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Article

Renewable Energy Communities as a New Actor in Home Energy Savings

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Abstract
Renewable energy communities (RECs) might be an interesting new stakeholder in stimulating home energy-saving efforts by tenants and homeowners due to their potential of raising awareness locally and gaining public support for low-carbon energy and energy-savings projects, because RECs are often locally sited, in close social proximity of residents, and are already part of local structures and share local institutions. This comes with many benefits since they already have a reputation locally, a social history with the local community, and can be trusted by the latter. This makes them potentially better suited than other—often less-trusted—parties (i.e., government and business companies) to use their agency to encourage sustainable change. The article builds on empirical data from the EU Horizon 2020 project REScoop Plus, using a mixed-methods research approach, including desk research, expert interviews, validation workshops, and multiple surveys among RECs in six EU member states about energy-saving actions implemented, and their effectiveness in terms of raising awareness, influencing the intention to save energy, and actual energy-saving behaviour. This article provides more insight into the assessment of actions and measures for coaching householders to achieve energy savings and low carbon goals. In addition, it shows the potential of using RECs as a new strategy to address home energy savings in the current housing stock, including options to improve the energy performance thereof.

Keywords
citizens' initiatives; community energy; energy conservation; energy transition; home energy savings; renewable energy communities; societal self-governance

Issue
This article is part of the issue "Zero Energy Renovation: How to Get Users Involved?" edited by Tineke van der Schoor (Hanze University of Applied Sciences) and Fred Sanders (CPONH NGO).

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1. Introduction

In the challenge of renovating the existing housing stock in the built environment, increasing its energy performance and improving residents' participation in neighbourhood renovation activities is crucial. Both tenants and owners should reconsider their energy use and the energy production of their dwelling or should be encouraged by agencies to do so. An actor that is easily overlooked is the self-organisation of citizens who can help each other to live "energy-neutral." These include, among others, joint housing projects (Tummers, 2021), associations of tenants or owners in a particular building or neighbourhood, eco-villages, and so-called renewable energy communities (RECs). In European legislation (see Section 3), RECs are legal entities that have as a primary purpose to provide environmental, economic, or social community benefits to its members or shareholders by engaging in renewable energy activities on a not-for-profit basis. In practice, the benefits of their activities do not just concern their members or shareholders but also the larger community.

2. Research Questions

In this article, the activities of RECs that are linked to the improving energy performance of homes in the existing housing stock are presented. In particular, we

discuss the advantage of RECs as an agent over others that stimulate households to save energy or invest in renewable energy. Behavioural determinants of households consuming energy can be targeted with actions or interventions—i.e., as "policy instruments"—to induce change or to change the conditions that influence how energy is consumed. Creating zero-energy homes is not merely a technological or economical challenge; it also contains a human factor. Creating zero-energy homes also calls for a change in the behaviour and the energy practices of final energy users (i.e., householders). This involves the consumption of energy in more rational and efficient ways. In the residential sector, this behaviour of tenants and homeowners is crucial. In particular, households consume energy and can be targeted with the aim of behavioural change, leading to lower volumes in energy demand. Research on energy saving tends to be within the context of low-carbon behaviour-change activities (Howell, 2012).

Historically, households are considered a target group that is difficult to reach or to persuade (Bressers & Ligteringen, 1997). RECs are increasingly considered important players in renewable energy and energy-saving efforts (Coenen et al., 2017). The hypothesis that is central to this article holds that extending the role of RECs as a new stakeholder in the energy renovation of homes and, more in general, home energy savings, has the potential to reach the difficult target group of tenants and homeowners. Establishing new RECs or getting existing ones involved would raise the level of participation of inhabitants in neighbourhood renovation activities and encourage more sustainable lifestyles. For these reasons, RECs can be considered a new and promising strategy to improve energy performance in the current housing stock.

In this article, three questions are addressed:

1. How do RECs encourage their members and (other) households to save energy?
2. To what extent are RECSs capable of effectively encouraging their members and (other) households to save energy?
3. To what extent could the potential involvement of RECs be considered a new strategy to improve the energy performance of the current housing stock?

To answer the first question, Section 3 discusses what RECs are and how they relate to stimulating home energy-savings. In Section 4, arguments are discussed on why RECs as agents of change are particularly suited to influence home energy savings. In Section 5, types of energy-saving instruments and actions are presented. This is confronted with the potential of RECs to use these mechanisms. Section 6 addresses the research approach and methods of the present study. Section 7 presents an overview of energy saving actions implemented by RECs. And in Section 8, the empirical results and insights are presented, highlighting the use of actions and measures of home energy savings. To answer the second question, the effectiveness of several dedicated energy-saving measures is discussed. In the concluding section, the research questions above are answered and we reflect on the potential advantages of a larger involvement of energy communities as a new strategy to increase the energy renovation rate of the existing housing stock.

3. Renewable Energy Communities

In the academic literature on community energy and policy practice, citizen energy initiatives go by very different names, like citizen-led renewable energy initiatives, local renewable energy organisations (Boon & Dieperink, 2014), local low-carbon energy initiatives (Warbroek et al., 2019), or renewable energy cooperatives (REScoops; REScoop.eu, 2022). The academic debates surrounding the growing academic field of energy communities contribute to "a bulwark of empirical examples, theoretical reflections and methodological tools" (Creamer et al., 2019, p. 1). Here, we follow the concept of "energy communities" as it was introduced through the "Clean Energy for All Europeans" package by the EU in its legislation, notably as: (a) "citizen energy communities" (CECs; Article 2 of the Electricity Directive) and (b) "renewable energy communities" (Article 2 of the Renewables Directive). Article 2 of the Renewables Directive defines RECs. "Renewable energy community" means a legal entity:

1. Which, in accordance with the applicable national law, is based on open and voluntary participation, is autonomous, and is effectively controlled by shareholders or members that are located in the proximity of the renewable energy projects that are owned and developed by that legal entity;
2. Whose shareholders or members are natural persons, small and medium-sized enterprises, or local authorities, including municipalities;
3. Whose primary purpose is to provide environmental, economic, or social community benefits for its shareholders or members or for the local areas where it operates, rather than financial profits.

The definition of CECs (Article 2 of the Electricity Directive) is quite similar to the one on RECs. The second and third bulleted issues are the same as the Renewable Energy Directive. The first issue holds that the autonomy principle is absent when compared to the definition of RECs. Where community initiatives seeking to produce, distribute, and consume energy locally are not a new phenomenon, the definition of CECs is the explicit recognition that community energy is not just about jointly producing renewable energy.

Energy communities are also engaged in other energy services and activities (Seyfang et al., 2013), such as persuading their members to conserve energy

(Coenen et al., 2017; Hoppe et al., 2016, 2019; Oteman et al., 2014; van der Schoor & Scholtens, 2015). Promoting home energy savings goes well with the primary purpose of providing benefits by RECs or CECs. When home energy savings are successfully promoted the energy savings create economic benefits including reduced energy bills for households (REScoop.eu & ClientEarth, 2020). Social benefits of the activities promoting energy-saving include the provision of different services (e.g., energy advice) to members including investment in energy efficiency and energy poverty. In addition, the energy-saving promotion provides environmental benefits including the reduction of greenhouse gas emissions. In the present article, the main focus is on measures that target influencing the curtailment and efficiency behaviours (including investment and adoption decisions) of tenants and homeowners. Historically, RECs and related NGOs have been stimulating home energy savings going back to the previous century. For example, in the UK, the Energy Savings Trust was established and served as an intermediary focusing on promoting energy-saving behaviours. It did so at a national level by delivering services to other (local) community energy organisations and households in terms of networking, supporting, and funding (Seyfang et al., 2014). It also created websites and online repositories that local community energy organisations could use to demonstrate energy savings and the lowering of carbon emissions (Hargreaves et al., 2013). Brummer (2018) shows that both in the UK and the US, community energy organisations are active in educational activities providing knowledge on energy-saving behaviours, combined with raising awareness for issues connected with energy consumption, such as climate change. Furthermore, Heiskanen et al. (2010) observed community energy organisations running virtual energy-saving platforms. More recently, RECs have also started to use high-tech solutions to stimulate home energy savings, e.g., through the use of smart grids, virtual power plants, and smart meters (van Summeren et al., 2020).

4. The Potential of Renewable Energy Communities to Influence Citizen Energy Saving

There are specific normative reasons for the existence of RECs, linked to objections against practices in current energy markets, and more in general the (fossil fuel and nuclear-fed) centralised energy system model (Coenen & Hoppe, 2021). According to the Renewable Energy Directive, the EU wants RECs and energy-active citizens to become agents of change in the sustainable energy transition in all EU member states and play an instrumental role in the low-carbon energy transition (Directive 2018/2001, 2018). The potential of RECs to stimulate home energy savings and renewable energy investments of tenants and homeowners lies in several factors where they, compared to other organisations (mainly from the public and private sector), are fairly well-positioned. When compared to other organisations (like local government, distribution system operators, or energy companies) they can potentially deliver services more efficiently for several reasons (Coenen & Hoppe, 2016; Coenen et al., 2017). Here, three groups of arguments are distinguished, respectively related to social embeddedness, community advantages, and trust and social acceptance. Social embeddedness in communities and social structures makes a difference with other agents:

- RECs are already embedded in social structures, and therefore have close ties with their customer groups and have direct contacts with consumers regarding energy saving (Hess, 2018);
- They can raise awareness among both the larger community and individual members to stress the importance of energy-saving. Because of their social embeddedness in local communities, they are likely better equipped to reach out to target groups than other agents would (Bauwens & Defourny, 2017; Dóci et al., 2015; Hewitt et al., 2019);
- They can set energy saving as a social norm within the community (Abrahamse et al., 2005).

Energy communities have the advantage over other agents of being a (local) community:

- RECs can organise energy-saving expertise dissemination at the community level, e.g., by organising workshops, working groups, or setting up an "energy library";
- Through their critical mass, they can build energy-saving expertise to share with members and the community (Bauwens, 2016);
- They can define and distribute the available capacity of renewable energy as a common resource in the community (Becker et al., 2017; Wolsink, 2012);
- They can better deal with NIMBY problems (the phenomenon of people objecting to the siting of something perceived as unpleasant or hazardous in the area where they live, especially while raising no such objections to similar developments elsewhere) related to aspects that have to do with siting (renewable) energy plants by balancing spatial, social, economic, and environmental interests in the community (O'Neil, 2020).

RECs, because they are a social community, have the advantage of generating more trust and social acceptance over other agents:

- They are viewed as a reliable partner to give advice, supply energy systems and appliances, and make people more willing to take energy-saving investment risks (Walker et al., 2010);

- They cannot only give personal and tailored assistance to members to develop a personal capacity to save energy but are trusted by the target group;
- They can easily cooperate with local stakeholders and have a different position because of their non-for-profit and idealistic goals (Hoppe et al., 2015; Warbroek et al., 2019; Warbroek, 2019);
- They can tailor energy-saving measures to where it is effective, while also addressing related social issues like energy poverty and justice (Feenstra & Hanke, 2021).

5. Types of Energy-Saving Instruments and Actions

Although energy communities are not governmental organisations, there is an analogy between the activities of RECs allowing their members to save energy and invest in renewable energy and the use of public policy tools. However, public policy is made by governments and organisations which act on behalf of governments. Public policies are legitimised by elected politicians' decision-making. Governments use policy tools or instruments to influence citizen behaviour and achieve policy goals (Dahl & Lindblom, 1953). Because tenants and homeowners are not a well-organised target group that the government can address, compared to business companies, policy instruments like voluntary agreements and permit systems are not suitable. So, actions aiming at energy savings of members, or the broader community of energy communities have to focus on influencing individual decisions and action. Schneider and Ingram (1990) distinguish five reasons why people are not taking action that can be addressed by policy: People may believe the law does not direct or authorise them to take action; they may lack incentives or the capacity to take the actions needed; they may disagree with the values implicit in the means or ends, or the situation may involve such high levels of uncertainty that the nature of the problem is unknown; it is unclear what people should do or how they might be motivated. Policy instruments address these problems by: (a) providing authority, (b) providing incentives or capacity, and (c) using symbolic and hortatory proclamations. Next, Schneider and Ingram (1990) distinguish five types of policy instruments:

1. Authority tools, which are statements backed by the legitimate authority of the government that grant permission, prohibit, or require action under designated circumstances;
2. Incentive tools are tools that rely on tangible payoffs, either positive or negative, to induce compliance or encourage utilisation;
3. Capacity tools are tools that provide information, training, education, and resources to enable individuals (or groups and agencies) to make decisions or carry out activities;
4. Symbolic and hortatory tools motivate people to take policy-related actions based on their beliefs and values. A hortatory is a person or thing that strongly requests someone else to take a particular action;
5. Learning tools that promote learning about the problem and the knowledge and uncertainty about both the problem and the action to be undertaken.

RECs cannot use all types of policy instruments. Real authority tools are not relevant to the energy community, but many actions of energy communities are backed up by their legitimacy as democratically organised, voluntary membership organisations. For direct influence, they need rewards to motivate households with individual tangible payoffs. Indirectly, RECs can influence the context in which the energy-saving decision is taken by using capacity tools. Through information or knowledge tools, tenants and homeowners can be persuaded to alter their energy consumption behaviour because they are confronted with new facts, information, or knowledge. The situation in itself has not changed. Regardless of the information (knowledge, arguments, and moral appeal) that is transferred, or through which mechanism (encouragement, persuasion, etc.), the change in behaviour is still voluntary. This also means that the provision of information does not always lead to a change in energy-use behaviour, because it is up to the REC member or other tenant or homeowner to act based on the information. However, a recent study revealed that financial motives seem overrated and communal motives underrated concerning involvement in community energy-saving actions (Sloot et al., 2019).

The relation between information and behaviour brings us to another strand in literature next to policy science, namely behavioural intervention strategy, which has a background in environmental psychology (Abrahamse et al., 2005; Frederiks et al., 2015; Gardner & Stern, 1996). If the assumption of how a policy instrument works is based on behaviour, there is a lot of resemblance between the two strands of literature. In psychology, interventions are actions performed to bring about change in people. There is one type of intervention strategy that is directed towards activities to modify behaviour. Behavioural interventions may be aimed at, viz., (a) voluntary behaviour change, by changing individual knowledge and/or perceptions; and (b) changing the contextual factors (i.e., the pay-off structure) which may determine households' behavioural decisions (Abrahamse et al., 2005). In this article, we focus on what can be called micro-level factors and not the macro-level or structural factors. These factors, together with institutional factors and cultural developments, influence the motivation, preferences, attitudes, opportunities, and abilities of households to save energy.

Behaviours related to household energy saving can be divided into two types of behavioural change (Gardner & Stern, 1996): (a) efficiency behaviour, as a one-shot action or decision to save energy (for instance buying energy-efficient equipment or the thermal insu-

lation of houses); and (b) curtailment behaviour, with repetitive efforts to save energy (for instance lowering the temperature in a room by changing the thermostat or deciding to dry the laundry outdoors in the garden instead of in an electric drying machine; Steg et al., 2018). Abrahamse et al. (2005) use a taxonomy for behaviour change interventions first issued by Geller et al. (1990) which addresses antecedent and consequences strategies. Antecedent strategy attempts to influence one or more behavioural determinants prior to the performance of energy-saving behaviour. Examples are goal setting, commitment, information provision, and modelling. Another example—well practiced among RECs—pertains to the promotion of energy-saving advice services giving pledgees the information to take action themselves (Bomberg & McEwen, 2012; Heiskanen et al., 2010). On the other hand, the consequences strategy tries to influence behavioural determinants after the occurrence of the energy-saving behaviour by providing consequences feedback on the outcome after the occurrence of the behaviour. Consequence strategies—i.e., offering rewards, or providing feedback—are based on the assumption that the presence of positive or negative consequences will influence behaviour because it will make energy-saving more attractive. Candelise and Ruggieri (2020) observed RECs in Italy using energy bills to stimulate home energy savings among their members.

6. Research Methodology

The empirical data in this article is taken from the EU's Horizon 2020 project REScoop Plus (2016–2018; Chalkiadakis et al., 2018; Coenen et al., 2017) which addressed RECs using their agency to encourage household energy savings and household renewable energy investments. The main goal of the project was to research how to improve energy savings and household renewable energy investment stimulation strategies as an activity for REScoops across Europe. REScoops are defined as "groups of citizens who organise themselves to collectively take action to foster the use of renewable energy and increase energy efficiency standards" (REScoop.eu, 2022), and can be considered to serve as a good example for RECs.

To answer the two research questions central to this article, different research strategies are used applying a mixed-methods approach. For the first question—how do RECs encourage their members and (other) households to save energy or invest in renewable energy options?—an exploratory research approach was used to map the incentives, measures, tools, and approaches the researched REScoops use. First, an inventory of was made of interventions and strategies used by seven REScoop federations from six EU nation-states, all organisations in the project consortium (the REScoops in the project consortium are Coopernico, in Portugal; Enostra, in Italy; Ecopower, in Belgium; Enercoop, in France; EBO, in Denmark; SEV, in Italy; and SOMenergia, in Spain). The inventory work presented was based on desk research (organisation documents and organisation websites), a literature review, and primary data collected using an expert survey. These seven experts were appointed by their REScoop organisations and were contacted, asked to complete a questionnaire, and produce a factsheet about dedicated actions they use to stimulate home energy savings among their members. Based on the desk research and following the expert survey and collection of the factsheets, the appointed experts were interviewed (via Skype). In addition, two online expert workshops were organised to discuss and validate the (preliminary) results. The main purpose of the interviews was to gain more insights into the experiences, background, context, and use of actions and dedicated measures. Based on the inventory, eight in-depth illustrative case studies were conducted to shed light on the actual meaning and experiences with the implementation of particular (combinations of) actions and measures.

To answer the second research question—to what extent are RECSs capable of effectively encouraging their members and (other) households to save energy?—first, energy savings behaviours, energy consumption, and indicators of energy savings needed to be measured. Secondly, it had to be assessed whether and how these could be related to the actions and measures implemented by the REScoops. In addition, (anonymised) longitudinal energy consumption data were obtained from the REScoops in the project and for some control groups with different suppliers. Due to the availability of data, actual consumption data focused on electricity consumption (excluding gas and other sources needed for heating of homes and tap water). Next to longitudinal data sets additional data were obtained from REScoops (or companies performing energy service management to REScoops) about members and non-members clients (consuming energy supplied by REScoops, or persons otherwise connected as non-clients) to the REScoop community about their energy use (Sifakis et al., 2018, 2020).

Two rounds of surveys were conducted among REScoop members, non-members clients (consuming energy supplied by REScoops but not having obtained REScoop membership), or persons otherwise connected to the REScoop community and others. First, in the spring and summer of 2017, a first round of surveys was conducted among six REScoops in five EU member states (N = 10,585). Second, in the spring and summer of 2018, a second round of surveys was conducted among seven REScoops in six EU member states (N = 7,556). Whereas the 2017 survey focused on general REScoop characteristics and home energy savings, the 2018 survey paid more intention to the implementation of several dedicated REScoop measures (interventions). The behavioural analysis focused on behaviour related to the use of both electricity and energy sources used for in-home heating.

Figure 1 below summarises the research strategy in the REScoop Plus project to determine the influence of

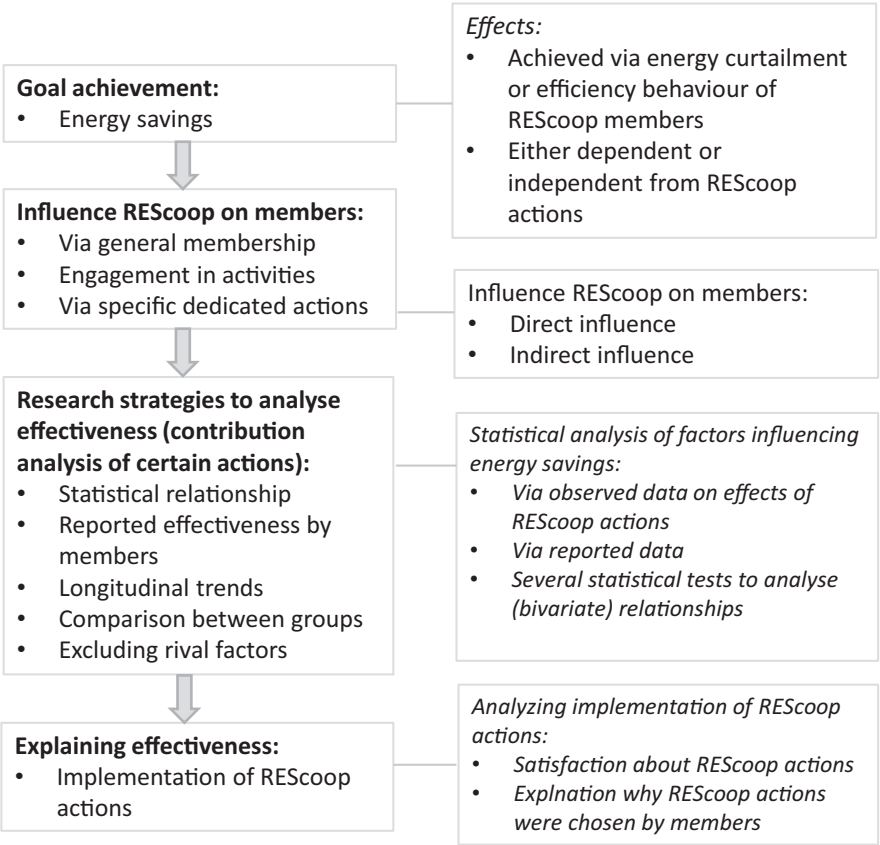

Figure 1. Research strategy to determine the effectiveness of REScoops to encourage their members to save energy. Source: Adapted from Coenen and Hoppe (2018).

REScoop on its members. Here, effectiveness means that home energy savings are reached due to the actions of the energy communities or membership and not through other factors (i.e., home energy savings can be attributed to REScoop actions and activities).

7. Overview of Actions of Energy Communities

In this section, the question "how do energy communities encourage their members and (other) households to save energy?" is addressed. Figure 2 presents an overview of actions and dedicated measures implemented by six REScoops studied in the REScoop Plus project (Coenen & Hoppe, 2016). The overview is based on the dimensions of energy behaviour (with the extremes of the dimension as either curtailment of efficiency behaviour) and type of strategy (either antecedent or consequence strategy). An overview of several illustrative specific and dedicated measures used by these REScoops in the project is presented in Table 1.

Based on the classification defined in Section 3, Figure 2 shows that:

- RECs use a wide range of measures to encourage members and non-members to save energy. The majority of measures use antecedent strategy rather than consequence strategy, and curtailment behaviour appears to be targeted more than efficiency behaviour.
- In terms of "policy instruments," the majority of measures can be seen as capacity tools to inform target groups about the benefits of energy-saving and to prepare how to engage in energy-saving behaviour. Examples include the use of energy ambassadors, awareness-raising events, inspiration sessions, and using mock homes with state-of-the-art energy-efficient technology as a role model. Incentive tools (like rewards or competitions) are also observed but appear less frequently. The measures observed also include technological tools like energy communities lending infrared heating meters to observe thermal bridges in their homes, smart meters to measure and provide feedback on energy consumption to householders, and ICT interfaces to support energy service delivery—including tariffs and billing—and information to households (as "clients" and energy community member at the same time).
- The mapping exercise also revealed integrated measures that include a multitude of actions and contain both antecedent and consequence strategies. Examples include the "Dr Watt" training programme of the French REScoop Enercoop (see Table 1), which contain both capacity and incen-

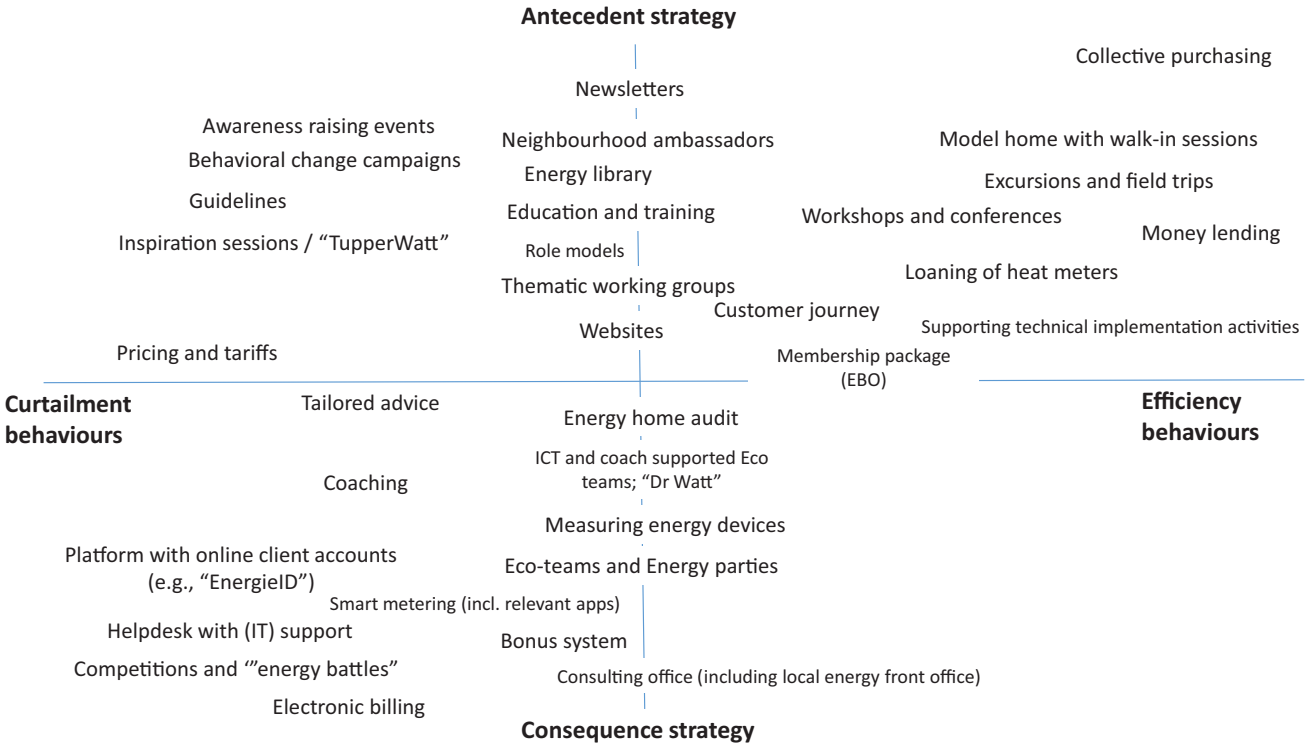

Figure 2. Classification of actions and measures implemented by REScoops to stimulate home energy savings. Source: Adapted from Hoppe and Coenen (2021).

tive tools, yet also uses technological tools in support (i.e., ICT, home metering equipment, and a smart meter). Table 1 illustrates several specific dedicated measures used by energy communities.

8. Effectiveness of the Actions RECs Implement

In this section, the question "to what extent are energy communities effective in encouraging their members (and other households) to save energy?" is addressed. Discussing the effectiveness of membership is particularly interesting from the perspective of this article. However, when members of the RECs save energy, this does not automatically mean that this is due to actions of the REC or the influence of simply being a member. Furthermore, if RECs influence their members (or clients), they have to distinguish between different types of influence and actions of the former. A distinction can be made between general membership, being involved in activities, and the influence of specific actions and dedicated measures. The latter concerns interventions in which members participate or through which they are addressed. These types of measures resemble actions that could have been taken by other agents. Unspecified measures entail the generally presumed influence of being (indirectly) exposed to REC actions and information. This is not unique for REC members. Also, other agents might take more unspecified measures not linked to a specific behavioural change of the tenants and house owners targeted. However, membership influencing REC members to attain certain goals (like energy savings) is more unique for RECs. Membership potentially influences energy saving for several reasons. Becoming a member (and/or customer) can be seen as making an informed choice; in other words, one chooses deliberately to engage in using green energy.

The reason to become a member can be motivated by environmental or sustainability concerns or by pragmatic financial or technical reasons, like the expectation to receive better service provision or more comfort. If one obtains REC membership, one receives information on the importance of saving energy and how to do so (Bauwens, 2016). This could mean that the information level of the REC members on the importance of renewable energy and possibilities to save energy increases after obtaining membership, which could lead to a higher knowledge level (concerning renewable energy and energy-saving options). However, more information or awareness does not automatically mean that one also engages in actions to attain a certain goal (like saving a certain amount of energy). Here, it is assumed that it is easier for energy communities to influence members who are more concerned about personal finance and actively engaged in their energy community, for instance, because they hold shares in their energy community or visit meetings it organises. This is a particular subset of REC members, i.e., the subset of engaged members (Coenen & Hoppe, 2018).

Table 1. Overview of illustrative specific dedicated measures used by energy communities.

Measure	Implemented by REScoop (Country)	Description
Dr Watt	Enercoop (France)	An online tool that comes with an offline training course to help consumers self-diagnose their electricity consumption. The approach seeks to make households more aware and to increase understanding of home electricity consumption, but also provides tailored advice.
TupperWatt	Enercoop (France)	TupperWatt meetings are organised for households who want to be more involved in energy community activities and put citizens at the centre of energy issues. This type of event—inspired by "Tupperware parties"—fits the general communication strategy of Enercoop: not too much advertising and creating social links within the community while sharing experiences.
EnergieID	Ecopower (Belgium)	A SaaS ("software as a service") platform to support households to understand and manage their energy consumption as well as renewable energy production (via solar panels). Customers sign up with an account on EnergieID and, every month, they fill in their energy consumption data. Then, together with the helpdesk service of Ecopower, the energy bills and energy consumption are analysed and discussed with customers (including Ecopower members), either by phone or by email.
DH Package	EBO (Denmark)	District heating (DH) package, or *pakkeløsning* in Danish, is a conversion package for homeowners to switch from a gas grid connection to a (sustainable) DH system grid connection. It includes four steps: (a) a home visit and an agreement of where the district heating unit is going to be installed, (b) the establishment of a heat service line to the consumer's house and restoration of the garden, (c) the removal of the consumer's existing heating source, and (d) the delivery and installation of a new district heating unit. Before the measures are taken, unburdening of the homeowner takes place. Afterward, the performance of the installed DH system package is monitored periodically. *Pakkeløsning* entails an integrative DH installation.

Source: Based on Hoppe and Coenen (2021).

8.1. Results From the REScoop Plus Project

Figures 3 to 7 present the key results from the REScoop Plus project on REScoops and home energy savings of their members.

Respondents indicate average energy savings in the range of 4–6% (Figure 4). Of those who measured their energy consumption, about 21–22% indicate having saved at least 10% energy, and between 9–10% indicate having saved at least 20% (Figure 5; Coenen & Hoppe, 2018).

To determine whether REScoops, without specifying how, influenced their members on energy saving, either actual or perceived, the reported influence by the members is presented in Figure 6.

The surveys indicated that REScoop members undertake many (individual) energy-saving actions like lowering the thermostat or taking shorter showers (Figure 7).

Energy savings are considered to become more important after joining a REScoop (or at least for four out of six REScoops surveyed, i.e., Ecopower, Enercoop, Enostra, and SOM Energia), but, as Figure 6 shows, between 20% and 52% of the respondents attribute home energy-savings to their REScoop (and, if so, this mostly concerns efficiency behaviour, in particular switching conventional lighting to LED lighting). One obvious explanation for the influence on energy-saving behaviour would be that REScoop members had already started saving energy before they became a member. Moreover, those people already showing a high degree of pro-environmental behaviour also seem to get involved in RECs (i.e., showing reverse causation; Sloot et al., 2018).

In the surveys, members were asked about their energy-saving actions and how these relate to the actions of the REScoop. Only a part of those respondents—e.g., 18% of the respondents from Enercoop and 36% of respondents from Ecopower; for energy curtailment behaviours this is considerably less (15–17%) than for energy efficiency behaviours (20–30%; Hoppe et al., 2019)—however, indicates that (individual) energy-saving actions can be attributed to their REScoop (Hoppe et al., 2019). Overall, members of REScoops were found to be committed to saving energy in terms of attitude, intention, and actual behaviour. They show high engagement with various energy-saving behaviours (both curtailment and energy efficiency behaviours) and demonstrate more individual energy-saving behaviours than those who are not members of REScoops (or other RECs). The longer the energy community membership, the more knowledge is gained, and the more energy-saving behaviours are performed. This relates to visiting

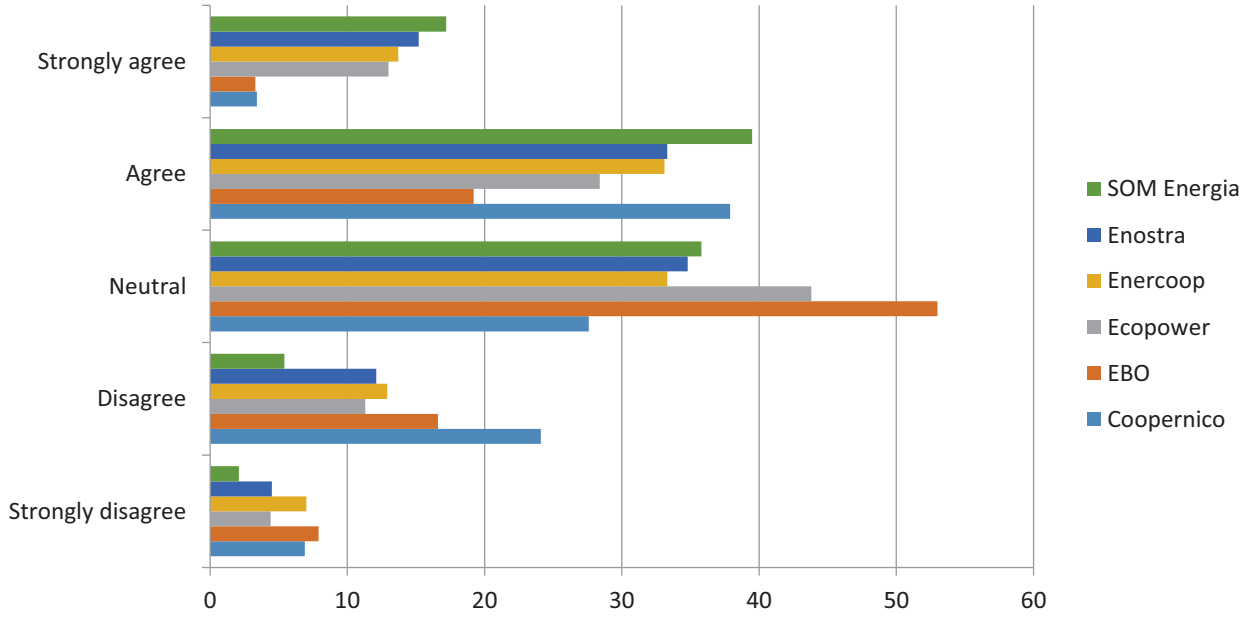

Figure 3. Response, in %, to the 2018 survey item "After having joined a REScoop, energy savings have become more important to me" by REScoop.

more energy community meetings (or workshops) and activities within integrated (i.e., combination of) measures (Hoppe et al., 2019).

The energy consumption data obtained from the REScoops allowed conducting longitudinal time series trend analysis that revealed several important findings (Sifakis et al., 2018, 2019). The key finding is that implementing energy efficiency interventions of various types, such as technical support, special tariffs, energy generation schemes, and smart meters, leads to substantial energy reductions of more than 10%, cumulatively (Sifakis et al., 2020). More specifically, joining a REScoop was found to lead to a more than 20% reduction in electricity consumption. Also, installing solar panels on one's home reduces REScoop members' electricity demand by more than 45%, with those having

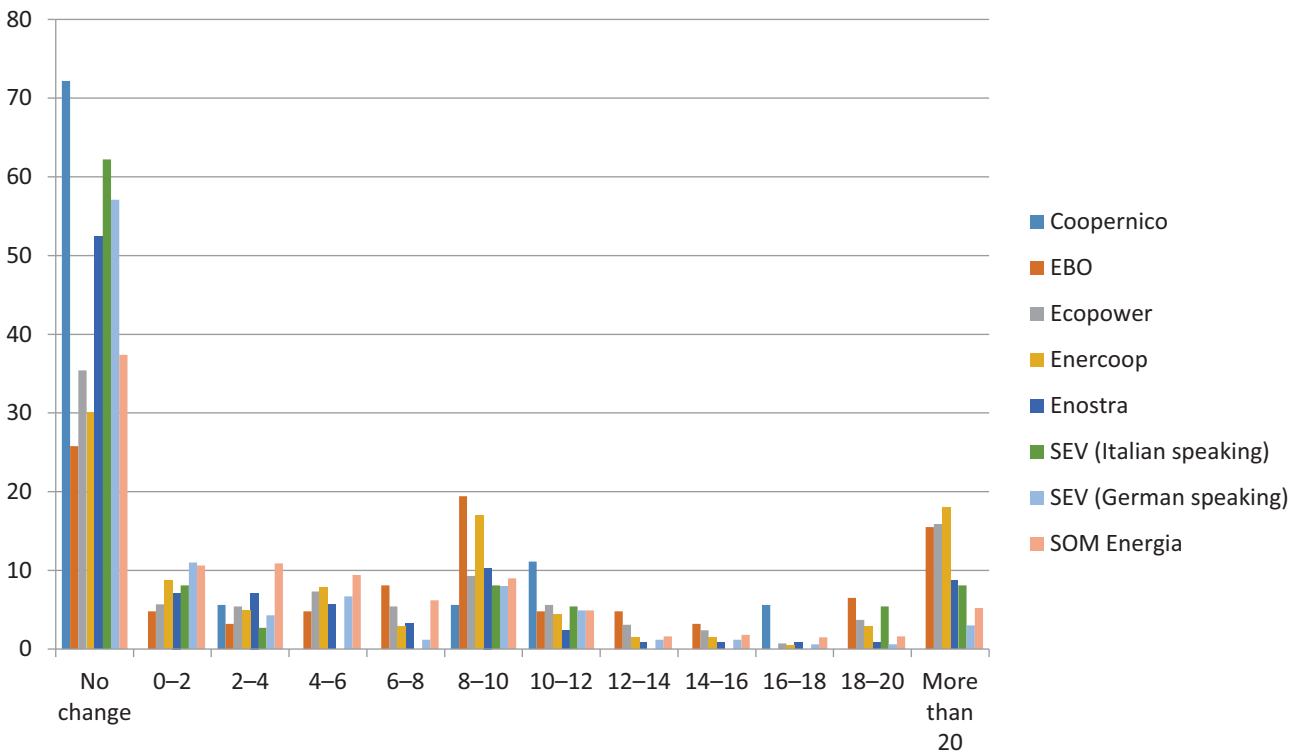

Figure 4. Reported energy savings by REScoop, in % (2018 survey).

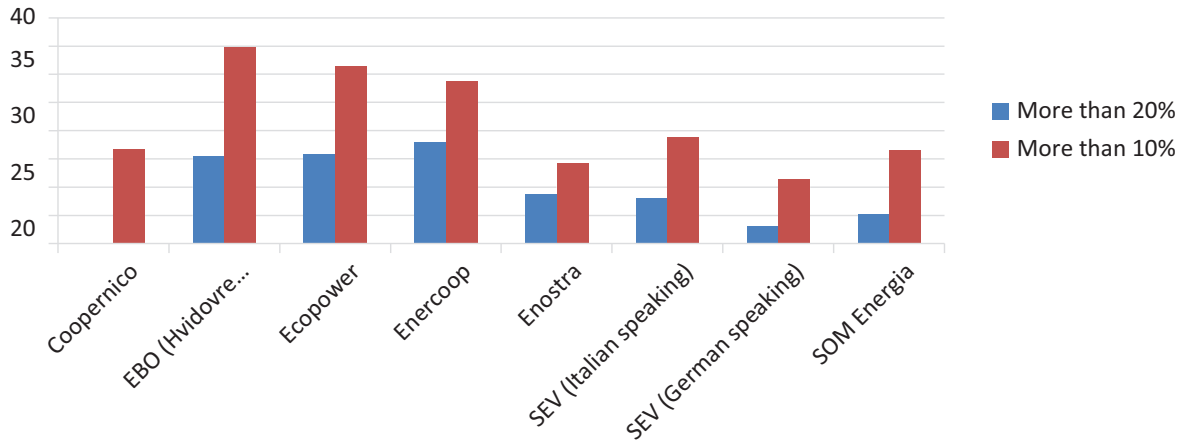

Figure 5. Reporting of more than 10% and 20% energy savings realised, in % of respondents, by REScoop (2018 survey).

solar panels installed at home consuming nearly three times less grid-supplied electricity than those who do not have solar panels installed at home. At Ecopower, no less than 43% of the respondents were found to be prosumers, generating their green power locally. The share of Ecopower members having installed solar panels at home has also increased sharply over recent years, encouraged by Ecopower's agency (Sifakis et al., 2020). Furthermore, energy efficiency interventions of various kinds, such as technical support, special tariffs, energy generation schemes, and installing smart meters, statistically correlate (positively) to substantial reductions in energy consumption.

To nuance the conclusion that only a part of those respondents indicates that (individual) energy-saving actions can be attributed to a REScoop, we have to look at so-called specific measures that concern interventions in which members participate or through which they are addressed. In particular, the use of specific integrated measures (including both antecedent and consequence strategy, such as the Dr Watt intervention by Enercoop) can be considered as fairly effective, resulting in considerable energy savings. The longitudinal data analysis (Sifakis et al., 2020) showed that those who register with EnergieID save 10% in energy consumption, those who partake in Dr Watt training sessions at Enercoop

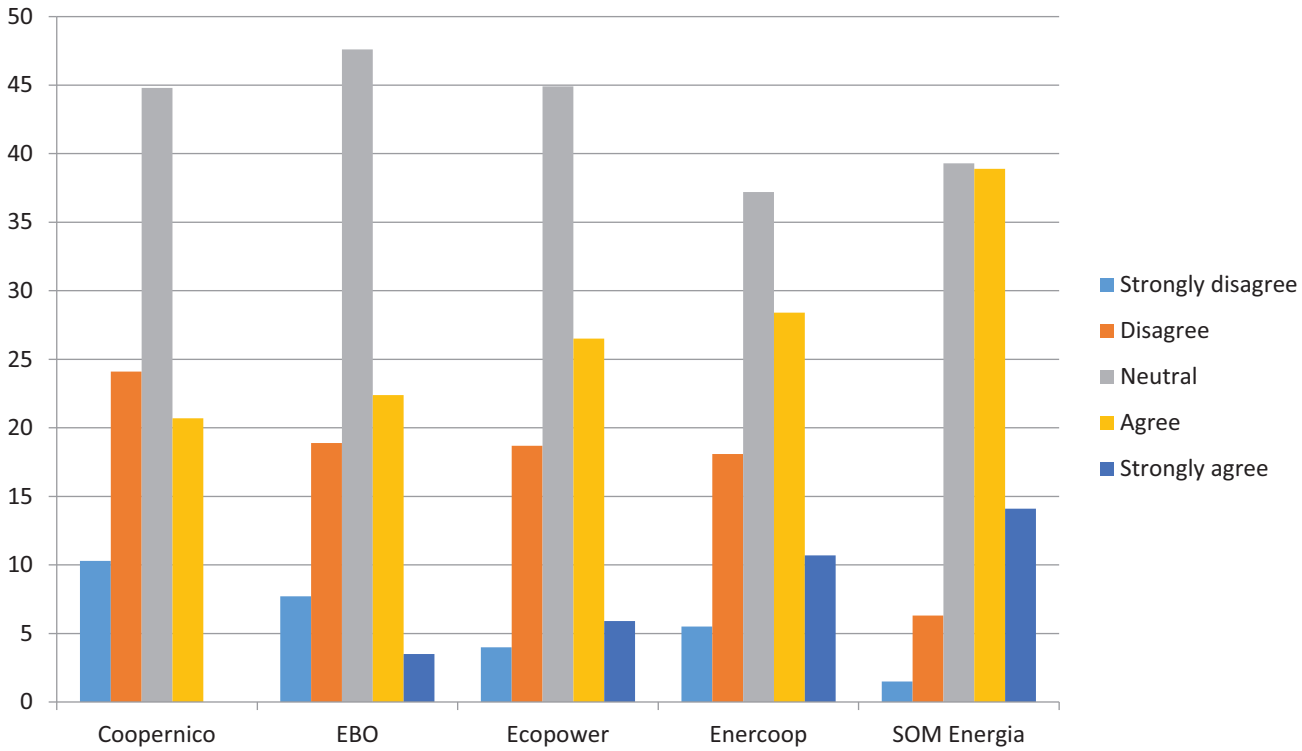

Figure 6. Response, in %, to the 2018 survey item "My REScoop has contributed to that I save more energy in my household" by REScoop.

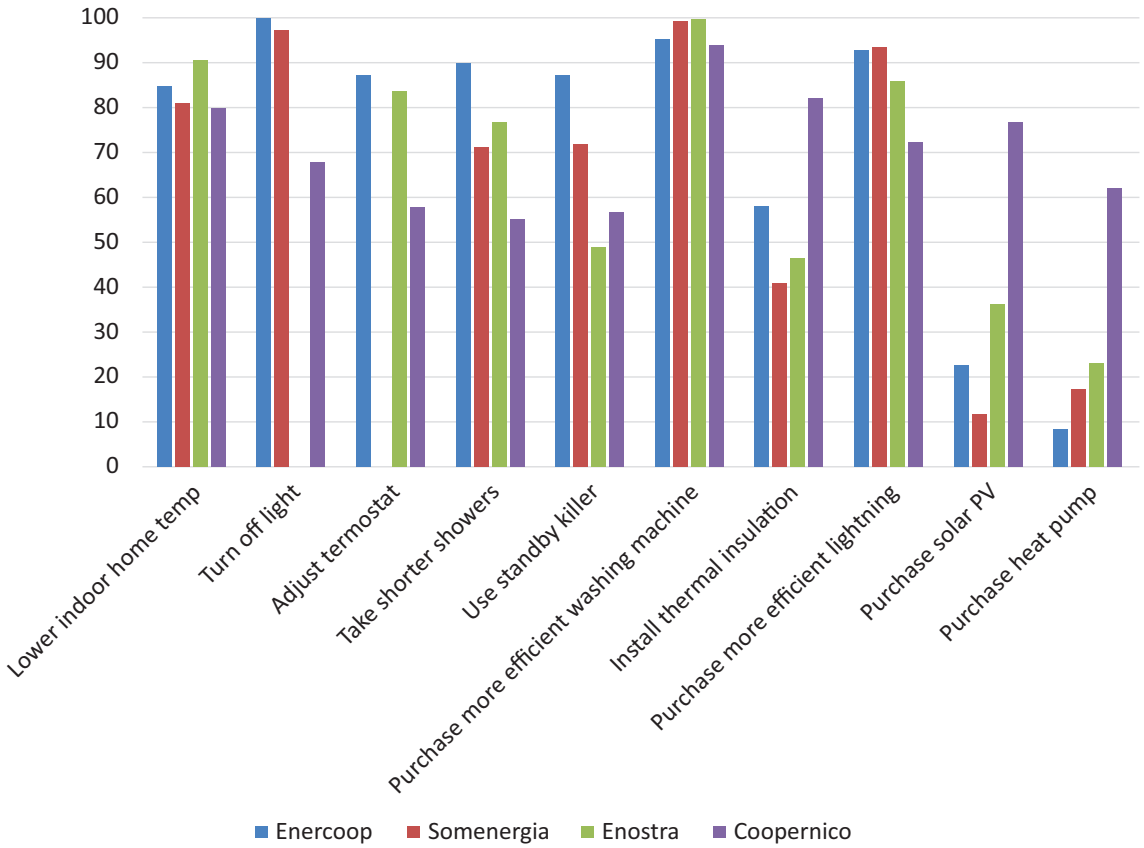

Figure 7. Response, in %, to the 2018 survey item about engagement in particular energy-saving behaviour (per REScoop).

were found to consume 13% less electricity than others who did not partake, and those who had smart meters installed were found to consume over 26% less electricity. The longitudinal data analysis results should, however, be interpreted with caution as limitations in the data collection (mostly due to challenges to the availability of reliable data) caused the research to only modestly address (internal and external) validity issues. Installing a solar panel system might, for instance, create a distorted image concerning the influence of smart meter installation on total household electricity consumption.

The conclusions of the longitudinal data analysis (Sifakis et al., 2020) correspond to the survey results. In the 2017 survey, several specific energy measures and tools implemented by REScoops (i.e., Dr Watt training sessions, personal advice, or EnergieID) were found to be significantly and positively related to energy savings (since becoming a REScoop member; Coenen & Hoppe, 2017). Moreover, users were generally satisfied with them. EnergieID users also indicated increased importance and contribution to energy savings. Increasing portions of the respondents indicated realising energy savings (e.g., EnergieID: from 20% in 2017 to 30% in 2018 at Ecopower; Dr Watt: from 3% of Enercoop members to 37% in 2018). Results from the 2018 survey revealed that specific measures using platforms (along with related informational actions) were found to statistically correlate positively to reported energy savings, whereas sole informational actions (e.g., TupperWatt, or saving tips on the energy-saving Wiki) only influenced the intention to save energy, but no actual energy savings (Coenen & Hoppe, 2018).

9. Conclusions

When facing the challenge of the large-scale refurbishment of the existing housing stock, increasing resident participation in neighbourhood renovation activities is of crucial importance. Establishing RECs in neighbourhoods or housing projects in general, or more specifically in large-scale energy renovation projects, could potentially serve as a means to increase citizen participation rates. Furthermore, taking a value perspective, this increased level of participation could potentially come with more democratic rules for decision-making in these projects, giving residents a firm say and making these processes more transparent. RECs are based on democratic principles, including voluntary participation; they are autonomous, effectively controlled, and owned by members that are located in the community (and near the projects they run). Further involving RECs would potentially help to overcome the issue of reaching tenants and homeowners as a target group. Due to their embeddedness in local social structures, RECs have a better starting position to encourage change. This might also be due to the distrust citizens have in government or for-profit businesses. However, although households that hold membership in RECs might prove easier to

reach, there is the question of their motivation of being a REC member (Bauwens, 2016). A condition for the better starting position is the underlying mechanism that they are more easily persuaded because they already have strong (pro-environmental) behavioural attitudes and are exposed to subjective norms in the energy community that favour behaviour that will likely encourage home energy savings.

An overview of measures presented in Section 7 shows that RECs address home energy saving in various ways. This is done by, for example, raising awareness, providing education, and training to households and advisers, but also by providing support in audits and implementation processes. The actions of RECs have many characteristics of public policy instruments or actions of other agents. Besides the argument that involving RECs in home energy renovation might contribute to overcome the problem that tenants and homeowners are difficult to reach, RECs benefit from the closer proximity to households and the local community they belong to. The REScoop Plus project showed that overall members of REScoops were found to be committed to saving energy in terms of attitude, intention, and actual behaviour.

The results from the project show that RECs can influence households in general, and, more specifically, their members in three ways: First, via the social structure and norms that pertain to energy community membership, assuming that households obtain (or maintain) energy community membership. Second, via the active engagement of households, but in a general sense (e.g., reaching out to them by organising energy community meetings). Third, by employing dedicated actions and measures to persuade households to save energy. The present study showed that, of the reported home energy savings by the respondents, only a limited part of these (individual) energy-saving actions can, according to the respondents, be attributed to the energy community (i.e., the REScoops in the project). However, specific energy actions and dedicated measures implemented by REScoops were found to positively relate to energy savings. Specifically integrated measures (which include both antecedent and consequence strategies) can be considered fairly effective (Sifakis et al., 2020).

A major limitation of the survey-based research was that no randomised sampling was used for privacy and organisational reasons. Therefore, some of the results may be explained by the fact that only the more motivated members participated in the survey. Secondly, a (quasi-) experimental setting with independent experiments and control groups could not be created, so the effects of individual (and combinations of) interventions could not be studied in-depth.

To answer the third research question—to which extent could the potential involvement of RECs be considered a new strategy to improve the energy performance of the current housing stock?—the illustrative cases show that the specific influence of the dedicated measures is larger than the general influence of RECs on energy saving, and this influence lays in the energy community context of these dedicated measures.

There is a difference between RECs and other agents trying to reach the target group of tenants and homeowners. As presented in Section 3, RECs have certain advantages because of their social embeddedness in local communities and the trust and social acceptance they have there, as well as being a social community in itself. In taking action, particular membership is a distinguishing factor. The results from the REScoop Plus project show that all three forms of engagement between members and the energy community (i.e., membership, engagement activities, and the use of specific and dedicated measures) contribute in a positive way to the household's energy-saving intention, behaviour, and eventually energy savings. The effectiveness of the use of specific actions and dedicated measures cannot be seen without the social context of a REC. Its non-profit goals and democratic setup, in combination with the trust and acceptance they have among their members and other community members, contribute to the effectiveness of their actions and measures. Does this automatically mean that REC membership and engagement strategy are necessary conditions to better influence household energy-saving behaviour? Although some results indicate that these factors alone can already encourage household energy-saving behaviour, results of the analysis of dedicated measure implementation reveal that they can trigger and reinforce these conditions. In summary, membership, engagement activities, and specific dedicated measures appear to reinforce each other and are, arguably, jointly the most probable to trigger energy-saving behaviour among households.

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Conflict of Interests

The authors declare no conflict of interests.

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