Experiences from Local Authorities Stimulating the Adoption of Low-Carbon Technologies by Homeowners

E. Mlecnik[1]

[1] TU Delft, Faculty of Architecture and the Built Environment, Delft (The Netherlands)

Abstract

To meet carbon reduction goals, local authorities aim to achieve a market acceleration for owner-occupied single-family home renovations by increasing awareness of – and enabling access to – low-carbon technologies for homeowners in target areas. In this framework, this research summarizes and examines project experiences of seven local authorities in Belgium, France, The Netherlands and the UK in the period 2017-2021. These cover the use of different models of demo exemplars and pop-up consultancy centres in target areas, web module developments and the use of Home Energy Monitoring Systems by local authorities. The results show that local authorities can benefit from using an innovation adoption model to develop an integrated mix to support homeowners throughout their whole renovation journey. Depending on their context, local authorities can focus on specific customer segments and target areas to support adopting new technologies, renovation measures at district level, deep renovation, phased retrofits and any combinations thereof. Physical and digital communication can be tailored to (pop-ups in) specific target areas, customer segments and local actors. Local authorities can work more closely together with intermediaries, also to achieve more renovations, group buying actions, specific energy coaching for groups of homeowners and Integrated Home Renovation Services.

Keywords: Renovation, homes, local authorities, innovation adoption, low-carbon technologies, customer journey

1. Introduction

To meet the objectives of the European Green Deal to reduce greenhouse gas emissions by at least 55% by 2030, European authorities need to boost the energy performance of existing buildings (European Commission, 2019). Buildings account for 40% of the EU's total energy consumption and for 36% of its greenhouse gas emissions from energy (European Commission, 2019; European Commission, 2020). At least 40% of buildings floor area in developed economies was built before 1980, when the first thermal regulations came into force (IEA, 2022), 85% of the EU's building stock was built before 2001 (European Commission, 2020), and 85-95% of the buildings that exist today will still be standing in 2050 (European Commission, 2020). Roughly 75% of buildings in the EU is energy inefficient according to current building standards (Filippidou & Jiménez Navarro, 2019).

Building renovations are happening but the rate is too slow: the annual renovation rate of the building stock varies from 0.4 to 1.2% per year in the Member States and this rate will need at least to double to reach the EU's objectives (EU, 2019). An annual deep renovation rate of over 2% is needed from now to 2030 and beyond, and policymakers are urged to retrofit 20% of the existing building to a zero-carbon-ready level by 2030 (IEA, 2022). This implies that building renovations need to happen much faster and with more ambitious energy-saving goals and that consequently low-carbon technologies - such as improved glazing and window frames, thermal insulation, airtightness solutions, energy-efficient HVAC systems, energy-saving lighting and appliances, renewable energy systems - need to be adopted faster and in greater amount by more building owners.

The adoption of such solutions is influenced by building characteristics and a range of personal, contextual and external factors (Ebrahimigharehbaghi, 2022). A key barrier is that the decision to proceed with home energy renovation often belongs to non-professional property owners, who experience home renovation as a huge undertaking (de Vries et al., 2020). Single-family homeowners find a renovation effort too expensive, too complicated, too cumbersome, while their knowledge about processes, solutions, measures, legal aspects and incentives is limited. This suggests the need for de-hassling policy interventions (de Vries et al., 2020).

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Local Authorities (LAs) see it as their task to help implement national goals and try to help solve local barriers to speed up single-family home renovations (Mlecnik and Hidalgo-Betanzos, 2022). Besides incentives, local energy planning and control of regulations, they also engage in communication and facilitation of energy renovations. LAs aim to cleverly nudge homeowners to invest in energy renovation measures and renewable energy systems, making best use of local skills and support schemes. In the local context, they provide homeowners and citizens in general with knowledge and services to understanding the home renovation process, evaluating options, managing the process, financing the renovation and delivering an end result, in general: to facilitate their renovation decision processes.

In this context LAs are looking for a mix of policy interventions that can help to create awareness and easy access for low-carbon renovation solutions. LAs have for example developed improved digital interfaces that target homeowners to adopt such solutions (Kwon et al., 2021a) and they have experimented with the development of pop-up consultancy centres in districts where energy advice is given to visiting citizens (Mlecnik et al., 2021; Kwon et al., 2021b). Furthermore, LAs have used demo exemplars to convince homeowners (Baylis et al., 2021). Also, Home Energy Monitoring and Management Systems (HEMS) have been deployed by local authorities to homeowners to nudge homeowners to invest in renovation measures (Kwon et al., 2021c).

To better understand the barriers LAs encounter in such developments, this paper assesses the activities of seven local authorities regarding how they dealt with creating awareness for - and providing easy access to - low-carbon technologies for homeowners, including energy efficiency solutions and renewable energy systems.

2. Research approach

This qualitative study is done using the widely accepted theoretical framework of innovation adoption theory (Rogers, 2003), as also discussed and adapted by various authors for the topic of housing (e.g. Mlecnik, 2013; van Oorschot et al., 2020). It assesses innovation adoption in the framework of the Interreg 2 Seas Triple-A project (2017-2021, www.triple-a-interreg.eu). In this project seven local authorities (LAs: cities of Rotterdam, Breda, Antwerp, and Mechelen; EOS Ostend; SPEE Hauts-de-France; Kent County Council) identified, tested and evaluated new ways of supporting homeowners in local target areas using adapted communication policy approaches involving web portals, pop-up consultancy centres, visits to demonstration exemplars and easy access to Home Energy Monitoring Systems (HEMS). A systemic approach was jointly developed with universities (TU Delft, University of Ghent) and energy distribution net manager Fluvius. This resulted in a model that helps the LAs to identify strategic priorities and activities they can develop to improve single-family homeowner adoption of low-carbon renovation measures (see Figure 1).

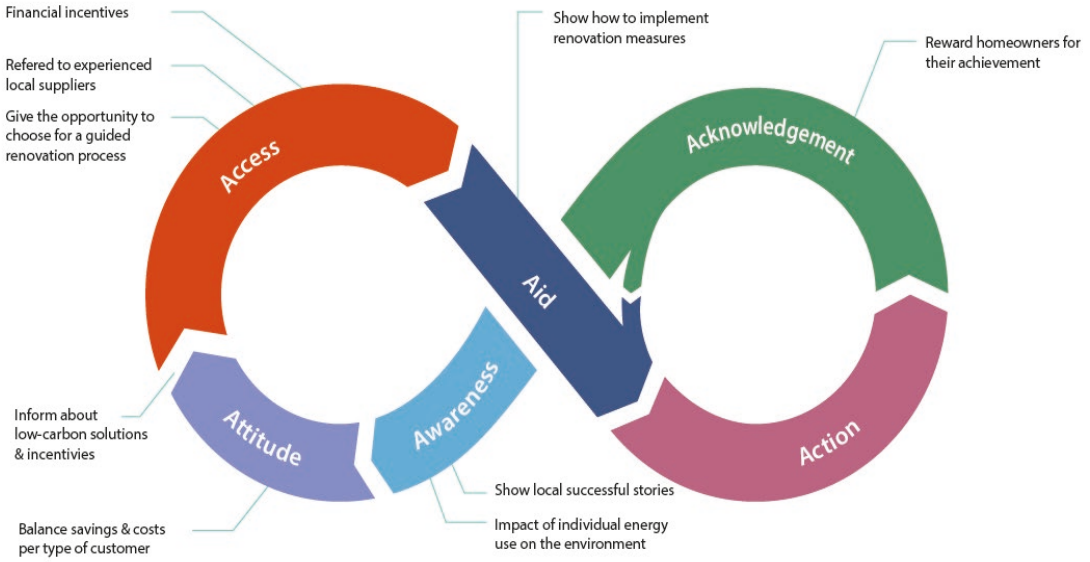

Fig. 1: Model for local authorities for developing operational activities and policy instruments for supporting the adoption of low-carbon technologies by homeowners. Sources: Triple-A (2021); Kwon et al., (2021a).

The LAs used this model for reflecting on available and needed actions and local policies that could be developed either by themselves or with partners and local stakeholders in co-creation. Per type of activity the model was also used to discuss how the activity could lead to creating awareness and changing the homeowners' attitude towards a proposed renovation solution. Furthermore, LAs reflected on how they could facilitate easier access to the solutions and help the homeowners further along the process, for example for contracting executors, for providing help during execution and for checking quality. Hoping that this would lead to speeding up homeowner decisions, LAs further aimed to engage homeowners acknowledging the successful implementation of a solution to help other homeowners, for example by letting them explain their experiences during home visits or online. Specific developments were supported by literature research, questionnaires, interviews, an inventory of low-carbon technologies and financial schemes, jointly organized business modelling and co-creation workshops and local events.

For the LAs the systematic thinking in terms of the homeowner renovation journey was rather new. In this framework LAs aimed to innovate their own working processes and internal arrangements with a specific focus as described in the Triple-A (2021) project. Within this project, the LAs developed both their virtual and physical consultancy for homeowners and an integrated mix of measures to support adoption of low-carbon technologies by homeowners. LAs' existing web portals would be adapted with additional web modules developed by the LAs, using both qualitative and quantitative research as well as co-creation with local stakeholders (Kwon et al., 2021a). The seven LAs also wanted to test local pop-up consultancy centres in target areas, either on a fixed location or in a mobile format (Meijer et al., 2018; Kwon et al., 2021b; Mlecnik et al., 2021). HEMS were used to support convincing homeowners to renovate (Kwon et al., 2021c) and installation of low-carbon technologies was to be tested through demo exemplars (Baylis et al., 2021).

3. Main project results

Main cumulative results achieved by the LAs during four years project activity (until December 2021) are illustrated below. The figures were developed based on obligations from the Interreg 2 Seas Programme Manual to continuously track key performance indicators, which were defined in detail by the project partners. The figures can give an indication of the relative merit of the various actions. Note that all activities are heavily interrelated, so the figures should be interpreted with care.

3.1 Experiences with demo exemplars and target areas

The demonstration exemplars implemented in the LAs ranged in their approaches but were grouped into four different types (Baylis et al., 2021):

- Model A: Utilizing new and innovative technologies: particularly looking at the use of battery storage systems when combined with solar panels to increase their effectiveness.
- Model B: Whole house or nearly-zero carbon retrofit: often included a range of measures to make the house as energy efficient as possible.
- Model C: Large scale or community wide mass retrofit: included group buying schemes or whole district approaches.
- Model D: Longer term phased retrofit: often only one or two resident-led measures depending on the circumstances of the homeowner, aiming to drive renovation and more engagement before the measures were installed.

These models were explored using a structured development approach (Baylis et al., 2021):

- Identifying suitable target areas: 8 local authority regions for single-family home renovations
- Exploring how to engage citizen segments in target areas: young families, empty-nesters, existing adopters, people with major life changes, highly educated financially successful persons, persons receptive to renovation in their district, fuel poor citizens.
- Identifying suitable financial incentives for engaging single-family homeowners: funding and finance including individual subsidies, group subsidies, property tax incentives and added tax incentives
- Testing installation of technologies through demonstration homes
- Evaluating CO_2 reduction of demo exemplars and awareness raising

For developing the demo exemplars LAs used the input from jointly organized workshops, brainstorms, meetings, buddy cooperation, standardized contracts and information about finance, funding and demo models.

Regarding Model A, in total 12 battery storage systems were installed. Experiences were mixed. For example, the Kent County Council could easily convince 10 homeowners to install a battery pack. These households were mainly interested in new technology developments and volunteered to install the system. In Flanders the LAs found it very difficult to select homeowners indiscriminately. Finally, actors were found that engaged in the development of a virtual power plant in a renovated apartment building, supported by European funding. Other partners tried to engage homeowners as well. Available data from Rotterdam show that four storage systems with solar panels in Rotterdam achieved 4,8 tons annual carbon savings.

Regarding Model B, Antwerp offered a consultant for homeowners, but wasn't able to convince citizens to achieve this type of renovation. Also Mechelen struggled to convince citizens due to the needed high investment cost, the administrative burden of building permits and the lack to predict or guarantee the expected energy savings. On the other hand, the Integrated Home Renovation Services (IHRS) offered by SPEE Hauts-de-France led to developing personalized work programs for 61 demo houses achieving annual savings of 227 tons carbon emissions. The Rotterdam door-to-door campaign offering energy scans and further support on request led to 21 installed measures in 5 homes, leading to annual carbon savings of 16.9 tons. This shows that nearly-zero carbon retrofit can be difficult to implement but gives excellent carbon savings results. To achieve deep retrofits there seems to be a need to develop IHRS beyond awareness raising and providing easy access and to include also specific aid and financial solutions for homeowners.

Concerning Model C, SPEE Hauts-de-France successfully used residents to engage other persons in the district: measures in 62 homes led to 250 tons annual carbon savings. Rotterdam successfully used a regional energy consultancy desk as intermediary between supply and demand to organize group purchases, which could target 24 cities at the same time. Through this partnership Rotterdam installed measures in 187 homes in the target areas leading to 172 tons annual carbon savings. EOS successfully organized a group purchase of 363 solar panel installations using dedicated social media, adverts, face-to-face and group meetings, leading to 249 tons annual carbon savings.

For Model D, SPEE Hauts-de-France successfully used their IHRS to install measures for 499 demo homes, achieving 1,901 tons of annual carbon savings. Rotterdam also used its energy consultancy desk to carry out door-to-door actions and energy scans and support until installation on request. In this framework most residents chose 1 or 2 measures, resulting in 1,049 measures in target areas in 435 homes, leading to 624 tons annual carbon saving. Breda developed awareness raising and easy access together with a local citizen energy cooperation, which resulted in 2000 registered interested homeowners, about 500 kitchen table consultancies by energy coaches and 134 financial loans offered in target areas, saving annually 138.9 tons of carbon emissions. The cooperation was also successful in engaging homeowners to tell their adoption story to other homeowners. Mechelen also successfully used motivated citizens as 'ambassador' in the target district. In a street with 50 homes this led to collective action engaging 21 families guided by an energy coach. Mechelen achieved in total 17 installations leading to 8,640 tons of annual carbon savings. This experience led to a broader system of energy coaches that support collective action in Mechelen.

Cumulatively LAs also developed 27 open home events. Demo events attracted 90 visitors. Homeowner engagement during visits ensured language was at the right technical level for non-experts. Events and peer-to-peer communication were effective at engaging new audiences to engage with home retrofit measures. On the other hand, it was also difficult to find volunteers and maintain a good rapport with the homeowners sharing their experience.

LAs also successfully used 1599 thermographic surveys to convince homeowners. Also, process-related homeowner feedback surveys were part of the strategy and 199 surveys were received.

Overall, the seven LAs installed in total 2,542 demo technologies in homes achieving carbon savings of 4,095.7 tons per year (calculated according to national standards). In a wider area 4,215 homeowners were engaged, resulting in annual carbon savings of 2,104 tons. The results per model show mixed experiences per LA, but also the power of more integrated services, collective action and instruments for engaging homeowners to achieve better carbon savings. Due to COVID-19 most demo activities ceased in 2021.

3.2 The use of pop-up consultancy centres

As a key feature related to the success of awareness raising and easy access in target areas, LAs successfully developed and deployed short-term or longer-term renovation consultancy in the target areas using mobile or fixed pop-up consultancy desks and units, which are exemplified in Figure 2.

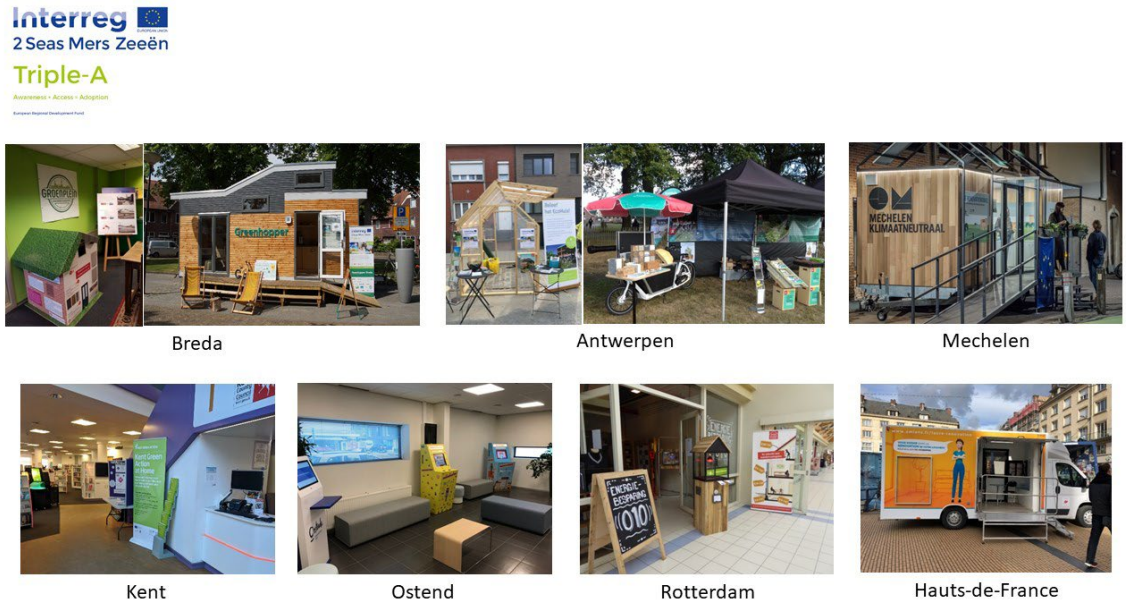

Fig. 2: Different types of pop-up consultancy centres developed and tested within the Triple-A project for stimulating the adoption of low-carbon technologies by homeowners. Source: Triple-A (2021).

Figure 2 shows for example the first unstaffed consultancy booths developed by Breda in libraries (top left). This action attracted far less homeowners compared to the mobile staffed pop-up developed by Breda (second top left). Ostend had a similar experience placing an information booth in a public office and later also developed a mobile unit. Also Mechelen and SPEE Hauts-de-France were inspired by the Breda development and used a mobile unit. Antwerp engaged in more low-cost staffed information stands on events and in target areas. Kent County Council also targeted low-cost unstaffed consultancy booths in libraries and public offices. Rotterdam developed two staffed sustainability consultancy centres in a shopping centre.

The LAs developed 10 pop-up consultancy centres in target areas. for guiding visitors and invested cumulatively €371,355 for developing the centres, involving in total 182 supply-side actors. The operating costs per pop-up varied from €6,435 to €246,310 and the investments varied from €4,065 to €101,790 depending on the planning, the size and format of the pop-up, the location/ mobility, the political framing, the staffing, opening hours, and so on. Cumulatively, 11,545 persons visited the pop-up centres. LAs spent in total 3,677 person-hours staffing the pop-ups. See also Kwon et al. (2021b) for further details and an evaluation of the effectiveness per pop-up.

Not all LAs systematically tracked the number of visitors engaging in follow-up consultancy or adoption of low-carbon technologies, mainly due to a lack of a CRM system or staff. From those who did, LAs counted at least 327 visitors engaged in follow-up consultancy or adoption, and 164 homeowners requested financial measures through the pop-ups. The project experiences show there is no one-size-fits-all approach for developing local pop-ups. Amongst other, the customer segments in the target areas, local policy strategies, political focus and available resources will influence the choice of pop-up. Promotional activities, embedded events, staffing and partnerships with local organizations, consultants and suppliers can highly influence the functional effectiveness of the pop-ups (Kwon et al., 2021b; Mlecnik et al., 2021). Due to COVID-19 most pop-up activities ceased in 2021.

One might speculate that such pop-up development cannot be financed or staffed by smaller LAs. Nevertheless, the pop-up idea was copied by multiple other LAs. Inspired by the seven LAs, pop-ups were for example adopted by Hoogstraten, Meijerijstad, Oosterhout, Gilze-Rijen, Dartford, Sittingbourne, Amiens, South of Aisne, Rotterdam's WoonWijzerWinkel, Woonkantoor Antwerpen, Kamp C, Groene Groei.

3.3 The development of specific web modules

LAs highly rely on operating web portals to communicate with citizens. Therefore digital consultancy is an integral part of any LA action to support adoption of low-carbon technologies for citizens. In this framework, it was observed that LAs are developing strategic plans to improve their web portals. In practice, this often translates into the development of specific web modules that can either operate dependent or independent from the LA main website, depending on what they perceive the best option for homeowners to find and collect reliable information and to get familiar with low-carbon renovation solutions.

LAs found that the activation of customer segments in target areas needs to be supported with specific digital tools that were previously not a part of the LA web portals. These included for example cost-calculation tools or mapping tools for homeowners to search related renovation projects or to search their home on a thermography map. But also low-end modules like registration, referral, appointment and feedback forms, information and consultancy modules on renovation measures and financing, were often still missing. Furthermore, LAs found a need to develop specific modules to be able to find a contractor and to share renovation experiences and adoption success stories.

LAs developed up to 20 modules; some were discarded after evaluation or redevelopment of the main website. For a remaining set of 15 web modules LAs measured cumulatively 52,621 unique number of visitors. See also (Kwon et al., 2021a) for an evaluation per web module. Overall web module visits were highly influenced by events and communication actions that drew attention to these new modules. The registration of web visitors didn't allow a breakdown per target group. Although this could not be tracked for all LAs, cumulatively at least 3,724 requests for information about low-carbon technologies were related to the web modules. 24 financial measures were made available by the LAs via the web modules. Cumulatively 10,942 financial measures were requested by homeowners. LAs also engaged 2 energy consultants and 172 SMEs in further business model development of web modules. Online 'events' proved to be popular.

Some LAs organized feedback from stakeholders to decide on the specific content of web modules. Only a few module developments effectively used co-creation or tried to develop web modules or platforms which cover all home renovation journey stages.

LAs experienced organizational or policy changes during the development of the web modules which led to an increased needed budget and sometimes the need to start again from scratch. For example, Breda's main website was totally redeveloped after an election. LAs were mainly tied by fitting web module development into ongoing web portal development plans and communication campaigns. During the development process, some LAs discovered their web sites lacked modular build-up. The investment and exploitation costs were higher for new websites than for web modules that could be integrated in an existing website. For most LAs basic infrastructure for following up actions, such as a Customer Relationship Management system, was missing. This made it also difficult to understand the success factors related to policy actions and the Triple-A development.

Specific modules also led to specific problems. For example, LAs also needed to carefully take into account Global Data Protection Regulations for developing modules using homeowner experiences. Also, instead of making contractor lists by themselves, LAs finally opted to provide links to third parties (non-profit organisations) that host such lists. Some LAs observed that some web modules would be better hosted at a regional or national level to serve multiple LAs at the same time. Particularly smaller LAs don't have to means to invest in elaborate web modules.

3.4 The deployment and use of HEMS

All LAs investigated the use of Home Energy Monitoring and Management Systems (HEMS) as a means to influence homeowner decisions, and consequently identified promising ways of using, adapting, selecting and procuring HEMS, as well as improved ways to collaborate with local stakeholders. 606 HEMS were installed by the end of 2020. During COVID-19 the installation of HEMS largely ceased. Until the end of 2021, a few additional homeowners were found for implementing the HEMS. Next to the seven LAs engaged in the project also the city of Sint-Niklaas adopted the HEMS Triple-A method.

A good response rate was achieved to questionnaires: 57% of HEMS users answered to questionnaires (Kwon et al., 2021c). 77,2 % of people reported they are at least satisfied with having the HEMS, 56.1% of people reported they are at least satisfied with the use of the HEMS. There was no direct follow-up planned of the number of low-

carbon technologies adopted by HEMS users, but in the second questionnaire 29,3% participants confirmed having invested in energy-saving measures and about 29% of the responding users also adopted energy saving measures.

LAs originally intended to modify HEMS before bringing them into homes and to monitor energy use. In practice this was technically not possible, and later also no longer wished for due to rapid commercial HEMS technology development. Also, the need for data cleaning and correction was underestimated and would require a huge staff effort. Finally, LAs decided to offer commercially available HEMS. In practice,

LAs found it very difficult to offer HEMS to homeowners, even if they were for free, due to privacy regulations and the need for unbiased selection of homeowners and open procurement. Also, compatibility issues and homeowner trust were sometimes factors that formed a barrier. During the project also energy distribution net managers started rolling out digital meters in homes which were perceived as competing or not compatible with the chosen HEMS.

Overall, in the beginning of the project LAs thought HEMS distribution would be a key success factor for the adoption of renovation measures, but in practice it proved to be an added benefit for homeowners. Due to the rapid commercial development, most LAs no longer see the need to offer HEMS as a LA service, unless they are part of a quality assurance system, such as in the SPEE Hauts-de-France IHRS system.

3.5 Dissemination and exploitation of results

Overall, the project could show promising results and strategies worth multiplying. Multiple reports and hands-on recommendations for local authorities were made available (www.triple-a-interreg.eu). A cross-border implementation guideline for local authorities was made available in English, Dutch and French and a “Get started!” page (https://www.triple-a-interreg.eu/get-started) was put online for LAs.

Results were promoted through on-line roadshow sessions and newsletters. For example, a Dutch roadshow communicated strategies and results to 151 project managers of LAs; in total nearly 600 participants were reached.

Overall the Triple-A method was embraced by multiple actors and Triple-A communication activities reached more than 175,000 stakeholders, including 4,479 LAs, 6,042 SMEs, 119,499 homeowners.

Regarding the management of the actions, the COVID situation impacted the need for organizing the project mostly online. The communication was considered the most critical topic, but effective online communication was achieved despite important delays. For example, events were originally developed to take place physically, were postponed and transferred to online events.

4. Discussion and outlook

When diving deeper into the Triple-A experiences of the LAs - see also the Interreg 2 Seas project reports on https://www.triple-a-interreg.eu/project-reports -, recommendations come forward that should be addressed in future developments:

- The success of awareness raising using online or physical homeowner consultancy highly depends on the nature and intensity of communication activities (see above).
- Most local authorities are not (yet) used to think in terms of subsequent needs of homeowners during a customer renovation journey (Triple-A workshop result).
- Communication is needed in carefully identified target areas to reach out to customer segments for upscaling renovation activities (Triple-A workshop result).
- Specific initiatives are needed for vulnerable households (Triple-A workshop result).
- The success of actions in districts highly depends on strengthening a “neighborhood feeling” (see for example Rotterdam).
- Co-creation processes are highly recommended to develop knowledge bases and incite public, private and civic actors (positive experiences Triple-A partners).
- LAs need to attract specific skills, such as specialized IT staff (Kwon et al., 2021a).

- Smaller local authorities usually don't have sufficient budget and need to find a centralized solution, for example a provincial desk or regional support (Triple-A roadshow result).
- Lack of CRM systems and privacy and security issues can hinder follow-up of homeowner activities and thus evaluation of policy targets (see above).
- Most local authorities do not yet have a 'modular' build-up of their online communication (Kwon et al., 2021a).
- Public-private collaboration can be hindered by a reluctance of LAs to engage in collaboration with local supply side or service actors (Triple-A experiences).
- In case of referral to private consultants or suppliers, independent listing is preferred Kwon et al., 2021a).
- To promote deeper retrofits IHRS are needed that also support deeper in the renovation process (Triple-A workshop result).
- Quality control within renovation processes and solutions to support after-care are not yet sufficiently integrated in LA consultancy processes (Triple-A workshop result).
- To reach multiple homeowners and suppliers at the same time it is recommended to work closely together with energy cooperatives (see for example Breda) or non-profit associations that act as intermediaries between supply and demand (see for example Rotterdam)
- Group buying initiatives of for example solar technologies can be highly successful in target areas (see for example Ostend)
- Energy coaches can be deployed for guiding groups of homeowners at the same time (see for example Antwerpen and Mechelen).

Regarding these issues, the Triple-A project also led to a spin-off project proposal on Integrated Home Renovation Services, which was prepared and submitted in the LIFE-CET call HOMERENO. During the Triple-A project it became clear that another strategy to multiply renovation measures would be to engage groups of homeowners at the same time, for example by using citizen-led energy cooperatives or formal assemblies of homeowners. The new project will focus on developing six Integrated Home Renovation Services for Condominium Associations in the Netherlands and Flanders. The new project, entitled 'CondoReno' will also compare LA-driven and market-driven IHRS and develop a digital resource centre for the IHRS in Mechelen and Ostend. It will also explore achieving living-cost neutral deep renovations to engage all target groups.

5. Conclusion

The Interreg 2 Seas Triple-A (2021) project showed multiple new opportunities, successes but also important barriers for Local Authorities (LAs) to further support the Renovation Wave. The project experiences show that LAs can certainly improve awareness raising for homeowners for adopting low-carbon technologies, and make access to carbon-saving renovation solutions easier. LAs can benefit from using a customer renovation journey model to develop more targeted actions. Depending on their context, LAs can focus on specific customer segments and target areas to support adopting new technologies, renovation measures at district level, deep renovation, phased retrofits and any combinations thereof.

Both physical and digital communication and consultancy provided by LAs remain very important and can be tailored to (pop-ups in) specific target areas and customer segments, including tailored information on available funding and clear information in layman's terms. Using demo exemplars, pop-up consultancy centres, specific web modules and HEMS can all have their merit to make homeowners adopt low-carbon technologies, but the relative effectiveness of such actions largely depends on local context and available resources and persons and the way these actions are embedded in LA programs and communication.

While LAs traditionally invest in awareness raising, providing easy access to low-carbon solutions can still be facilitated more. In this framework LAs can work more closely together with for example experienced homeowners, citizen energy cooperatives and non-profit organizations that act as intermediary between renovation measure supply and homeowner demand. To achieve more renovations, facilitating group buying actions and specific energy coaching for groups of homeowners can also be relevant. To achieve more deep renovations it is important to develop services beyond traditional consultancy services including specific aid and

financial solutions embedded in Integrated Home Renovation Services.

While this project mainly focused on single-family homes, a follow-up LIFE-CET project entitled 'CondoReno' will create and multiply Integrated Home Renovation Services for private condominiums in the Netherlands and Flanders.

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