

Article

Consultancy Centres and Pop-Ups as Local Authority Policy Instruments to Stimulate Adoption of Energy Efficiency by Homeowners

Frits Meijer ^{1,*}, Ad Straub ¹ and Erwin Mlecnik ²

¹ OTB—Research for the Built Environment, Faculty of Architecture and the Built Environment, Delft University of Technology, Julianalaan 134, 2628 BL Delft, The Netherlands; a.straub@tudelft.nl

² Management in the Built Environment, Faculty of Architecture and the Built Environment Delft University of Technology, Julianalaan 134, 2628 BL Delft, The Netherlands; e.mlecnik@tudelft.nl

* Correspondence: f.m.meijer@tudelft.nl; Tel.: +31-(0)6-28-61-64-27

Received: 31 May 2018; Accepted: 31 July 2018; Published: 3 August 2018



Abstract: The housing sector is responsible for a more than a quarter of the total final energy consumption in the EU. As the majority (70%) of the EU-housing stock is owner occupied and largely consists of single family dwellings it is understandable that many countries focus their energy saving policies on homeowners. Complementary to the national policy frameworks, regional and local authorities implement locally based policy instruments targeting specific groups and individual homeowners. In order to enlarge the effectiveness of their policy instruments and to reach the energy saving goals, frontrunner local authorities in particular are searching for ways to reach homeowners. Consultancy centres and pop-ups can be a way to make individual homeowners more aware about their energy use and stimulate them to apply low carbon technologies. The research results not only show that a wide range of business models are available to develop, structure and organise these consultation centres and pop-ups, but also that they indeed could play an important role in accelerating the energy performance of owner occupied housing. Through a pop-up or consultancy centre, public and private parties can join their forces to reach, stimulate and support the individual needs and wishes of homeowners during their customer journey to realise an energy efficient dwelling.

Keywords: policy instruments; energy efficiency; business models; consultancy centres; customer journey; local authorities; pop-ups; owner-occupied housing stock

1. Introduction

The housing sector has a vast energy saving potential. In 2015 the residential sector was responsible for a quarter of the total final energy consumption in the EU. The average EU household uses this energy primarily for the heating of space and water, 65% and 14% respectively [1]. The last two decades the European Union and its Member States have undertaken serious efforts to promote energy efficiency in the residential sector. Ambitious energy saving goals were set and regulations and policy instruments were developed and implemented. As the majority (70%) of the EU-housing stock is owner-occupied and more than half of the population in each EU Member State lives in owner-occupied dwellings in 2015 [2], many policies specifically address the owner-occupied sector. The contents and goals of these national policy instruments vary widely and regional and local authorities are identifying additional policy instruments to improve targeting single-family homeowners in specific neighbourhoods (e.g., with predominantly pre-war or early post war owner-occupied housing). The common denominator is to motivate and stimulate owners to undertake action by tackling the existing (regulatory, economic, information and organisational) barriers that prevent the owners from

undertaking energy saving measures in their dwellings. Over recent years the role of local authorities in this policy area has become more and more important [3]. It is in this respect predominantly acknowledged that, instead of a common national policy approach, an approach is needed that is based in the municipalities and its neighbourhoods. A policy that aims to change the individual behaviour of owners that should be based on the needs, possibilities and wishes of these homeowners.

2. Research Methodology and Structure of the Article

This article presents findings of the Interreg 2 Seas project Triple-A, in which local authorities in the Netherlands, Belgium, France and the UK try to achieve a breakthrough in the energy renovation of owner-occupied single-family dwellings. This breakthrough should be realised by increasing the awareness of the homeowners and by enabling and increasing access to energy saving products and technologies (The seven local authorities that participate in the project are Antwerp, Mechelen, Oostende (Belgium), Breda, Rotterdam (the Netherlands), Picardie (France) and Kent County (United Kingdom). The main goal of the project is to stimulate the adoption of low-carbon technologies by homeowners through awareness and easy access. More information can be found at <http://www.triple-a-interreg.eu/>. Local authorities that are participating in the project consider consultancy centres and pop-ups as an additional policy instrument to improve the energy performance of owner-occupied housing [4].

The main research question addressed is how promising business models for local-authority driven (longer-term) consultancy centres and (short-term to medium-term) pop-ups, can be developed and used to address homeowners in general and/or in targeted neighbourhoods to stimulate them to improve the energy performance of their dwellings and adopt energy-saving technologies. An important additional sub question addresses the possible role market parties can play as an intermediary, both in the development of the centres and pop-ups as during the exploitation phase of the pop-ups.

To answer these questions, the experiences of existing consultancy centres and pop-ups in the four Triple-A countries are analysed. In the Netherlands: 033Energie (Amersfoort), ICDuBo and WoonWijzerWinkel (regions Rotterdam Rijnmond and Haaglanden), Reimarkt (various local authorities) and the Foundation Huizenaanpak (Haarlem and region IJmond and Zuid-Kennemerland). In Belgium: EcoHuis (Antwerp), Kyotomobiel and Woon+bus (3Wplus, region Halle-Vilvoorde). In France La Maison de l'habitat durable (Lille), and in the United Kingdom energy advice pop-ups (Sussex and Kent) and an energy advice centre (London). The functioning of the centres and pop-ups is approached from two angles: their service provision and their business organisation. The service provision of existing pop-ups and consultancy centres has been analysed using the customer journey model shown in Figure 1.

For the analysis of the organisational or business set up of pop-ups and consultancy centres the business model canvas presented in (Figure 2) has been used.

To illustrate (and gain more understanding in) the wide variety of applicable business models, two cases are presented more in-depth. The Kyotomobiel (Belgium) as a stand-alone temporary pop-up model, initiated by local and regional authorities. ICDuBo (Netherlands) as a combined public and private initiative that combines a centre on a fixed location with varied temporary pop-ups in target neighbourhoods. A combination of interviews and desk top research was used to gain insight in the models.

Section 3 presents a short literature review of barriers to energy efficiency in owner-occupied housing and the policy mix authorities deploy to overcome these barriers. The experiences of consultancy centres and pop-ups in Belgium, France, the Netherlands and the UK are analysed in Section 4. Section 5 further zooms in-on the two cases (Kyotomobiel and ICDuBo) and sketches the wide variety of business models that can be used when developing consultancy centres and pop-ups. Section 6 discusses whether consultancy centres and pop-up models could make a difference to improve the energy efficiency in the owner-occupied housing sector. Conclusions are drawn in Section 7.

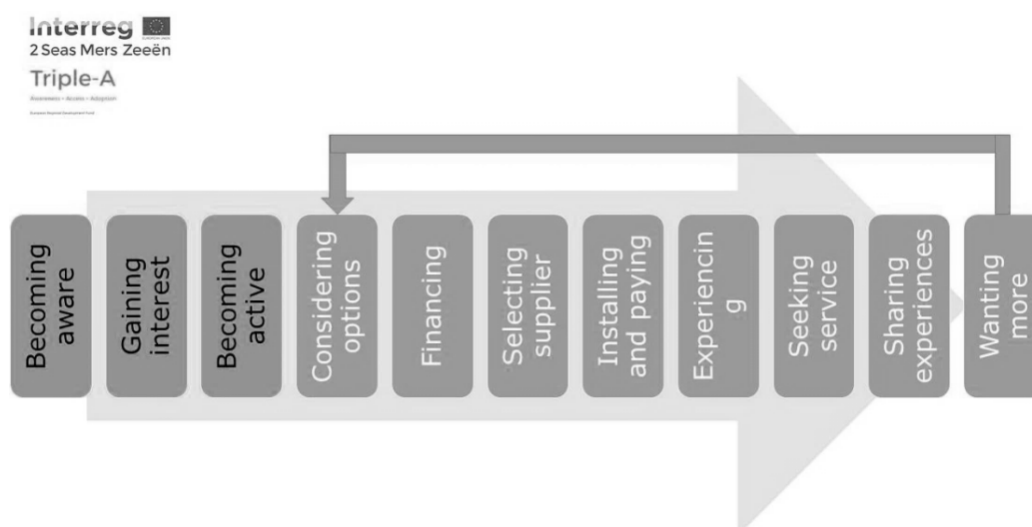


Figure 1. Customer journey. Source: [4], inspired by [5].

8. Key partners Defines who will contribute to the pop-up development and promotion without being directly involved in providing the daily services	6. Key activities Defines what services will be delivered in the pop-up	2. Customer Values Defines what added value you bring with the pop-up to the customer segment	4. Customer Relationships Defines how you will keep the relation with the customer ongoing after visit	1. Customer Segment Defines the expected customers for the pop-up
	7. Key resources Defines who should daily deliver the services and with what means		3. Customer Channels Defines how you will inform the customer about the pop-up	
9. Cost structure Estimates the expected yearly costs to run the pop-up and its service			5. Revenue Stream Defines how the pop-up will sustain its costs in the future, preferentially create its own revenues	

Figure 2. General Business Model developed and used for Triple-A partners. Source: [4], inspired by [6].

3. Regulatory Framework for Energy Efficiency in Owner-Occupied Housing

This section addresses the barriers to energy efficiency in owner-occupied housing and the policy instruments that are usually be implemented to overcome these barriers.

3.1. Barriers

The realisation of significant energy-saving and emissions-saving potential is faced with a range of barriers. There is a wealth of studies addressing these barriers [7–19] Although the precise categorisation of the barriers differs in the various research studies, a distinction is often made between institutional and political, market and economical, financial, technical and behavioural (or social) barriers. Table 1 summarizes the categories of barriers addressed in the literature sources above and illustrates them with some examples.

Table 1. Categorisation of barriers to energy efficiency in owner-occupied housing.

Barriers	Examples
Institutional and political	Lack of clarity or coherence, or the presence of conflicting rules and energy regulations.
Market and economical	Imperfect (or sometimes asymmetric) information to appraise the actual value of taking energy saving measures, split-incentive problems and limited access to capital. Lack of adequate professional advice and support. Limited offers and complicated procurement procedures are also often attributed to this category. The current fragmentation of the supply side means that homeowners can be forced to play a coordinating role during construction. Most homeowners not only lack the skills, but in many cases also the time to play this role.
Financial	Lack of upfront money to pay for the measures and the (under homeowners) widely shared opinion that the benefits (energy saving) do not weigh up against the investment costs.
Technical	Lack of affordable energy efficiency technologies that are suitable to local and individual conditions and needs. This also could include the discrepancies between projected and the actual savings that are realised after the renovation, due to, for instance, the use of inadequate technologies or faults in design or calculations.
Behavioural (or social)	The form of information, lack of sharing objectives, credibility and trust, values, inertia and bounded rationality.

For owner-occupiers, the lack of awareness, the absence of sufficient knowledge and the lack of cost effectiveness and funding are often seen as the main barriers to undertake energy efficiency measures. Reflecting the general trend, behavioural aspects to explain the cautious attitude of homeowners are gaining attention. Homeowners often do not consider the energy performance of their dwelling to be a real issue. They may even find the quality of their dwelling sufficient as it is and have other priorities. It is difficult to pinpoint a generally applicable main barrier for homeowners. Every homeowner encounters its “personalized” barriers depending largely on the characteristics of his or hers household and dwelling and even on their own beliefs and daily environment. This implies that local policies also should reflect the need for market intermediaries to be able to offer tailor-made advice. Various sources have addressed this topic and indicate strongly that intermediaries that connect demand with supply can play an important role in helping to eliminate these barriers for homeowners [20–23].

3.2. Policy Instruments

Traditionally, local and national authorities deploy a mix of policy instruments to overcome or to diminish the barriers that homeowners face. As with the barriers, the precise categorisation of the policy instruments slightly differs in the existing research literature. Nonetheless the instrumental mix to improve the quality of private housing generally is categorised in regulatory, economic, organisational and communicative instruments [7,10,24,25]. Within the sciences of public administration this categorisation of related sets policy instruments is more and more referred to with the overarching concept of energy efficiency governance. Energy efficiency governance is defined as “the combination of legislative frameworks and funding mechanisms, institutional arrangements, and co-ordination mechanisms, which work together to support implementation of energy efficiency strategies, policies and programmes” [10]. Table 2 gives an overview of the general classification of policy instruments.

Table 2. Categorisation of policy instruments used to improve energy efficiency in owner-occupied housing.

Categories	Examples
Regulatory instruments	General and specific laws and rules, specific exemptions, covenants and agreements that are generally used to force homeowners to comply with certain demands. These could include energy reduction targets, minimum energy standards, compulsory energy audits or the use of energy management systems.
Economic instruments	Usually deployed as an incentive to move homeowners into action: grants, subsidies, low rented loans, revolving funds and tax incentives for investments that lead to an improvement of the energy performance. However, they can also be used as a disincentive like tariff structures where higher consumption of energy leads to higher tariffs, a mortgage system or real estate tax system where owners with an energy poor dwelling have a higher mortgage or tax rate.
Organisational instruments	Aim to streamline the organisation of the process. Especially in neighbourhoods it can be difficult to activate multiple homeowners based on one demonstration project. Individual homeowners have various and sometimes competing wishes, needs and possibilities. Guidance for multiple homeowners at the same time can steer homeowners in a predefined direction.
Communicative instruments	Communicative instruments are used to enlarge the awareness of the homeowners, to offer them possible technical, financial and practical solutions and guidance throughout the process. This can vary from (national) public information campaigns and promotions to the provision of tailor made information and demonstrations on individual level (e.g., training, personal advice, peer-to-peer testimonies and demonstration exemplars).

Within this governance approach various local authorities are considering using consultants to implement the policy instruments. The Triple-A project also investigates how consulting can be embedded in pop-up and consultancy centre models to support the abovementioned instruments.

4. Pop-Ups and Consultancy Centres as an Addition to the Policy Mix

4.1. Typology

The Triple-A project [4] indicates that various types of centres and pop-ups can be identified (see Table 3). The main differentiating factors are the project time frame and the location.

Table 3. Types of consultancy centres and pop-ups identified in the Triple A project.

Type	Example
Short-term in an existing building	Energy advice consultants that “pop-up” for a part of the day or up to one or two weeks in a local coffee bar (e.g., Sussex) or the temporary opening of an “open house” to show neighbours what energy saving measures are possible in their dwelling and how they can be realised (e.g., Amersfoort and The Hague).
Short-term in a mobile office	Mobile centres (e.g., a caravan or bus) that visit targeted streets or neighbourhoods for a day or up to one or two weeks to provide information and guidance to local homeowners. Examples can be found in Halle Vilvoorde (Belgium: Kyotomobiel) and Rotterdam/The Hague (WoonWijzerWagen).
Medium-term in an existing building	The energy advice and guidance is delivered in an existing building for a period up-to 2 years. For instance, in various neighbourhoods in Rotterdam this type of pop-up has proved to be successful.
Long-term in an existing building	This category appears to be the most common variant in the local authorities that participate in the Triple-A project. In the Netherlands, the city of Rotterdam has the WoonWijzerWinkel in Rotterdam, Amersfoort the 033Energie shop and Reimarkt has energy advice shops in various municipalities. In the Belgian town of Antwerp citizens can contact and visit the advisors in the EcoHuis in Antwerp. Residents living in the metropolitan area of Lille (France) can turn to the Maison de l’habitat durable.

Some local authorities combine various typologies and have established permanent consultancy centres in existing buildings and additionally deploy short-term pop-ups in neighbourhoods. In most examples, web portals and local demonstration projects are used to attract residents, who ideally should become customers. For example, in the Netherlands, digital energy counters are used by municipalities and regions to persuade homeowners to come to visit their permanent energy advice centres [4]. On the website homeowners are invited to visit the physical centre. In almost all Dutch cases, local authorities additionally use short term pop-ups to try to convince homeowners to undertake action. The importance of a website and a demo exposition to attract visitors is also illustrated by the

experiences of the Antwerp EcoHuis in Belgium and the Maison de l'habitat durable in Lille, France. Contrary to the foregoing examples, the Kyotomobiel (in the Belgian Halle-Vilvoorde region) is used as a short-term instrument to make residents aware of the importance to undertake energy saving actions and to help and guide them to realise energy saving measures. In all examples supply side actors are involved. In their studies, Mlecnik and Straub [26] already showed that in various European countries, policymakers and authorities support various types of informal or formal partnerships with the supply side to realise far reaching energy savings in single-family houses of homeowners. This includes partnerships that include specialised supply side consultants that offer integrated solutions that streamline the customer journey of the homeowners.

The permanent stores analysed in the Triple-A project are located on a central place with high urban density, although experiences in Rotterdam show that the location in itself does not necessarily attract the expected target group. In most cases the mobile pop-ups or short-term energy advice pop-ups emerge at easily reachable locations to attract as many visitors as possible. In other cases, pop-ups are specifically used to attract homeowners in a certain neighbourhood or street. This is for instance the case with the medium-term pop-ups in Rotterdam.

4.2. Service Provision: The Customer Journey Model

Consultancy centres and pop-ups can be seen as communication channels to stimulate homeowners to undertake energy saving measures in their dwellings. A temporary location of such a centre in a specific neighbourhood can attract homeowners in that district. The way the communication is organised and provided could influence the decision-process of the homeowner [27]. Subsequently this can affect the various steps that are included in the customer journey illustrated in Figure 1. The first essential task is to try to make homeowners aware of the possibilities and benefits. Ideally, after awareness is created, the pop-ups and consultancy centres support the owners during the rest of their customer journey.

The first steps—creating awareness and interest—in order to get homeowners into action are important. In the communication with homeowners in this phase it is essential to pay serious attention to the social context of the individual homeowner. Consultants need insight and knowledge about their behaviour, household situation and energy consumption pattern to overcome possible “behavioural” barriers. Marketing tools to get insight in energy consumption and physical dwelling characteristics and an overview of possible tailor-made product solutions could play a decisive role for persuading homeowners. After a decision has been taken, the communication focusses on more practical things: choosing the actual measures, financing options, providing technical advice, demonstration of products, providing tailor-made technical solutions, selecting contractors and installers, planning and supervision during construction, safeguarding guarantees and aftercare. For these services the involvement of market intermediaries is essential. During the journey, consultants can make use of the existing mix of national and local policy instruments (e.g., subsidy schemes, low renting loan possibilities from revolving funds, tax schemes).

Most Dutch examples cover most steps of the customer journey. In Belgium, the EcoHuis Antwerp aims to inform, advise and support residents for sustainable and healthy living, particularly also to lower homeowners' energy and water use. Certain tools and specialized advisors (“EcoHuis Doctors”) are offered for consultancy. The Kyotomobiel functions along the same lines. The advisors offer free energy scans and audits and provide free advice. The goal is to provide the residents with a set of solutions that is fully aligned with their situation and helps them to improve the energy performance of their dwelling.

The advisors that are employed in the consultancy centres and pop-ups generally are independent intermediaries who help to achieve the implementation of policy instruments. In the Netherlands these are often energy consultants (advisors and architects) or other “experienced” independent persons, either volunteers, employees of the local authority or external persons employed by the

(local) authorities using local procurement rules. The Belgian “Eco doctor” in the EcoHuis is for example an independent advisor-architect employed by the local authority.

The role of consultation centres and pop-ups is closely related to the question how communities can play a role to facilitate, increase and sustain carbon reduction practices. To overcome the difficulties of engaging the public in community initiatives and sustaining pro-environmental behaviours Axon [28,29] has drawn up a framework of cognitive, affective and behavioural engagements or interventions that could be used to maximise the enablers or drivers and minimise the barriers for individuals to participate in communal projects [28]. Drawing on focus groups conducted in seven UK communities, Axon [29] identified and analysed thirteen specific (and interrelated) interventions that could encourage change in the short-term, maintaining momentum in the medium-term and sustaining sustainability in the long-term to address various enablers or drivers of, and barriers to, sustainable lifestyles. One of the interventions analysed was implementing pop-up shops in communities. The residents viewed pop-up shops as enablers to action where face-to-face advice and feedback could be provided to residents looking for support with sustainable practices. Although little research has been undertaken into the precise role of pop-ups and their effectiveness [29] Axon expects that pop-ups that offer multiple interventions (such as tailored feedback and face-to-face advice) could contribute as a long-term intervention to support sustainability.

5. Case Studies

Two case studies are described in this section a short term pop up in Halle-Vilvoorde in Belgium (the Kyotomobiel) and a combination of a consultancy centre with temporary pop-ups in the Rotterdam—The Hague region in the Netherlands. The business models of both initiatives are pictured in Figure 3.

5.1. 3WPlus Halle-Vilvoorde, Belgium: Kyotomobiel

The main characteristics of the Kyotomobiel are:

- Type: a short term, mobile pop-up.
- Initiative: public initiative taken by regional and local authorities.
- Customer Journey: although in principle the complete customer journey can be covered, in practice the emphasis lies on creating awareness and assisting during the planning phase.

The initiative has been taken by 3WPlus, a non-for-profit public regional partnership in which 35 local authorities participate that are located in the administrative district Halle-Vilvoorde. The partnerships’ main focus lies on making improvements in the policy areas Housing (in Dutch: “Wonen”), Working and Welfare. Within the Climate Project Kyoto in the neighbourhood, the mobile pop-up “Kyotomobiel” caravan has been introduced in six local authorities early April 2016. The intended length of the project is three years.

The Kyotomobiel in itself demonstrates how a dwelling can be made more energy efficient. The mobile has a water pump, PV solar panels and a battery storage system that provides autonomy for 8 h. The mobile is insulated with wood wool insulation and has a green roof. The Kyotomobiel and its services are available for every inhabitant of the six local authorities that wants more information on the possibilities to improve the energy performance of his or her dwelling. As such the mobile does not target certain customer or dwelling segments. The added value the Kyotomobiel aims to bring reflects this general approach. The main goal is to provide visitors (via a personal approach) low-threshold-information, advice and support about making their dwelling more sustainable, less energy demanding and more comfortable. Visitors can make an appointment for an energy audit of their dwelling, so they can gain insight in the amount of energy they use and the practical and technical solutions to lower it substantially. In the colder periods of the year a thermal imaging camera is available to make a heat scan of the dwelling.

KYOTOMOBIEL: SHORT TERM MOBILE POP-UP				
8. Key Partners Relevant 3WPlus departments, 6 LAs and province of Flemish Brabant, social workplaces, local network organisations (e.g. in the field of labour and sustainability)	6. Key Activities Providing information, energy-audits, heat scans, custom-made advice, organisation of special projects	2. Customer Values Focus on lower energy bill and Increased living comfort via personal approach and guidance	4. Customer Relationships Personal contact after visits, energy-audit at home.	1. Customer Segments Homeowners in general , especially houses with bad energy performance
	7. Key resources Permanent staff and the mobile bus (Kyotomobiel)		3. Customer Channels Flyers, banners, local newspapers, LA websites Table with drinks and special events s	
9. Cost Structure Estimated costs to run Kyotomobiel € 90.000 per year			5. Revenue Stream Lion share financed by local and provincial authorities, very limited (symbolic) contribution via energy-audits (€ 40; 2016 129 audits) and heat scans	

ICDUBO: COMBINATION OF LONG-TERM CONSULTANCY CENTER AND SHORT- TO MEDIUM-TERM LOCAL POP-UPS.

8. Key Partners 24 Las in regions The Hague and Rotterdam , Alliance Sustainable Rijnmond and local suppliers & manufacturers	6. Key Activities Intermediary role, independent and step-by-step advice Events	2. Customer Values Creating awareness, tackling barriers, offering financial help, advice and unique offers	4. Customer Relationships Via a Customer Relation Management tool	1. Customer Segments All homeowners interested in taking up energy saving and comfort improving measures. Pop-ups in targeted communities.
	7. Key resources Website, shop and pop-ups, brochures, marketing, community ambassadors		3. Customer Channels Digital platform , local websites , physical stores and pop-ups, marketing actions, local meetings.	
9. Cost Structure Total costs are unknown. Costs for temporary pop-ups vary (estimation of one pop-up, open for one year and occupied with one energy expert, varies round € 75.000			5. Revenue Stream Is Unknown. Still large contribution from Las (Alliance Sustainable Rijnmond). Contributions from suppliers and manufacturers and fees for premium services	

Figure 3. Business Model of Kyotomobiel and homeowner consultancy ICDuBo [4].

Residents who become customers get a detailed report that contains a step-by-step guide to the measures they can undertake to improve the sustainability, energy performance and comfort of their dwelling. The Kyotomobiel advisors point out which materials, products and techniques should be used. The customers also receive information about relevant financial issues. Insight is given in the investment costs, subsidy and financing possibilities (e.g., green or low rented loans). Also information about payback times and financial savings is given. If customers already have concrete ideas about the measures they want to take, the potential CO₂-savings can be calculated. In most cases the proposed measures are related to insulation and the provision of hot water and heating. For the insulation of the roof and attic floor it is possible to buy the materials via a joint purchase program. On average the Kyotomobiel consultant spent a day per dwelling on all these activities.

To promote the Kyotomobiel, a wide range of customer channels is used, varying from leaflets, brochures, banners, publications in the local press up to targeted information on the websites of local and regional authorities. Mouth-to-mouth promotion is also considered important. In some local authorities' ambassadors (former customers) are active to promote the Kyotomobiel and to convince their fellow residents to undertake action. The exact site of the Kyotomobiel is selected in consultation with the local authorities that are involved. Generally three factors are taken into consideration before a location is chosen

- The potential to attract visitors (e.g., a busy place where the Kyotomobiel “sticks out”).
- Accessibility: the Kyotomobiel must be easy and safely accessible for all potential visitors
- Close to city centre or (in specific cases) close to the centre of a targeted neighbourhoods.

The period when the Kyotomobiel pays a visit to one of the cities is also chosen in consultation with the local authorities. At the first day of the opening a small terrace is arranged, so that the visitors can be offered drinks. If possible, and depending on the needs of the local authority, arrangements are made to attract as much people as possible. For example: during an opening in the summer holidays a so called “play-bus” was present with animators to entertain the children of the visitors.

During the total length of the project (3 years) the Kyotomobiel will approximately be present 5 weeks in each of the six participating local authorities. On location the Kyotomobiel can on average be visited 3 h per day on three working days a week.

The first year's practical experience shows that the Kyotomobiel advisors have to deal with some specific issues relating to customer relations. Advisors sometimes experience difficulty in communicating or use the existing information material with specific customer segments. Some visitors (for example elderly) do not have a computer, and with others (for example non-western migrants) talks can be cumbersome and time-consuming. Monitoring progress and support during execution of the technical measures are not explicit tasks of the advisors. In practice, most customers only visit the Kyotomobiel to get advice and their personal roadmap to carry out measures. Nevertheless, some of them come back regularly to ask for help or advice (e.g., finding a suitable builder or installer). A minority of the customers is supported throughout their complete customer journey. The work is generally carried out by recognized contractors who are liable for and should guarantee the quality of their work.

The estimated yearly costs to exploit the Kyotomobiel are around € 90.000. This amount is almost completely financed by the participating local and provincial authorities. Customers account for a very small part of the revenues. They have to pay € 40 for the advice and support services they get from the advisors of the Kyotomobiel. The key resources of the Kyotomobiel are the advisors and consultants who generally are employed by (local and regional) authorities that are involved in the project. Other key partners in the project are network organisations related to the labour movement and organisations promoting ecological and sustainable society and sustainable waste and material management.

At the beginning of the project the goals were expressed in the minimum number of energy audits that should be realised. The goal in the first year (April 2016–April 2017) was to realise energy audits in 120 owner-occupied dwellings, followed by an extra 150 in the second year and another 170 in the second year. The results were better than expected. Between April 2016 and December 2017 almost 600 visitors have been registered as customers of the Kyotomobiel [4]. Although tenants are also welcomed by the Kyotomobiel, practice shows that the vast majority of visitors are homeowners. Up to December 2017 roughly 420 of them have requested an energy audit of their dwelling. In November 2017 a total of (only) 142 audits have been actually carried out. The explanation for the large gap between the number of audits that has been requested and the actual number of audits that has been carried out is that the lion share of the requests came in after the communication about thermography. Taking into account the fact that a heat scan is only possible during the winter months, and the fact that the Kyotomobiel has a small staff, it proved impossible to carry out all the requests directly. In dwellings where an energy audit was carried out, the homeowners received tailor-made information and support to execute the planned measures [30]. The homeowners were helped finding a builder or installer and assisted in finding a way to finance the costs of the renovation. Not every visitor of the Kyotomobiel wants to have an energy scan. Quite a lot of visitors come by with questions and the advisors of the Kyotomobiel provide them with answers. The Kyotomobiel does not only focus on the individual needs. In the last few years a large asbestos roof project has been carried out. The roof has been renovated and insulated. At the moment it is unclear how many owners have actually started implementing the measures, what type of measures they are carrying out, the costs of their investments and the effects the work has on their energy use. Besides interim surveys that are planned, an elaborate end evaluation will take place towards the end of the project.

5.2. ICDuBo, Netherlands: WoonWijzerWinkel and Pop-Ups

The main characteristics of ICDuBo are the following:

- Type: a combination of a long-term information and consultancy centre in an existing office with short to medium-term local pop-ups (both mobile as in an existing building).

- Initiative: regional and local authorities have taken the initiative. Currently ICDuBo is a partnership between public bodies, local, regional authorities and representatives of the (private) supply side (builders, installers, advisors, etc.).
- Customer Journey: almost the complete journey is taken care of: from raising awareness and initiating renovation plans up to the assistance during the execution of the work.

The regions Rotterdam-Rijnmond and Haaglanden have developed a digital energy counter, which is related to both a physical energy consultancy centre in Rotterdam (Innovation Centre for Sustainable Building, managed by ICDuBo) as a mobile pop-up (“WoonWijzerWagen”). Additionally, the municipality of Rotterdam organises pop-ups in targeted neighbourhoods. ICDuBo, a non-for-profit organisation, plays a key role in this initiative. ICDuBo is the central platform where local and regional authorities, educational institutions, suppliers, builders and installers cooperate to create a market place where demand can meet supply. Both on the website as in the physical ICDuBo store a wide range of products and materials can be found that can be used to improve the energy performance of a building. More than 20 municipalities in the Rotterdam and The Hague regions are active within ICDuBo’s “WoonWijzerWinkel” that focusses specifically on homeowners.

The mobile “WoonWijzerWagen” occasionally pops up in local authorities in the Rotterdam and The Hague regions. Interested homeowners with plans or questions about energy saving measures can walk in to get information, advice and support, which are provided by an independent staff.

In 2016 and 2017 Rotterdam has organised three additional pop-up centres in targeted neighbourhoods. Two popped up in the centre to attract as much people as possible. The last one was positioned in a targeted location and attracted local homeowners via specific local campaigns. The choice of the targeted neighbourhood was determined by looking at specific local needs and possibilities (e.g., the need to remove asbestos or a planned replacement of sewers). The last pop-up was open a couple of months and had long opening hours. The staff consisted of an independent advisor who was trained to approach entering visitors immediately. Usually technical information was provided about certain energy saving measures (mostly thermal insulation, but also solar energy and smart meters) and subsidy and financing possibilities. Information about technical measures depended on the period of the year. In the colder months, emphasis was on thermal insulation, and in the summer displays were focused more on solar energy and, for example, home energy monitoring systems. Homeowners who wanted to proceed further and make actual renovation plans could get specific advice tailored to their own situation at the WoonWijzerWinkel. In practice around 15% of the visitors actually went to the WoonWijzerWinkel after their visit to the pop-up.

The experiences of these short/medium term pop-ups show that it is essential to organise activities and campaigns to attract as many homeowners as possible. A prime location in itself does not attract sufficient visitors. There is also a need for eye catchers to attract visitors. For instance, in the last (and most successful) pop-up a Tesla battery was placed to attract residents. Visitors also got “ticket” advantage in this pop-up. They got detailed and tailor-made information about their own situation and were offered information about the use and advantages of smart meters. An important asset of one of the pop-ups was also that it became an information (and inspiration) centre for neighbourhood activities. Cooperation was, for instance, realised with local aspiring jewellers, and sometimes social activities were organised.

6. Discussion: Could Pop-Ups Make a Difference?

The experiences show that pop-ups and consultancy centres could play an important role in accelerating the energy performance of owner-occupied housing. They offer local authorities an excellent chance to improve their communication and provide homeowners with tools and support. An essential element is that expert intermediaries should be involved to offer tailor-made advice. Pop-ups that target certain neighbourhoods also make it possible to address the needs and wishes of individual homeowners.

Many strategies and policy approaches to convince homeowners to undertake action are currently insufficiently embedded in the social context of homeowners, meaning their specific individual behaviour, household and financial situation, energy consumption and energy use pattern. Several research projects indicate that tailored and personalised approaches could be an effective motivational strategy to improve the energy performance of owner-occupied dwellings [31–36]. A pop-up or consultancy centre could be just the right policy vehicle to realise this; they enable a tailor-made individual approach with neighbourhood actions in local communities.

Nearly all initiatives analysed in this article are financed or subsidised by (national, regional or local) authorities. This applies as well to the development costs as the management cost of the centres and pop-ups. This means that these centres and pop-up models cannot be seen as independent policy instruments, which can be analysed separately with a business model approach. In general, they can be interpreted as a local authority customer channel, that is part of their policies to improve the energy performance of the owner-occupied housing stock. If local authorities want to add consultancy centres and pop-ups as instruments to their policy mix, the involvement of private parties (e.g., building product suppliers, builders and installers) is necessary. Not only in financial terms, but first and foremost because these market intermediaries could play an essential role providing homeowners with technical advice, solutions and support.

The specific role of pop-ups and consultancy centres reflects the national policy framework of each country. The Netherlands and Belgium attach a greater importance to the development of pop-ups and consultancy centres compared to France and the United Kingdom. The Dutch national policy to stimulate the development of local digital and physical energy counters is closely related to the emergence of consultancy centres and pop-ups [37,38]. To some extent this is also the case in Flemish cities that aim to make renovation coaches and energy houses available on the short term [39]. In the United Kingdom and France the policy framework differs from Belgium and the Netherlands. The main goal of the UK national policy is to offer information, advice and support, mainly supporting digital platforms instead of face-to-face contacts. Regional and local policy instruments for energy saving are currently limited. The key role in tackling energy poverty of low income residents is going to be played by energy suppliers instead of local authorities [40]. In practice, however, it can be noted that a few local authorities (e.g., Kent County), are considering to set up pop-ups as a means to reach homeowners. In France the situation is different again. French local authorities are taking a more and more important role in improving the energy performance of the existing housing stock. It is anticipated that current territorial energy renovation platforms will make more use of consultancy centres and pop-ups to inform, advice and support owners [41]. Some public energy efficiency services (for example SPEE Picardie) are already developing a pop-up to support their current homeowner renovation services.

In all examples studied in the four countries, regional and/or public parties pay the bill, both for initiating the pop-ups as for its daily management. In a few cases additional income is generated by asking customers to pay a small fee (e.g., for an energy audits or for a specialist that makes a site-visit). Only the Dutch examples 033Energie and De Huizenaanpak illustrate that centres and pop-ups can also be “formalized” in foundations that are led by private parties. Nonetheless also in these cases, local (or regional) authorities are mainly responsible for financing the activities. The only example that is found where private parties launched a commercial centre is Reimarkt in the Netherlands. However, even there, local authorities have subsidised the development of the initiative and currently still pay a large part of the costs for daily management.

This study indicates the potential valuable effects of policy instruments as consultancy centres and pop ups on the sustainable (and community based) improvement of owner occupied dwellings in neighbourhoods and streets. Nonetheless further research is necessary, both into the services and tasks these centres and pop-ups should provide as into to their effectiveness. With respect to their tasks and services, the theoretical framework of Axon (2016–2017) could be used to try to identify which tasks (or interventions) of consultancy centres or pop-ups are (theoretically) important to maximise

the drivers and minimise the barriers for homeowners to undertake actions. Actions that could be aimed at improving the energy performance of their dwellings and at improving their “sustainable behaviour” in general.

With respect to the effectiveness of pop-ups, research is necessary into a wide range of subjects of which the most important are:

- Type of measures that is taken by homeowners.
- Investments made in their dwellings and the way the investments are financed.
- Effects on the reduction of energy use, emissions and other sustainable issues.
- Effectiveness of the multiple tasks and services the centres and pop-ups deliver.
- Effectiveness of the various approaches (e.g., consultancy centres in the city centre versus pop-ups in targeted neighbourhoods or communities).
- Role and contribution of market intermediaries in the initiatives.
- Relation between the costs of the instrument and its benefits and effectiveness,
- Effects on the awareness and neighbourliness, sense of community and cooperation (especially related to energysaving/sustainability issues) of individual homeowners.

7. Conclusions

Pop-ups and consultancy centres can effectively support homeowners during their customer journeys to improve the energy efficiency of their dwellings. The question whether certain customer segments (or dwelling types) must be targeted or not largely determines the choice for the type of centre. A permanent centre in an easily accessible location can be sufficient to raise awareness and offer information and advice to the general public. If local authorities wish to focus their policy attention on certain streets or neighbourhoods, it is advisable to use short or mid-term mobile pop-ups. The experiences with existing pop-ups show that there are various ways to reach the goals. A permanent consultancy centre in the town centre (aimed at homeowners in general) can be combined with the deployment of short or mid-term pop ups (mobile or in an existing building) to attract targeted homeowners in a specific neighbourhood. A combination of various types of pop-ups and centres can be very effective, but success or failure highly depends on the nature and intensity of communication activities. Local authorities also should take into consideration that pop-ups and consultancy centres could be used to organise other activities to strengthen the “neighbourhood feeling”.

The business model canvas can support local authorities to organise and set up pop-ups or consultancy centres. The various business model “items” are naturally strongly intertwined. It starts with the goals a local authority wants to reach, which can vary from raising awareness up to practical assistance. This determines the type of pop-up or consultancy centre that is needed. In general, all types of centres and pop-ups could handle all the steps of the customer journey. The initiative of nearly all existing examples has been taken by local, regional or national authorities. In some initiatives—as illustrated in the case studies—cooperation has been established with other non-for-profit organisations. Local authorities should try to involve the supply side directly in the development of pop-ups. Building products suppliers, builders and installers—but also independent advisors such as architects and experienced energy consultants—should be invited as (key) partners as soon as possible, to assure their role during the essential customer journey steps like designing, contracting, managing, executing and verifying quality.

This article, and especially the in-depth case analyses, illustrate that a mix of policy instruments in a pop-up or consultancy centre model can be initiated at the same time by a combination of public, semi-public and private initiatives. The possibilities seem endless. The common denominator is that via these pop-up models public and private parties can join their forces to reach, stimulate and support homeowners during their (gradual) customer journey to realise an energy efficient dwelling.

Author Contributions: Design of the research project E.M. and A.S. Performance of the research F.M., A.S. and E.M., Analyses of the case studies and data: F.M., A.S. and E.M. Writing of the article: F.M., A.S. and E.M. Original draft preparation: F.M. and A.S. All three authors have read and approved the final manuscript.

Funding: The Triple A project is funded by the European Fund for Regional Development (within the framework of the Interreg 2 Seas Mers Zeeën Programme; project number 2502-029) with financial support of the Provinces of South Holland and West Flanders. The APC was funded by Delft University of Technology.

Acknowledgments: This article is based on the work that is done in the framework of the Interreg 2 Seas project “Triple-A: stimulating the Adoption of low-carbon technologies by homeowners through Awareness and easy Access” (<http://www.triple-a-interreg.eu/>).

Conflicts of Interest: The authors declare no conflicts of interest.

References

1. Eurostat. Energy Consumption in Households. Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Energy_consumption_in_households (accessed on 21 March 2018).
2. Eurostat. Housing Statistics. Available online: http://ec.europa.eu/eurostat/statistics-explained/index.php/Housing_statistics (accessed on 21 March 2018).
3. Gram-Hanssen, K.; Jensen, J.O.; Friis, F. Local strategies to promote energy retrofitting of single-family houses. In *Energy Efficiency*; Springer: Dordrecht, The Netherlands, 2018; pp. 1–16.
4. Meijer, F.; Straub, A.; Mlecnik, E. *Concepts for Consultancy Centres and Pop-Ups for the Adoption of Low-Carbon Technologies by Homeowners (Triple-A: Stimulating the Adoption of Low-Carbon Technologies by Homeowners through Increased Awareness and Easy Access)*; TUDelft: Delft, The Netherlands, 2018.
5. VNG. Klantreis Energiebesparing Woningeigenaren. Report VNG in Collaboration with PwC. 2015. Available online: <https://vng.nl/files/vng/20172106-vng-rapport-klantreis-energiemaatregelen-woningeigenaren.pdf> (accessed on 29 January 2016).
6. Osterwalder, A.; Pigneur, Y. *Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers*; Wiley: New York, NY, USA, 2010.
7. Guertler, P.; Smith, W. Energy efficiency in the sustainable refurbishment of high-rise residential buildings: Mapping out an integrated policy approach. In *Energy for Sustainable Development*; Elsevier: Amsterdam, The Netherlands, 2006; Volume 10, pp. 37–44.
8. Klinkenberg, F.; Sunikka, M. *Better Buildings through Energy Efficiency: A Roadmap for Europe*; Report as part of the Eurima Blueprint Project; Eurima: Brussels, Belgium, 2006.
9. Meijer, F.; Itard, L.; Sunikka-Blank, M. Comparing European residential building stocks: performance, renovation and policy opportunities. *Build. Res. Inf.* **2009**, *37*, 533–551. [[CrossRef](#)]
10. European Bank for Reconstruction and Development (ERBD). *Energy Efficiency Governance: Handbook*, 2nd ed.; International Energy Agency (IEA): Paris, France, 2010.
11. Haavik, T.; Mlecnik, E.; Rødsjø, A. From demonstration projects to volume market of sustainable construction. *Energy Procedia* **2012**, *30*, 1411–1421. [[CrossRef](#)]
12. Stieß, I.; Dunkelberg, E. Objectives, barriers and occasions for energy efficient refurbishment by private homeowners. *J. Clean. Prod.* **2013**, *48*, 250–259. [[CrossRef](#)]
13. Organ, S.; Proverbs, D.; Squires, G. Motivations for energy efficiency refurbishment in owner-occupied housing. *Struct. Surv.* **2013**, *31*, 101–120. [[CrossRef](#)]
14. Straub, A. *COHERENO: Collaboration for Housing Nearly Zero-Energy Renovation Publishable Report*; TU Delft: Delft, The Netherlands, 2016.
15. Wilson, C.; Crane, L.; Chryssochoidis, G. Why do homeowners renovate energy efficiently? Contrasting perspectives and implications for policy. *Energy Res. Soc. Sci.* **2015**, *7*, 12–22. [[CrossRef](#)]
16. Langlois-Bertrand, S.; Benhaddadi, M.; Jegen, M.; Pineau, P.O. Political-institutional barriers to energy efficiency. *Energy Strategy Rev.* **2015**, *8*, 30–38. [[CrossRef](#)]
17. Vogel, J.A.; Lundqvist, P.; Ariasa, J. Categorizing barriers to energy efficiency in buildings (The 7th International Conference on Applied Energy—ICAEE2015). *Energy Procedia* **2015**, *75*, 2839–2845. [[CrossRef](#)]
18. Klöckner, C.; Nayum, A. Specific Barriers and Drivers in Different Stages of Decision-Making about Energy Efficiency Upgrades in Private Homes. *Front. Psychol.* **2016**, *7*, 1362. [[CrossRef](#)] [[PubMed](#)]
19. Palm, J.; Reindl, K. Understanding barriers to energy-efficiency renovations of multifamily dwellings. *Energy Effic.* **2018**, *11*, 53–65. [[CrossRef](#)]

20. Kivimaa, P.; Martiskainen, M. Innovation, low energy buildings and intermediaries in Europe: Systematic case study review. *Energy Effic.* **2018**, *11*, 31–51. [CrossRef]
21. Martiskainen, M.; Kivimaa, P. Creating innovative zero carbon homes in the United Kingdom: Intermediaries and champions in building projects. *Environ. Innov. Soc. Transit.* **2018**, *26*, 15–31. [CrossRef]
22. Killip, G.; Fawcett, T.; Janda, K.B.; Beillan, V.; Nösperger, S. Building Expertise: Industry responses to the low-energy housing retrofit agenda in the UK and France. In Proceedings of the ECEEE Summer Study, Toulon/Hyères, France, 29 May–3 June 2017.
23. Killip, G.; Owen, A.; Morgan, E.; Topouzi, M. A co-evolutionary approach to understanding construction industry innovation in renovation practices for low-carbon outcomes. *Int. J. Entrep. Innov.* **2018**, *19*, 9–20. [CrossRef]
24. Itard, L.C.M.; Meijer, F. *Towards a Sustainable Northern European Housing Stock Figures, Facts and Future*; IOS Press (TUD): Amsterdam, The Netherlands, 2008.
25. European Environment Agency (EEA). *Achieving Energy Efficiency through Behaviour Change: What Does It Take?* EEA Technical report; EEA: Copenhagen, Denmark, 2013.
26. Mlecnik, E.; Straub, A. *Barriers and Opportunities for Business Collaboration in the nZEB Single-Family Housing Renovation Market*, IEE Intelligent Energy Europe COHERENO Project Report; TU Delft: Delft, The Netherlands, 2014; Available online: http://www.cohereno.eu/fileadmin/media/Dateien/COHERENO_Report_Collaboration.pdf (accessed on 9 April 2018).
27. Rogers, E.M. *Diffusion of Innovations*, 5th ed.; Free Press: New York, NY, USA, 2003.
28. Axon, S. “The Good Life”: Engaging the public with community-based carbon reduction strategies. *Environ. Sci. Policy* **2016**, *66*, 82–92. [CrossRef]
29. Axon, S. “Keeping the ball rolling”: Addressing the enablers of, and barriers to, sustainable lifestyles. *J. Environ. Psychol.* **2017**, *52*, 11–25. [CrossRef]
30. 3WPlus. *Wonen, Werken & Welzijn in Halle-Vilvoorde*; Jaarverslag; 3WPlus: Halle-Vilvoorde, Belgium, 2016.
31. Gyberg, P.; Palm, J. Influencing Households’ Energy Behaviour—How is this Done and on What Premises? *Energy Policy* **2009**, *37*, 2807–2813. [CrossRef]
32. Oikonomou, V.; Becchis, F.; Steg, L.; Russolillo, D. Energy Saving and Energy Efficiency Concepts for Policy Making. *Energy Policy* **2009**, *37*, 4787–4796. [CrossRef]
33. Palm, J. The Public–private Divide in Household Behaviour: How Far into Home Can Energy Guidance Reach? *Energy Policy* **2010**, *38*, 2858–2864. [CrossRef]
34. Ellegard, K.; Palm, J. Visualizing Energy Consumption Activities as a Tool for Making Everyday Life More Sustainable. *Appl. Energy* **2011**, *88*, 1920–1926. [CrossRef]
35. Mills, B.; Schleich, J. Residential Energy-efficient Technology Adoption, Energy Conservation, Knowledge, and Attitudes: An Analysis of European Countries. *Energy Policy* **2012**, *49*, 616–628. [CrossRef]
36. Steg, L. Promoting Household Energy Conservation. *Energy Policy* **2008**, *36*, 4449–4453. [CrossRef]
37. MBZK (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties). *Voortgangsbrieven Energiebesparing (Kenmerk 2017-0000268686)*; MBZK: Den Haag, The Netherlands, 2017.
38. VNG. Gives an Overview in Dutch of the National/Provincial and Local Policies. Available online: <https://vng.nl/wegwijzer-energie> (accessed on 18 May 2018).
39. Vlaanderen. Is Duurzaam, Elaborates in Dutch on the Way Provincial Supporting Points Function. Available online: <http://www.do.vlaanderen.be/provinciale-en-stedelijke-steunpunten> (accessed on 18 May 2018).
40. DBEIS (Department for Business, Energy & Industrial Strategy). *Policy Paper, Clean Growth Strategy*; DBEIS: London, UK, 2017.
41. Gouvernement. Gives an Overview of the French Energy Policies. Available online: <http://www.gouvernement.fr/en/energy-transition> (accessed on 15 December 2017).

