions and Details: The description of the works needs to be clear within the contract, with sufficient detail to be able to resolve any issues in due course (see section above on responsibilities). The resident needs to be certain about what they are paying for and the contractor needs to be clear about what they are delivering. Any exclusions should be clearly laid out and agreed prior to signing. Any contractor terms and conditions should be reasonable and appropriate, and ideally underpinned by national standards and associated consumer protection rules:

1. How is the (detail within the) contract presented?
2. Are all products specified accredited for use in the particular scenario?
3. Is it easy to understand and clear for non-specialists?
4. What consumer protection measures are included?
5. Is there a complaints resolution system in place and a route to the ombudsman?
6. What insurance cover is in place to protect the different parties if something goes wrong?

Aftercare and Assurances: On completion of the work, the resident will need to receive the necessary quality assurance and formal warranty/guarantee documentation associated with the measure(s) installed. When/if things go wrong, once the contractor has left site, it is important that a means of resolving any issues is in place and that the aftercare is suitable. Sometimes this aftercare could include the local authority in terms of monitoring and assistance, and other times it is just the contractor. It is also in the long-term interest of the contractor to provide quality care and build their reputation:

1. What is the product warranty period?
2. What is the installation workmanship warranty period?
3. Who is providing the warranty measures, under which recognised system, and by when?
4. What level of aftercare exists under the contract? How quickly are contractors required to resolve issues?
5. What period of aftercare exists / What is the defects liability period? Who oversees this?
6. Is there an independent oversight body to which disputes can be referred if necessary?

What worked well with this approach:

- Standardised processes made the installations simpler for home owners

Lessons learnt:

- There won't be a one-size-fits-all contract that works for all countries, but the principles are the same.

Co-creation opportunities

Throughout the process partners have worked with external services to help install demonstration homes. This has mainly been through commissioned providers and consultants but has also included energy companies and other local authorities. This partnership working proved effective at implementing the demonstration homes and sharing expertise to engage residents.

Testing installation of technologies through demonstration homes

To measure the benefits of installations, a method to calculate carbon emissions savings had to be developed. This protocol aimed to ensure a standard approach between partners, and to ensure the data that was collected was consistent between partners.

To develop this approach, the partners considered what they currently used to gather carbon emissions data, and the commonalities between partners. We identified that all partners currently use a national model for projecting energy use, and all local authorities will be working with supply chains and installers, and hence will find similar challenges.

It was established that a joint approach between countries would not be effective due to the differences in carbon emissions per kw of energy between countries. Therefore, an emissions factor per country was identified from the national standards for use in the calculation.

The calculation developed to identify the carbon savings was:

[Energy demand prior to measure (kWh) – Energy demand post installation (kWh)] x relevant emissions factor ($kgCO_2/kWh$) / 1000 = tCO_2/a

The emissions factors were:

Member State	Grid and displaced electricity	Natural gas	Heating Oil	Biomass
	kgCO_2/kWh			
UK[1]	0.519	0.216	0.298	0.039
NETHERLANDS	0,530[2]	0,204[3]	0,267	0/ 0,395[4]
FRANCE	0.09	0.241	0.329	≈ 0.013
BELGIUM	0,258	0,202	0,279	0

There were some issues with the calculations, such as the performance gap between the emissions savings predicted per measure and the actual savings observed. The figures were also quickly outdated as some national guidelines were from as far back as 2012 and so not reflective of the current emissions factors. For this reason, the carbon savings emissions for partners ended up being from installers, or from the actual data captured through the use of HEMS (Home Energy Monitoring Systems – another Triple-A approach). Each partner's approach to calculate carbon savings has been summarised in the table below:

Kent	Real data from the HEMS system was collected to show the energy produced by the solar panels, as opposed to the total energy use. This allowed us to convert the number of kWh produced by the solar panels into the carbon dioxide that would have been produced for the same number of kWh from the grid.
Rotterdam	Based on national prefix values from Dutch Ministry RVO/Milieu Centraal.
Antwerp	The carbon savings calculation that is used for the Flemish Energy loan. For the energy loan carbon savings need to be calculated as well. Antwerp used the same calculation spreadsheet. In order to calculate the savings, you need to know the m² of insulation or glazing, kWp of solar panels and type of fuel used for the heater (gas, fuel oil or electricity).
Mechelen	Mechelen applied the national EPC calculation method before and after the renovation[5]. Each homeowner is monitoring the energy consumption using EnergieID (since 1/11/2018) and EnergieID+June Energy (since 21/2/2020). The energy consumption figures for 2019 (after renovation) indicate CO_2 emissions of 2,43 ton CO_2/year (this includes electricity for appliances and lighting) which seem to correspond with the estimated CO_2 emissions (after renovation). Energy consumption figures before renovation are not available.

[1] Source: BRE: http://www.bre.co.uk/filelibrary/SAP/2012/SAP-2012_9-92.pdf

[2] Source: CBS: https://www.cbs.nl/nl-nl/achtergrond/2017/06/rendementen-en-co2-emissie-elektriciteitsproductie-2015

[3] Source: RVO report "Nederlandse lijst van energiedragers en standaard CO2 emissiefactoren, versie januari 2017"

[4] Partners in the Netherlands must agree which of the two emissions factors to use for Biomass as different figures have been provided. Under Kyoto and EU ETS: emission factor for biomass is 0, but in other countries biomass is considered to never be zero and to always release some emissions.

[5] https://www.energiesparen.be/epc

PSEE	For all the demos, a thermal study is made to evaluate energy savings and carbon savings. PSEE uses the software called "DialogIE", developed by the French Environment and Energy Management Agency.
Oostende	1 kWp installed = 0,899 kWh produced Savings = 0,209 kg/kWh produced This was based on the installed capacity identified by the installers.
Breda	Used the Milieucentraal database (www.milieucentraal.nl) and the Woonwijzerwinkel Rotterdam.

What worked well with this approach:

- There are similarities between countries on the types of data available.

Lessons learnt:

- It is difficult to keep up with changing emissions factors given the speed of decarbonisation

Evaluating CO_2 reduction of demo exemplars

Between all partners, 1640 demo homes had measures installed, resulting in combined carbon savings of 3,383.02 tonnes of CO_2 per year. These results exceeded the target for the number of demo homes by over 140 homes and was close to the carbon savings target of 4,191 tonnes. The reduced carbon savings from the target was thought to be shifting types of demo from those with larger carbon savings to those with smaller savings. The partners found difficulty encouraging residents to undergo whole house (nearly zero carbon) retrofit, leading to many taking on smaller measures instead. There has also been significant decarbonisation of the electricity grid since the project proposal and so for those partners who get carbon savings data from their installers it can be difficult to ensure the 2015 carbon figures are used. Although actions were taken in the target areas, there was a spill-over effect in the wider region and to other LAs.

Open home and experience sharing events varied between partners, with some hosting events at the demo homes while others chose to do poster campaigns to share resident experiences with demos. The target for thermographic surveys was greatly exceeded through some partner collaborations with other European projects and schemes.

An overview of the current progress made against KPIs is seen below, this will continue until the end of the project.

KPI	Current progress
Number of open home and experience sharing events	27
Number of visitors to open home and experience sharing events	90
Number of thermographic surveys completed	1599
Number of feedback surveys from residents	199

Antwerp focused on model B-, the whole house or nearly-zero carbon retrofit. They engaged with 10 neighbourhoods and focused on installations of insulation (roof and cavity wall), new heating systems, solar panels, and new glazing. They found multiple barriers to

nearly-zero carbon retrofit, as homeowners were reluctant to undergo these works due to time, financial obligations, and building permits. However, 38 homeowners were engaged to install a total of 54 measures. This achieved a saving of 54.57 tonnes of CO_2 per year. They have also since installed battery storage for two homeowners through the cVPP project. This comprised of 2 saltwater batteries, one homeowner retrofitted this to their existing Solar PV installation and others installed Solar PV alongside this in collaboration with ZuidtrAnt. EMS system from battery will be used in combination with energieID for monitoring and control

Breda planned to implement models B- whole house or nearly zero carbon retrofit and model D- longer term phased retrofit. Breda's model focused on education of residents through a collaboration with Bres (an energy cooperative), to provide information sessions, the pop up (over 2,000 registered visitors) and kitchen table advice sessions (approximately 500). Actions were not directly recorded but were determined through follow-up contacts with homeowners 6 months after their visits, and records of energy saving loans granted in Breda were recorded over the three years. Breda also had difficulty with model B and found no residents have completed whole house retrofits. However, they had great success with model D and achieved 134 demo homes in the specific areas with 391 in wider Breda. This achieved savings of 138.9 tonnes of CO_2 per year and 381.1 tonnes of CO_2 per year, respectively.

Kent County Council focused on model A-, utilising new or innovative technologies. Kent County Council engaged their twelve districts to identify three districts where the demos should take place. 10 demo homes were then selected and had solar PV systems, battery storage and HEMS installed. This allowed Kent County Council to monitor the real time energy savings the systems provided. Residents were also monitored with regular surveys. These measures achieved a saving of 14 tonnes of CO_2 per year. A picture of the battery storage setup is shown on the left.

Mechelen implemented models B- whole house or nearly-zero carbon retrofit and model D- longer term phased retrofit. For model B-, Mechelen tried a neighbourhood approach but achieved one installation finding similar barriers to whole house retrofit as Antwerp and Breda. This model achieved a saving of 9.2 tonnes of CO_2 per year. For model D-, Mechelen used a neighbourhood approach again, but this time using an ambassador from the area who had approached them. Mechelen facilitated the process by offering free home visits with renovation advice, co-organising neighbourhood gatherings and offering financial support (neighbourhood subsidy and energy loans). Through this method they achieved 17 demo homes (with 4 more homes joining past the deliverable deadline) and a carbon saving of 8.6 tonnes of CO_2 per year.

PSEE installed demos of model types B- whole house or nearly-zero carbon retrofit, C- large scale or community wide mass retrofit, and model D- longer term phased retrofit. For model B-, PSEE carried out in-depth thermal analysis of the homes and developed personalised work programmes with energy renovation coaches. Through this model PSEE achieved 61 demos with a carbon saving of 227 tonnes of CO_2 per year. For model C-, PSEE reached out to everyone in a street or neighbourhood when one of the residents used their services to try and engage further residents. Through this model they achieved 62 demos and carbon savings of 250 tonnes of CO_2 per year. For model D-, PSEE offered the same thermal analysis as model B- with half day visits with an energy renovation coach. Through this method they achieved 499 demos giving carbon savings of 1901 tonnes of CO_2 per year.

Rotterdam implemented demos from model types A- utilising new or innovative technologies, B- whole house or nearly-zero carbon retrofit, C- large scale or community wide mass retrofit, and model D- longer term phased retrofit. For model A-, Rotterdam commissioned the regional energy counter (WoonWijzerWinkel) to install battery storage systems in homes. This model achieved 4 installations and a saving of 4.8 tonnes of CO_2 per year. For model B-, Rotterdam used collaboration with WoonWijzerWinkel and Klimaatroute to carry outdoor-to-door recruitment by providing energy scans if residents were interested. On request, Rotterdam then supported the resident further with installations, yielding 21 measures installed across five houses. This gave a carbon saving of 16.9 tonnes of CO_2 per year. For model C-, Rotterdam collaborated with WoonWijzerWinkel to organise group purchases to get group discounts through combined requests. Through this model 187 homes had installations giving carbon savings of 172 tonnes of CO_2 per year. For model D-, Rotterdam used the door-to-door recruitment model again with collaborators to achieve 1049 measures across 435 homes. This model gave carbon savings of 624 tonnes of CO_2 per year.

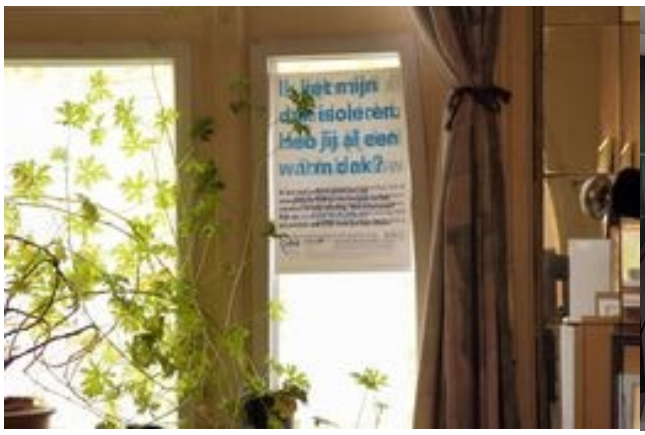
Oostende installed demos of model type C- large scale or community wide mass retrofit. Oostende collaborated with iChoosr to organise a group purchase of solar panels. Oostende provided information sessions, advertising, and social media engagement for those interested. They also requested homeowners who signed up showed their engagement through posters at the home and during events to help incentivise neighbours to get involved. Through this model Oostende achieved 363 installations and a carbon saving of 249 tonnes of CO_2 per year.

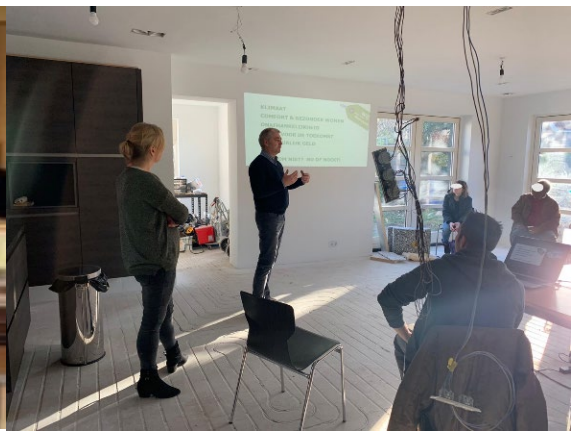
1.3. Sustaining Demonstration Exemplars

Once demonstration homes were completed, partners organised open home and experience sharing events to help engage more homeowners. These events varied depending on the needs of the partner, and included:

- some organised tours of demo homes to allow residents to see the technology in situ and talk to the owners of the demonstration homes about their experience
- poster campaigns sharing resident experiences with the technology and the process of installation
- Web modules that focused on sharing case studies and the experience of homeowners with renovating their homes
- Experience sharing events where homeowners engaged with their neighbourhood and shared their experience with renovations. This was led by an LA organiser who would interview the homeowners beforehand and also assist with technical information at the event.

Below are two pictures of different experience sharing events, one showing one of the experience sharing posters in Oostende and the other showing one of the LA led experience sharing events hosted by Rotterdam.





What worked well with this approach:

- The events were often the first engagement with home retrofit for some participants and were effective at engaging new audiences.
- The homeowner-to-homeowner approach ensured language was at the right technical level for non-experts.

Lessons learnt:

- A good rapport with the homeowners sharing their experience is integral to the success of the event, and fully understanding their experience.
- It can be difficult to find volunteers to share their stories or engage with the events. This tends to be more effective when done as part of a follow up visit following the retrofit or installation of technology.
- Open home events at people's homes were not as successful as it could be difficult to attract visitors. However, the online events proved to be popular.

1.4. Conclusion

This report is limited to the types of installations and the experiences of the Triple-A project. However, based on this, the following key recommendations can be made:

- Communication is very important and must be tailored to the area and audience you are targeting.
- Providing information on available funding, and clear technical information in layman's terms are very effective at raising awareness and access.
- Nearly-zero carbon retrofit can be difficult to implement but gives excellent carbon savings results.
- The majority of installations were phased retrofit as this allows the homeowners time to consider what they want to do next and see the effects of previous works before doing more.

A summary of the recommendations from partners for each technology type are shown below:

Model A: Utilising new or innovative technology

What worked well with this approach:

- The chance to stimulate the industry and provide more evidence for the benefits of battery storage systems.

Lessons learnt:

- Homeowners had some concern as the technology was less familiar to them.
- Make sure all technologies are explained well in common terms from the beginning to try and raise familiarity.

Model B: Whole house nearly zero carbon retrofit

What worked well with this approach:

- High carbon savings for each household where installations take place.

Lessons learnt:

- Whole house or nearly zero carbon retrofit has a huge financial, technical, and temporal impact, that homeowners are not always ready to accept.
- Homeowners wanted to assess all completed works before starting the next works.
- Sometimes needed building permits for the works.
- Residents don't always understand the necessity for zero carbon retrofit.

Model C: Large scale or community retrofit

What worked well with this approach:

- Community retrofit can get a lot of installations in one go.

Lessons learnt:

- Unclear legislation has an impact on the uptake by residents.

Model D: Longer term phased retrofit

What worked well with this approach:

- Easier to inspire people than other types of demo.
- Phased retrofit allowed residents the time between measures.

Lessons learnt:

- Lots of different options and advice as to what should be done first.

1.5. Annexes

Annex 1- Summary of finance and funding models employed by local authorities

Table 1: the funding options available for different project partners

Individual subsidies	**Subsidies Eandis (energy grid operator)- Antwerp, Mechelen, Oostende** Including roof or attic floor insulation, super-insulating glazing, insulation: cavity wall and outside wall, floor insulation, heat pump (max 40% of the total cost with a maximum depending of the type of heat pump), geothermic (4000 euro), air-water (1500 euro), hybrid air-water (800 euro) and air-air (300 euro), solar water heater (40% of the total cost, 550 euro/m² with a maximum of 2750 euro) **BENO-pass- Antwerp. Mechelen** Extra subsidy for a combination of min. 3 (1250 euro) and max. 7 (4750 euro) measures or total renovation. Measures have to be completed in max. 5 years **Flemish Renovation subsidy- Antwerp** Maximum 10.000 euro for different kind of measures (also not energy efficient related like electricity, new facades, new roof, plumbing etc…). The property has to be at least 30 years old and the subsidy has income conditions. **Improvement subsidy- Antwerp** For improvement measures like new windows, electricity, plumbing, new heating system,…). The property has to be minimum 25 years old and the subsidy has income conditions. **City of Antwerp subsidies- Antwerp** For energy investments above the subsidies of the energy grid operator Eandis: • Roof insulation: 3 euro/m² and 2 euro/m² extra if bio-based insulation materials are used. For more information see https://www.antwerpen.be/nl/overzicht/ecohuis-antwerpen/premies-en-lening • Solar water heater: 25 euro/m². • The city of Antwerp also gives a subsidy for green roofs: max. 30 euro/m² for max. 65m² green roof. **The renovation allowance- Antwerp** Offered by the home offices of the city of Antwerp. The value of the property cannot be more than 300.000 euro, has to be 20 years old and depending on the number of bedrooms you receive 50% of the total cost with a maximum of 9.000 euro. This is the only subsidy you have to request before the start of the renovation. For up to date information on the subsidies available in Belgium please visit: https://apps.energiesparen.be/subsidies/subsidiemodule. **Energy Company Obligation (ECO)- Kent**

	In cases where the residents in the demo exemplars would be interested in installing loft insulation, cavity wall insulation or heating systems, central government has obliged energy companies to provide grants to residents in the UK through a scheme called the Energy Company Obligation (ECO) fund. **ANAH Aid- SPEE** Grants available for homeowners to make renovations to their homes. **ISDE (Investment Subsidy Sustainable Energy)- Rotterdam** Thermal solar, heat pumps, biomass fired boilers and woodchips fired boilers. This ISDE is given as a grant to all private households after they have bought and installed the appliance **A subsidy on energy advise for house-owners- Rotterdam** Costs are 25 euro for houses built before 1990. If a measure is taken, the costs for advice are free. **Grant for houses built before 1990- Rotterdam** For which invest minimal 995 euro on insulation, one can get a grant for 100. **Subsidy for green roofs- Breda, Rotterdam** Per m2 implemented green roof, a grant is given of 20 euro.
Group subsidies	**Neighbour subsidy (BENOvatiecoach)- Antwerp, Mechelen, Oostende** To support collective renovation. The BENOvation coach receives 400 euro per homeowner. The homeowners have to subscribe and gather minimum 9 other neighbours to get the support of a coach. More information https://www.fluvius.be/nl/thema/benoveren
Property tax incentives	**Discount of property tax over 5 years- Antwerp, Mechelen** 50% for E30 and 100% for E20 for new buildings and 50% for E90 and 100% for E60 for major energy renovations in existing buildings with a building permit from 01/10/2016.
Added tax incentives	**Tax relief- Mechelen, Oostende** VAT 6% (instead of 21%) on invoice for renovation works done in a house older than 10 years. **Tax relief- Breda** Lower added tax rate on solar panels and insulation measures **Tax credits- SPEE** **Low tax (VAT) rate for insulation specific for labour- Rotterdam** This is 6% instead of 21%. **Tax (VAT) return for investment and installation- Rotterdam** Specific addresses, houses that are in bad maintenance-shape, can get free advice and help from the municipality to improve the housing quality, including energy. Measures taken, which are advised, are granted for 45% up to 3000 euro.

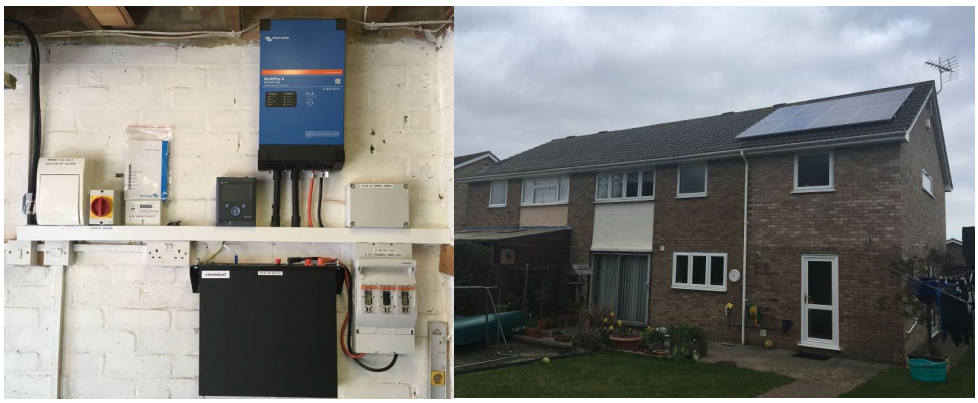
Table 2: the finance options available for different project partners

Partner	Finance options available
Antwerp	The homeowner can use his energy savings as an advantage to finance his investments (is only for small investments). The homeowner could use other financial instruments such as: • a loan provided by a private bank • the Flemish Energy loan by the city of Antwerp: max. 15.000 euro with payback time of max. 8 or 10 years and an annual cost percentage of 0% or 2%. The interest rate depends on the situation of the applicant. Applicants with an income <30.640 euro, applicants who rent their property through a social renting office, applicants who are protected customers for electricity or gas and applicants who meet the conditions to receive an OCMW heating allowance. When the interest rate is 0%, the payback time is max. 10 years, otherwise it is maximum 8 years. See https://www.antwerpen.be/nl/overzicht/ecohuis-antwerpen/premies-en-lening A total NZEB renovation is about 40.000 euros- 100.000 euros.
Breda	Designing a financing package, called Sustainable home subscription, which works as follows: If a homeowner wishes to do an energy renovation but cannot finance the cost at this time, they can participate in this subscription. The renovation is then payed for out of a special fund. The homeowner signs a subscription form with our local Energy Services company BResco. In this they oblige themselves to pay a monthly subscription fee for a duration of a previously agreed period (normally 15 – 25 years), after which the total costs of the renovation will be repaid. Financial schemes: • Energy savings loan • Sustainable home subscription (Woningabonnement Breda, "WoaB")
Kent	To support the ECO fund, some local authorities in Kent have local loans to support residents to pay for energy measures such as loft, cavity, and heating. An example of the most common loan used to support residents is the 'Winter Warmth' loan. It is a loan which is only available to owner occupiers (i.e. not tenants in the rented sector or social housing) and is only repayable if the house changes ownership (i.e. in the event of a house sale, or inheritance). The loan fund is provided by Kent County Council Public Health and distributed via local authorities to residents.
Mechelen	The homeowner can use his energy savings as an advantage to finance his investments (is only for small investments). The homeowner could use other financial instruments such as: • a loan provided by a private bank • the Flemish Energy loan by the city of Antwerp: max. 15.000 euro with payback time of max. 8 or 10 years and an annual cost percentage of 0% or 2%. The interest rate depends on the situation of the applicant. Applicants with an income <30.640 euro, applicants who rent their property through a social renting office, applicants who are protected customers for electricity or gas and applicants who meet the conditions to receive an OCMW heating

	allowance. When the interest rate is 0%, the payback time is max. 10 years, otherwise it is maximum 8 years. A total NZEB renovation is about 40.000 euros- 100.000 euros.
Picardie	There are two types of finance out of a regular bank finance : Picardie Pass Renovation can propose a finance to users of our service at 2.5%. The thermal diagnosis is able to say what the economical savings out of the renovation are. We make sure monthly payments stay close to the savings just like the picture below. Another finance is proposed to any residents by the government. It finances only the energy works renovation with an interest rate at 0%. It concerns insulation, heating system replacement, hot water maker replacement and windows replacement.
Rotterdam	*Lease concept*: company, e.g. energy suppliers or installers, implements measures and homeowner pays a monthly fee for lowering his energy bill *ESCO*: a company gets all the budget for maintenance of the house including the installations for long term (10-20 years) and uses this for investing in energy savings measures and they will also invest in innovative measures during the exploitation period, which is typically around 15 years, if that is more profitable for them. The homeowner pays a fixed price for energy. All risks are for the ESCO. *Output guarantee*: a company takes measures and guarantees a certain amount of energy savings. Banks, e.g. Rabobank The total amount of the loan depends on the types of measures being installed. There are also possibilities to hire products e.g. solar panels and heating hearths from the producers/installers so to minimise the thresholds for initial investments. This is actually a lease concept, where the homeowner pays a fixed price per month, during typically 15 years (end of lease period), after which the products are owned by the homeowner. The specific addresses, named under "Funding Information" can get a loan at the Stimuleringsfonds Volkshuisvesting Nederlandse gemeenten (SVn) for taking the advised measures.
EOS	Financial instruments such as a loan provided by a private bank or the Flemish Energy Loan (Vlaamse Energielening), provided by EOS (max. 15.000 EUR - max. 8 or 10 years, interest rate 0%,1% or 2% depending on target group) can be used to finance the investment.

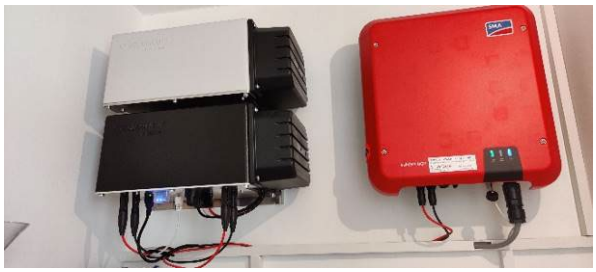
Annex 2- Summary of results model A: Utilising new or innovative technologies

Demo type A: Utilising new or innovative technologies Kent County Council
KCC installed solar PV panels with battery storage systems and HEMS in 10 homes. These took place in later 2018- early 2019 and gave savings of 14tonnes of CO_2 per annum



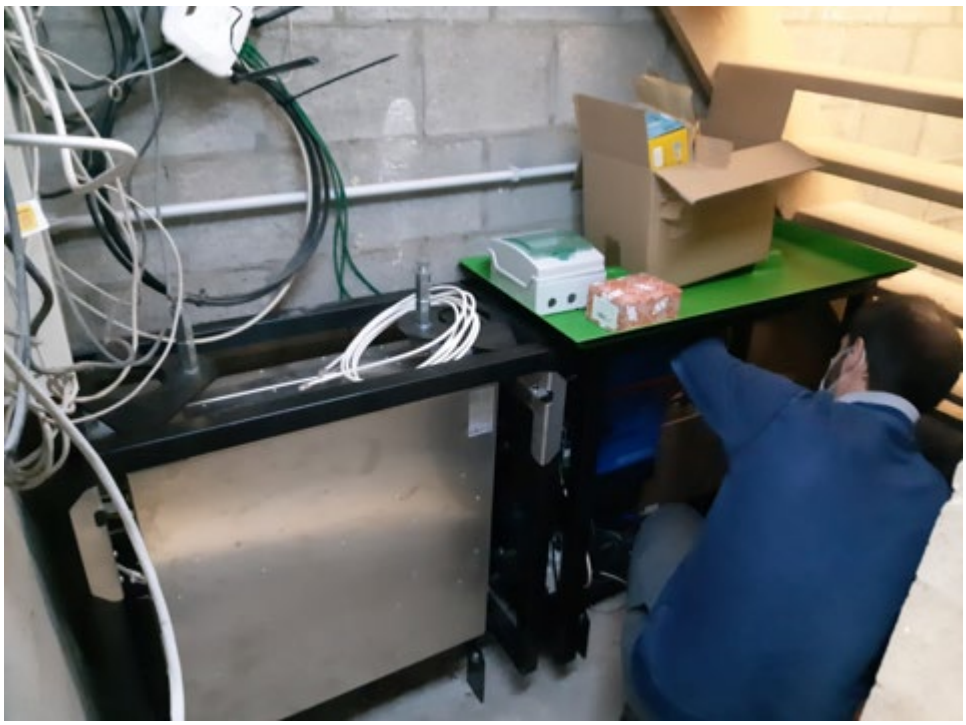
These pictures show the solar panel and battery storage system on a demo home in Kent.

Demo type A: Utilising new or innovative technologies Rotterdam
Rotterdam commissioned the Regional Energy counter WoonWijzerWinkel to make an inventory of Battery storages commercially available and to organise purchase and installation. Four battery storage systems were installed with solar panels, giving savings of 4.8 tonnes of CO_2 per annum.



A battery storage system installed in a Rotterdam demo home.

Demo type A: Utilising new or innovative technologies Antwerp
Antwerp installed 2 battery packs as part of the cVPP project. This comprised of 2 saltwater batteries, one homeowner retrofitted this to their existing Solar PV installation and others installed Solar PV alongside this in collaboration with ZuidtrAnt. EMS system from battery will be used in combination with energieID for monitoring and control. As these were just installed carbon savings haven't been realised yet.



This picture shows the battery system being installed.

Annex 2- Summary of results model B: Whole house or nearly-zero carbon retrofit

Demo type B: Whole house or nearly-zero carbon retrofit Antwerp
A selection of 10 neighbourhoods was made. Through the demo homes, different types of Low-carbon technologies were installed, including: • Roof insulation • Cavity wall insulation • New heating boiler • New glazing • Solar panels (still have to be executed) However, no demos of this type were achieved and some barriers to nearly-zero carbon retrofit were identified, including: • Technically • Financially • Time constraints • Homeowner worried about mess • Homeowner wanted first to see if the contractor would do a good job before starting extra works • Obligation of a building permit

Demo type B: Whole house or nearly-zero carbon retrofit Mechelen
Mechelen also planned zero carbon retrofit demo homes but found the following issues:

- Nearly-zero carbon retrofits require a significant investment. While literature[6] puts forward a cost of 40.000 – 60.000 euro per household (on average), this easily adds up to 100.000 euro or more, with a payback cost of 20 years or longer. It is therefore difficult to convince people to invest this kind of budget if they were not planning to do so in the first place. A neighbourhood approach then is limited to identifying the frontrunners, as it is not possible to convince households who were not planning to invest in a home renovation.
- Furthermore, it is difficult to predict or guarantee the expected energy savings for single family home renovations. Studies point out that there is a significant difference between the predicted and actual energy savings (the "performance gap" e.g. Deurinck 2015[7], Delghust 2015[8]), which is especially the case in old, existing homes.
- These kind of retrofits typically require a building permit and thus the collaboration with an architect is mandatory in most cases. We consider the architect as best positioned to support the homeowner in the renovation process (with the help of additional support in the form of energy experts or engineers). As a result, there is a less need for additional support and the added value that a local authority (for instance, unburdening the homeowner) can provide in this process is limited

To unlock nearly zero carbon retrofits, it seems that ('soft') policy instruments such as the ones developed within Triple-A (= communicating, facilitating) alone are not sufficient and should be complemented with ('hard') policy instruments (= regulation, financing). However, the tools developed within Triple-A are well-suited to promote best practices of nearly zero carbon retrofits.

Despite this, Mechelen managed to achieve one demo home saving 9.2 tonnes of CO_2 per annum.

Demo type B: Whole house or nearly-zero carbon retrofit PSEE
The serviced offered by PSEE includes carrying out an in-depth thermal diagnosis of the accommodation and developing a personalized work program. The energy renovation coach goes to the owners' home, over half a day, to take stock of the housing situation (wealth analysis), but also on the household's financial situation (analysis of energy bills, income and additional debt capacity…). On this basis, he builds up a work program, adapted to the needs and budget of the household. So PSEE does not have a special approach before going to the house and analysing their financing situation. The type of technologies installed changed according to the household. Most of them installed full insulation and thermodynamic systems. Overall PSEE installed measures in 61 demo homes achieving savings of 227 tonnes of CO_2 per annum.

Demo type B: Whole house or nearly zero carbon retrofit Rotterdam

[6] SERV, 2019. https://www.serv.be/serv/persberichten/vlaams-klimaatdoel-eist-durf-kapitaal-en-extra-mensen

[7] https://limo.libis.be/primo-explore/fulldisplay?docid=LIRIAS1729316&context=L&vid=Lirias&search_scope=Lirias&tab=default_tab&lang=en_US

[8] https://biblio.ugent.be/publication/6988905

Rotterdam commissioned the alliance WoonWijzerWinkel / Klimaatroute to carry out 'door-to-door' recruitment campaign by providing energy scans if residents are interested in. On request an energy advice could be provided and further support until installation if asked for. In principle, residents are free to choose their own contractors / installers. The alliance helps only when there is interest.

For each of the two Triple-A area, these activities have been commissioned leading to the results of model B&D. For model B, Rotterdam installed 21 measures in 5 homes, giving carbon savings of 16.9 tonnes of CO_2 per annum.

Annex 3- Summary of results model C: Large scale or community wide mass retrofit

Demo type C: Large scale or community wide mass retrofit PSEE
When a resident engages with PSEE and decides to undergo installations, they then engage the whole neighbourhood to see if anyone else would be interested. Most of the times the renovation program is the same except for the small technologies due to similarities in the housing. Through this method PSEE engaged 62 homes and saved 250 tonnes of CO_2 per annum.

Demo type C: Large scale or community wide mass retrofit Rotterdam
The regional energy counter Woonwijzerwinkel is commissioned by 24 cities in the region. One of their activities, as intermediary between the supply and the demand sides, is to organise group purchase. Because of their position, they can combine requests for the residents of all 24 cities and create sufficient mass to get interesting discounts. Through this partnership, Rotterdam installed measures in 187 homes and saved 172 tonnes of CO_2 per annum.

Demo type C: Large scale or community wide mass retrofit Oostende
 Solar panels are not implemented in potential houses yet, even though they are interesting to implement (low pay back period, easy to install, easy access to the technology etc.). The aim is to place 300 sets of solar panels. People participating in this project will be asked to show their engagement (e.g. with a window poster at their home, during events, on the EOS website/Facebook page) in order to sensitize their neighbours to do the same. Yearly we organised a group purchase via iChoosr. We provided face-to-face information and group sessions. We also used social media-Facebook, adverts in magazines, Email and Telephone for those who have signed up to the group schemes. So far Oostende has already completed 363 solar panel installations through group purchasing, saving 249 tonnes of CO_2 per annum.

Annex 4- Summary of results model D: Longer term phased retrofit

Demo type D: Longer term phased retrofit Breda
Breda tried to inform and educate residents through a joint effort with Bres through information sessions, web portal (www.woonwijsbreda.nl) and pop-up (Greenhopper). Breda were very successful in attracting people's attention, with almost 2,000 registered visitors to the pop-up and approximately 500 kitchen table advices by Energy coaches (from Bres) since the start of the Triple A project. The actual follow-up actions that are taken by the homeowners were not recorded. However, measures installed after the kitchen table sessions have been recorded through an effort by volunteers of Bres, who contact all homeowners they have visited approximately 6 months after the visit. If homeowners were enthusiastic, Bres invited them to give an official interview and publish their story in a newsletter or even on the web portal. We also have records of all Energy savings loans that have been granted in Breda in 2017, 2018 and 2019. Through this information Breda recorded 134 demo homes in the target areas, and 391 in the wider Breda area, thus savings 138.9 tonnes of CO_2 per annum and 381.1 tonnes of CO_2 per annum, respectively.

Demo type D: Longer term phased retrofit Mechelen
Mechelen used a neighbourhood approach. However, instead of selecting a neighbourhood up-front (top-down), they we were approached by a motivated citizen, who took the role of ambassador (bottom-up). In Esdoornplein, a street with 50 homes, this led to a collective action. In the end, 21 families participated, replacing their windows, installing cavity wall insulation and/or external wall insulation. An NZEB-coach guided them through the building process. We facilitated this process, offering free home visits with renovation advice, co-organizing neighbourhood gatherings, offering financial support through a neighbourhood subsidy and energy loans. Other partners included Kamp C (home-visits) and Fluvius (DSO offering grants for this system of NZEB-coaches[9] While a collective (neighbourhood) approach did not prove successful for model B, it did prove successful for model D. Achieving 17 installations during the project period and saving 8,640 tonnes of CO_2 per annum. Four more households then joined the project later on. This experience led to a city-wide system of NZEB-coaches, developed in collaboration with BE REEL! [10]

Demo type D: Longer term phased retrofit PSEE

[9] https://www.fluvius.be/nl/thema/benoveren/gratisadvies

[10] See documentation on the SURF-drive https://surfdrive.surf.nl/files/index.php/s/tFXN9Fu43yqylXP?path=%2FWP4%20DEMONstration%20exemplars%2FA%204.3%20Implementation%2FWorking%20Documents%2FPP5%20Mechelen \ NZEB-coaches

The serviced offered by PSEE includes carrying out an in-depth thermal diagnosis of the accommodation and developing a personalized work program.

The energy renovation coach goes to the owners' home, over half a day, to take stock of the housing situation (wealth analysis), but also on the household's financial situation (analysis of energy bills, income and additional debt capacity, etc.). On this basis, he builds up a work program, adapted to the needs and budget of the household. So PSEE does not have a special approach before going to the house and analysing their financing situation.

Most of the demos are in this category for economic reasons. This approach installed measures for 499 demo homes and achieved carbon savings of 1901 tonnes of CO_2 per annum.

Demo type D: Longer term phased retrofit Rotterdam
Rotterdam commissioned the alliance WoonWijzerWinkel / Klimaatroute to carry out door to door recruitment by providing energy scans if residents are interested. On request energy advice was provided and further support until installation if required. Residents were free to choose their owns contractors/installers. For each area, these activities have been commissioned leading to the results of model B&D. From these results it is possible to conclude that most residents take 1 to 2 measures at a time, on average 1,049 measures in the Triple-A areas in 435 homes giving savings of 624 tonnes of CO_2 per annum. The monitoring data are provided through these commissions by the alliance based on their CRM systems.