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Energy Communities Promoting Home Energy Savings: Interventions, Theory and Results

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8.1 Introduction

Sustainable energy transitions do not only require the change of energy resources (i.e., from fossil to renewable sources), but also include avoidance of energy spillage and increasing energy efficiency levels (Nejat et al., 2015). Moreover, in light of the energy trilemma, decreasing energy demand has become ever more urgent. However, this is not merely a technological nor an economical challenge. It includes a human factor. In this case behavioral change by final energy consumers, who can potentially consume energy in

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more rational and efficient ways. Behavioral determinants of energy users can be targeted with policy measures to induce change or to change the conditions that influence the ways in which energy is consumed. When looking into cities and regions, the realm in which Renewable Energy Communities (RECs) and Citizen Energy Community (CECs) operate, it is in particular households that consume energy and can be targeted with the aim of behavioral change leading to lower volumes in energy demand.[1] This is necessary because globally the residential sector comprises 27 per cent of energy consumption and 17 per cent of total CO_2 equivalent emissions. However, historically households form a target group that is hard to reach or to persuade. There are multiple reasons for this ranging from lack of urgency, knowledge, motivation, and investment capability to reasons that have to do with social norms (Abrahamse et al., 2005; Frederiks et al., 2015). The latter would refer to norms that apply at the neighbourhood level, or more particularly would apply to the social environment to which households and their members belong.

Here energy communities—be they either RECs or CECs—can potentially make a difference. These energy initiatives consist of citizens who jointly seek to produce and consume sustainable energy locally, and many are located in cohesive social communities with high levels of trust (Boon & Dieperink, 2014). In most of these communities, members reject the use of centralized fossil fuel and nuclear energy production, and they embrace decentralized authority and egalitarian values (Hoppe et al., 2019). Energy communities are increasingly considered important players in renewable energy and energy-saving efforts, in terms of raising awareness locally and gaining public support for low-carbon energy and energy savings projects (Coenen et al., 2017). Moreover, energy communities often have local origins and are well embedded in local social systems. This means that they are present in the immediate vicinity of residents. There are certain benefits to this since energy communities already have a social history and reputation with the local community, and can be trusted by the latter. This gives energy communities certain

[1] In this chapter we use the term 'energy communities' to address RECs. However 'energy community' might also cover some CECs since it is sometimes difficult to differentiate between the two.

advantages over others in society—i.e., government and business companies—to stimulate sustainable behaviors like home energy savings among households. This is in part also related to distrust citizens have in government—often culturally determined or based on historical experiences, for example, regarding unfair decision-making processes. Or with business enterprises—often distrusted for only trying to make profits that do not benefit communities and potentially harm the environment (Wolsink, 2007).

In the Clean Energy Package (CEP) RECs and CECs are supposed to focus on providing economic, social and environmental benefits. Economic benefits include: return on investment to members; promotion of local development; investment in public infrastructure; and reduced energy bills—at least for households and other non-professional customers (REScoop.eu and ClientEarth, 2020). Social benefits include: provision of different services (e.g., energy supply, or advice) to members; investment in energy efficiency, energy poverty initiatives; education and training for members or schoolchildren; promotion of energy democracy; and citizen empowerment. Finally, environmental benefits include: increased production of locally produced renewable energy; and greenhouse gas emission reductions (ibid.). However, it is fair to state that in addition, preventing energy spillage by promoting greater energy efficiency and energy savings would also contribute to environmental benefits. From this perspective it is important that energy communities use their agency to promote home energy savings, in particularly among households in their membership base but also among other target groups, and to manage the (renewable) energy systems they own or operate in efficient ways.

The question central to this chapter is: How do energy communities encourage their members (and others; i.e., households) in home energy savings? In addition: To which extent are energy communities effective in doing so? The chapter is structured as follows. In Sect. 8.2 theoretical arguments are provided that are relevant to energy communities undertaking energy savings measures. Section 8.3 addresses research approach and methodology. Section 8.4 presents empirical results and insights. In the concluding section (8.5) the questions are answered, and relevant insights are taken to reflect on the implementation and transposition of

the CEP on how energy communities can benefit in terms of strategy with regard to home energy savings.

8.2 Theory: Energy Communities and Interventions to Promote Home Energy Savings

This section consists of three parts. First, it addresses theory on home energy savings by taking a psychological perspective. Second, a range of interventions is addressed. Third, attention is paid to specific ways in which energy communities promote home energy savings.

8.2.1 Part 1: Theory on Home Energy Savings

Households use energy in direct and indirect ways, for different purposes, and in different amounts (Vringer and Blok, 1995). Home energy savings can be referred to in terms of energy conservation behavior, which can be viewed as the effort made to reduce the consumption of energy. This can be achieved in two ways: by using energy more efficiently or by reducing energy demand. Behaviors related to energy conservation (including those with the aim to save energy) can be categorized into curtailment behavior and efficiency behavior. The former concerns ongoing day-to-day actions, such as setting thermostats or switching off lights. Efficiency behavior on the other hand concerns one-time actions to save energy, such as investing in home improvements like thermal insulation or installing energy-efficient appliances (Frederiks et al., 2015).

Frederiks et al. (2015) discern two broad factors that generally explain for energy conservation. These are socio-demographic and psychological factors. Socio-demographic predictors include income, gender and education, but also home-related issues including ownership, size and type of home. Psychological factors on the other hand, include beliefs and attitudes, subjective norms, intentions and perceived behavioral control. Generally speaking, these psychological factors resemble independent variables from the Theory of Planned Behavior (Ajzen, 1991). This

theory holds that behavior can be predicted by personal attitudes, subjective norms, perceived behavioral control and behavioral intention. When applied to energy-saving behaviour, a person intends to save a certain amount of energy—which is influenced by attitudes, subjective norms, behavioral control and intention—and then performs actual energy-saving behavior(s) which will (or will not) result in actual energy savings.

8.2.2 Part 2: Interventions Targeting Home Energy-Saving Behaviours

A particular factor that intends to persuade households to engage in home energy-saving behaviors is incentives. In psychology, interventions are considered as actions that are performed to encourage behavioral change. One type of intervention strategy is directed towards activities to modify behavior. Behavioral interventions may be aimed at either voluntary behaviour change, by changing individual knowledge and/or perceptions, or changing the contextual factors (i.e., the pay-off structure) which may determine households' behavioural decisions (Abrahamse et al., 2005). In this chapter, micro-level factors are emphasized (as compared to macro factors that cannot be influenced by energy communities like socio-demographic factors, technological development or economic factors). This holds for activities by energy communities where they try to influence the behavior of their members directly and not through other actors or institutions (e.g., government or public policy). Within these micro-level interventions a distinction can be made between interventions applying either antecedent or consequence strategies. When using an antecedent strategy an agent tries to influence one or more behavioral determinants prior to energy-saving behavior (e.g., providing information with the intention that a household follows up and performs one or more energy-saving behaviors). Examples of actions that use antecedent strategy pertain to commitment, goal setting, information and modelling (i.e., using role models). When using a consequences strategy, an agent tries to influence behavioral determinants of the target group after the occurrence of the energy-saving behavior by providing feedback on performance (e.g., providing feedback on patterns of energy

consumption of a given household over the last week). Examples of actions that use consequence strategies are feedback mechanisms and reward systems (ibid.).

Another way to view interventions is in terms of policy (or policy instruments), be it as an instrument implemented by a non-state agent (which differs from government bodies implementing public policy). In comparison to public government energy communities are not steered by elected politicians and do not have a formal mandate based on formal law to formulate and implement policy. Yet most energy communities—in particular renewable energy cooperatives using the seven cooperative principles—apply direct democracy through membership participation, which legitimizes their activities in social ways. Nonetheless, there is no formal legal ground that allows energy communities to exercise power in one way or another over a person, subject matter or territory. Despite this difference, arguably an analogy can be made between actions implemented to by energy communities and the use of public policy by government agents to meet the same goal (i.e., home energy savings).

Policy goals have intended effects (like lowering carbon emissions). For policies to realize the intended impact on society, a large number of people in different situations must make decisions and take actions in line with the intended policy theory to achieve any meaningful impact. This can be achieved only when persons (i.e., target groups) conduct self-initiated actions that contribute to goal achievement, comply with rules or behave in controlled and expected ways in response to incentives that are implemented. In this sense policy emphasizes targeting behavioral determinants addressing individual decisions and actions of certain target groups in society (Schneider & Ingram, 1990). As compared to other target groups end-consumers (including households) are considered difficult to reach (Bressers & Ligteringen, 1997). However, households that also hold membership of energy communities might prove more easy to reach and persuade because they are likely to already have strong (pro-environmental) behavioral attitudes and are exposed to subjective norms in the energy community that favour behavior that will likely encourage energy savings. Nonetheless, actions energy communities use might have the same characteristics as public policy and are therefore appealing to local residents (i.e., households): they provide authority, incentives or

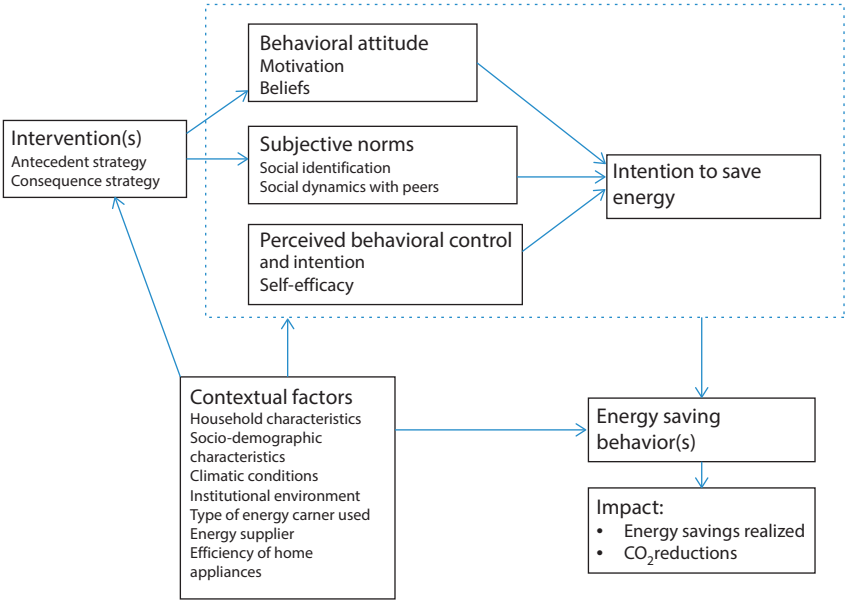

Fig. 8.1 Theoretical framework on interventions regarding home energy savings. (Adapted from: Ajzen (1991); Coenen and Hoppe (2018))

capacity; they use symbolic and hortatory proclamations to influence perceptions or values; or they promote learning to reduce uncertainty (Schneider & Ingram, 1990).

Based on the information provided from both the psychological and policy literature a theoretical framework is developed (see Fig. 8.1). It incorporates insights from different theories and research traditions (mostly Theory of Planned Behavior; Aizen, 2005) and policy evaluation theory (Bressers & Hoogerwerf, 1991; Schneider & Ingram, 1990). In this framework, energy community measures are seen as interventions, and can therefore be found in the box 'intervention(s)'. Here, interventions are expected to directly influence behavioral attitude and subjective norms of households with the aim to encourage them to perform energy-saving behavior(s). The framework, however, also contains the box 'contextual factors'. This is theorized to directly influence energy consumption, next to also influencing most of the other variables in the model. For

these reasons, it is clear that the interventions from the energy communities do not solely influence energy consumption. More conditions apply that influence household energy consumption. In other words, there are many (rival) explanations that could plausibly explain for home energy savings, like household characteristics (both socio-economic and with regard to the home as a physical object), demographics and environmental conditions.

8.2.3 Part 3: Energy Community Actions Targeting Home Energy Savings

As compared to other organizations (mainly from the public and private sector) energy communities (most often in the form of renewable energy cooperatives; REScoops) using their agency to encourage citizens (i.e., households) to save energy are fairly well positioned. There are multiple reasons for this. When compared to other organizations (like local government, distribution system operators (DSOs) or energy companies) potentially they can deliver services better for the following number of reasons (Coenen & Hoppe, 2016; Coenen et al., 2017):

- Energy communities are already embedded in social structures, and therefore have close ties with their customer groups, and have direct contacts about energy saving with consumers;
- Energy communities can give personal and tailored assistance to REScoop members to develop personal capacity to save energy;
- Energy communities can organize energy-saving expertise dissemination at the community level, e.g., by organizing workshops, working groups or setting up an 'energy library';
- Energy communities can build home energy saving expertise through gaining critical mass;
- Energy communities can cooperate better with local stakeholders;
- Energy communities 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 likely reach out better to target groups than other agents would;

- Energy communities can set energy saving as a social norm within the community;
- Energy communities are locally viewed as a reliable partner to give advice, supply energy systems and appliances and make people more willing to take home energy saving investment risks;
- Energy communities can tailor home energy saving measures to where it is effective, while also addressing related social issues like energy poverty and justice;
- Energy communities can define and distribute the available capacity of renewable energy as a common resource;
- Energy communities can deal with NIMBY problems related to aspects that have to do with siting (renewable) energy plants while balancing spatial, social, economic and environmental interests.

Energy communities pay attention to home energy saving in various ways. This can be done, for example, by raising awareness, providing education and training to households and advisers, but also by providing support in audits and implementation processes. A simplified way to see how this works in practice with a focus on how an energy cooperative deals with this and takes measures to convince its members to start saving energy. The way in which it implements energy saving activities varies from providing information and advice to actively guiding households and supporting them in implementing saving measures (Coenen & Hoppe, 2016).

Energy communities can influence the behaviors of their members in different ways. To create more clarity conceptually, we will address what energy community membership entails vis-à-vis general membership, actions and events that energy communities organize. Therefore, three (overlapping) (sub)sets of energy community membership are discerned. In this classification general membership is the first way an energy community influences its members. This concerns an overlapping set of the way energy communities influence their members. Within this set there is the engagement of members in the energy community, for instance by organizing meetings, via financial participation or via participation in dedicated actions or measures organized by the energy community

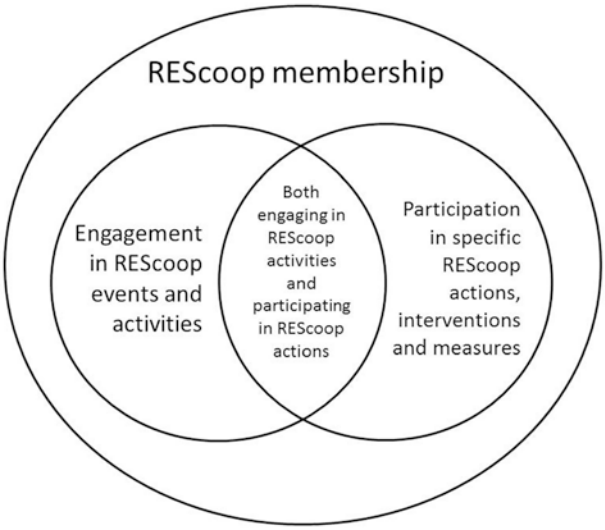

Fig. 8.2 Venn diagram of energy community membership (here applied to REScoops), discerning between general membership, engagement in REScoop activities and participation in specific dedicated REScoop actions. (From: Coenen & Hoppe, 2018)

(Coenen & Hoppe, 2018). Figure 8.2 presents a graphical overview of the influence spheres an energy community has on its members.

To link members' home energy savings behavior to the assumed influence of energy community actions we discern between specific and unspecified measures in relation to the member's (actual) behaviour. Unspecified measures entail the general presumed influence of being a member and being (indirectly) exposed to energy community actions and information. On the other hand, specific dedicated measures concern interventions for which information is available on which members participate in these specific actions or are exposed to them in another way (by becoming a target group for a specific intervention) (ibid.).

Here, it is assumed that the mechanism of energy communities influencing their members to attain certain goals works as follows. Membership potentially influences energy saving behaviors for a number of 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 membership, one receives information on the importance and ways to save energy. This could mean that the information level of the energy community members on the importance of renewable energy and possibilities to save energy increases after obtaining membership which could lead to a higher knowledge level (on 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). We assume that it is more easy for energy communities to influence members who are more financially and actively engaged in their energy community, for instance because they hold shares in their energy community or visit meetings it organizes. This is a particular subset of energy community members; i.e., the subset of engaged members (ibid.).

8.3 Research Approach and Methodology

The EU's Horizon 2020 project 'REScoop Plus' (2016–2018) (Chalkiadakis et al., 2018; Coenen et al. 2017) addressed energy communities using their agency to encourage home energy savings. This project researched and sought to improve energy savings strategies as an activity for renewable energy cooperatives (REScoops) across Europe. The research activities of the project involved two work packages: one addressing statistical analysis of energy consumption longitudinal data sets of REScoops, and another addressing behavioral aspects of REScoop incentives targeting home energy savings. The latter addressed the question, *"What behavioral and social aspects influence energy savings by households, including REScoop members?",* with the aim of empirically testing the claim whether REScoops can be considered effective agents in persuading households in achieving home energy savings.

The project included a wide set of research methodologies: exploratory analysis of the ways in which REScoops use their agency, to map the incentives, measures, tools and approaches they use, and conducting surveys to collect data that would allow for statistical analysis. The 'modus

operandi' methodological approach was used to analyse whether REScoops' agency would explain for behavioral change of households or not. Two rounds of surveys were performed among REScoop members and others. First, in the spring and summer of 2017 a survey was conducted among six REScoops in five EU states, with a total response of 10,585 households. Second, in the spring and summer of 2018 a survey was conducted among seven REScoops in six EU nations (N = 7556). Whereas the 2017 survey focused on general REScoop issues and home energy savings, the 2018 survey paid more intention to the implementation of a number of dedicated REScoop measures (i.e., specific interventions). The results presented in this chapter are mostly based on surveys among REScoop members, non-member clients (consuming energy supplied by REScoops), or persons otherwise connected to the REScoop community. The REScoops that were part of the research project included: Coopernico (Portugal), ènostra (Italy), Ecopower (Belgium), Enercoop (France), EBO (Denmark), SEV (Italy) and SOM energia (Spain) (ibid.).

It should be noted here that the study on analyzing the actual consumption data focused on electricity consumption (excluding gas and other sources needed for heating of homes and tap water). This was for reason of availability of data. Section 8.5.2's behavioral analysis focused on both electricity and energy sources used for in-home heating. In the next section of this chapter results from REScoop Plus are presented. However, to generate a more up-to-date depiction of the state of affairs on how energy communities use their agency to achieve household energy savings an additional in-depth case is presented (the Netherlands) that goes beyond merely focusing on energy communities as implementing agents and households as target group. The case study also pays attention to the structural and institutional environment as well as to the role of intermediary agents (also with regard to empowering of energy communities).

8.4 Results

8.5 Overview of Interventions

In this section the question, "How do energy communities encourage their members (and other households) in home energy savings?" is addressed. To answer this question an overview was established of the variety of action and interventions energy communities use. When looking internationally at energy-saving practices of energy cooperatives in Europe, an overview can be presented, in which measures can be classified into the dimensions of energy behavior (with the extremes of the dimension as either curtailment of efficiency behavior) and type of strategy (either antecedent or consequence strategy). This results in a 2×2 matrix with four quadrants in which the measures are positioned (See Fig. 8.3). The measures observed stem from different overview studies including but not limited to the EU-H2020 'REScoop Plus' project (Coenen & Hoppe, 2016; Schwencke, 2021). An overview of specific dedicated measures used by energy communities is presented in Table 8.1.

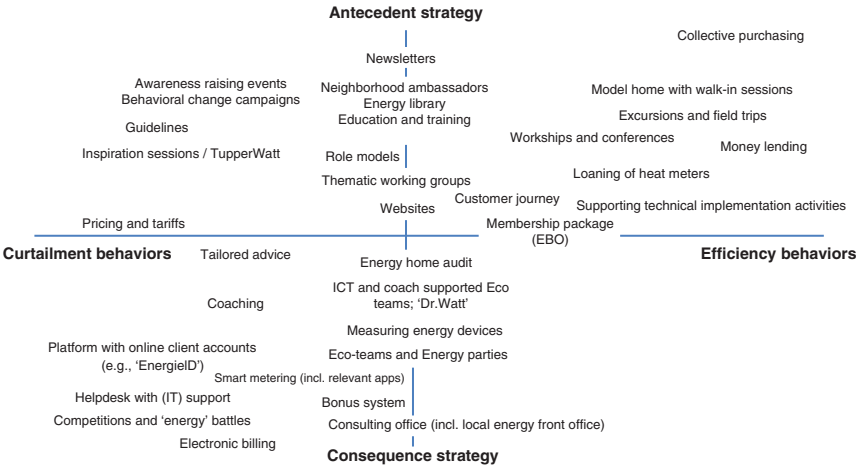

Fig. 8.3 Classification of measures implemented by energy communities to persuade households to save energy

Table 8.1 Overview of specific dedicated measures used by energy communities

Measure	Implemented by (energy cooperative, country)	Description
Dr. Watt	Enercoop (France)	An online tool that goes along with an offline training course to help consumers make a self-diagnosis of their electricity consumption. The approach seeks to make households more aware and to increase understanding into home electricity consumption, but also provides tailored advice.
TupperWatt	Enercoop (France)	Meetings organized for households that want to be more involved with energy community activities and that 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, creating social links within the community while sharing experiences.
EnergieID	Ecopower (Flanders – Belgium)	A SaaS-platform (i.e., "software as a service") to support households to understand and manage their energy consumption as well renewable energy production (via solar panels). Customers sign up with an account on EnergieID and on a monthly basis they fill in their energy consumption data. Then together with the help desk service of Ecopower the energy bills and energy consumption are analyzed and discussed with customers (including Ecopower members); either by phone or by email.
DH package	EBO (Denmark)	'Pakkeløsning' in Danish—a conversion package for home owners to switch from a gas grid connection to a (sustainable) DH system grid connection. It includes four steps: (1) A home visit and an agreement of where the district heating unit is going to be installed; (2) Building and connecting a heat supply line to the consumer's home and restoration of the garden; (3) A removal of the consumer's existing heating system; (4) A delivery and an installation of a new district heating unit. Before the measures take place unburdening of the home owner takes place. Afterwards performance of the installed DH system package is monitored periodically.

(*continued*)

Table 8.1 (continued)

Measure	Implemented by (energy cooperative, country)	Description
Customer journey	HIER opgewekt / Hoom (the Netherlands)	The customer journey concerns a stepwise approach to support home owners to make one's home more energy-efficient. It starts with awareness and inspiration, and includes checking whether the technical energy measure(s) installed meets the expectations set. This consists of six steps: Orientation, advice, quotation, execution, control and finally inspiring others. Trust is essential throughout the customer journey process. Home owners are looking for a reliable partner who will act in their best interest. Energy cooperatives take up this role and guide residents in making their homes more energy-efficient.
Info Energeia	SOM Energia (Spain)	A personalized energy awareness service, which provides information to households consumers via two channels. First, via a monthly report (in PDF) with benchmarking of a household's energy consumption against peers, and with useful tips. Second, via an online customer portal where the monthly reports and extended information are made available (including smart metering measurements).
Energy ambassadors	Hoom (the Netherlands)	A volunteer who conducts conversations with neighbourhood residents and guides them in the process of making their homes more energy efficient. Energy coaches know what making homes more energy efficient entails, both in terms of construction and installation technology. Energy ambassadors inspire and inform local residents based on their own experiences.

As can be observed in Fig. 8.3 there is a wide range of measures energy communities use. The figure reveals that the majority of measures uses antecedent strategy rather than consequence strategy and that curtailment behavior appears to be targeted more than efficiency behavior. Moreover, in terms of actions in terms of 'policy instruments' it can be observed that the majority of measures can be seen as capacity tools with the aim of informing target groups about the benefits of energy savings and to prepare how to engage in energy saving behaviors. Examples include the use of energy ambassadors, awareness raising events, inspiration sessions and using mock homes including 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 households enabling them to observe thermal bridges in their homes, smart meters to measure and provide feedback on energy consumption, and ICT interfaces to support energy service delivery—including tariffs and billing—and information provision to households (as 'clients'; and energy community members at the same time). The mapping exercise also revealed integrated measures that include a multitude of actions, and contain both antecedent and consequence strategy. Examples include the 'Dr. Watt' training programme of French REScoop Enercoop, which includes elements of eco-teams, role models, training and education, tailored advice, smart metering and ICT support. Hence, it includes both capacity and incentive tools, yet also uses technological tools in support (i.e., ICT, home metering equipment and a smart meter).

8.5.1 Use of Energy-Saving Measures by Energy Community Members

Second, an overview is created on which actions are used and in what frequency are used by energy community members at the energy cooperative LochemEnergie in the Netherlands (See Fig. 8.4) (Hoppe & Coenen, 2016). It reveals a wide variety of actions, mostly focusing on antecedent strategy. The chart reveals that there are no less than seven actions in which about half of the members or more participate.

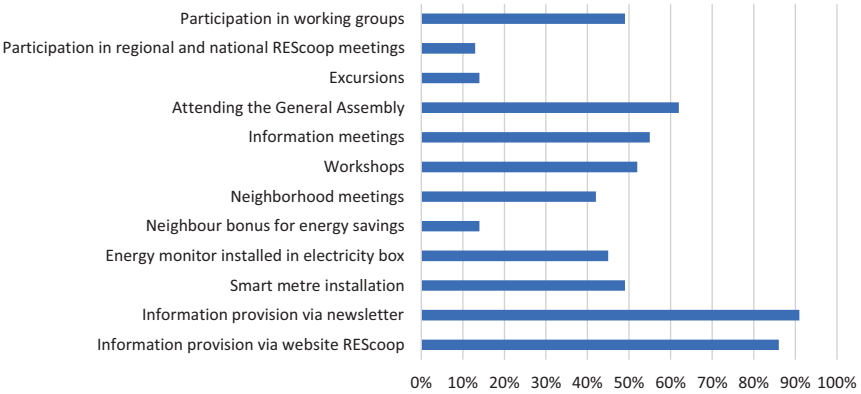

Fig. 8.4 Overview of members participating in dedicated energy savings actions implemented by energy cooperative LochemEnergie (in relative frequency of total membership)

8.5.2 Behavioral Analysis

The 'REScoop Plus' project surveys indicate that energy community members undertake many (individual) energy savings actions like lowering the thermostat or taking shorter showers. Only a fairly small part of those respondents, however, indicates that undertaking (individual) energy savings actions can be attributed to a REScoop (e.g., 18 per cent of the respondents from Enercoop; and 36 per cent of respondents from Ecopower) (Hoppe et al., 2019). For energy curtailment behaviors this is considerably less (15–17 per cent) than for energy efficiency behaviors (20–30 per cent). Between 36 per cent (Enercoop) and 64 per cent (Ecopower) of the surveyed energy community members indicate to using less energy savings after obtaining energy community membership. And 44 per cent of the respondents argued that energy community membership has contributed to household energy savings. Respondents indicate average energy savings in the range of 4–6 per cent. Of those who measured their energy consumption, about 21–22 per cent indicate to have saved at least 10 per cent energy, and between 9 per cent and 10 per cent indicates to have saved at least 20 per cent (Coenen & Hoppe, 2018).

Overall, members of energy communities were found to be committed to saving energy, both in terms of attitude, intention and actual behavior. They show high engagement with energy saving behaviors (both curtailment and energy efficiency behaviors) and perform (significantly) more individual energy savings behaviors than those who are not members of energy communities. The longer the energy community membership, the more knowledge is gained, and the more energy saving behaviors are performed. However, it should also be noted that only 5–20 per cent of the respondents attribute their energy savings behaviors to energy community membership (and if so this mostly concerns efficiency behavior, in particular switching conventional lighting to LED lighting). It can be argued though that regarding curtailment behaviors energy community members arguably were already engaged in energy saving behaviors prior to becoming energy community members. Other energy community factors that show a significant and positive statistical relation to energy savings (and intention to save energy) concern visiting of energy community meetings (or workshops), and integrated (i.e., combination of) measures like EnergieID (Ecopower), Dr. Watt (Enercoop) and InfoEnergia (SOM Energia). All three combine ICT tools with antecendent and consequence strategies, including feedback on actual consumption (ibid.).

Research was also conducted on the influence of rival factors including psychological predictors (e.g., goal-setting), social predictors (in particular social environment), knowledge level, demographics and household characteristics (i.e., education level, home size, and ownership). In multivariate regression analyses using three indicators of energy savings the most significant predictor turned out to be psychological factors. REScoop measures only modestly contributed to the explained variation of the models. However, the analysis also found strong statistical covariation between REScoop social/organizational factors and psychological predictors, stressing the importance of psychological predictors, which can potentially be targeted by cooperatives in their strategies to persuade their members to conserve energy (Hoppe et al., 2019). The study's results also support the claims that interventions are more effective when tailored to the target population (Abrahamse et al., 2005) and when combining informational and structural strategies with antecedent and consequence strategies (Gardner & Stern, 1996).

8.5.3 Effects of Dedicated Energy Saving Measures Implemented by Energy Communities

When looking into the use of specific integrated measures (including both antecedent and consequence strategy like the Dr. Watt intervention by Enercoop) implementation can be considered as fairly effective, with considerable energy savings as compared to the start situation. In the 2017 survey a number of specific energy measures and tools implemented by REScoops (i.e., Dr. Watt training sessions, personal advice, or EnergieID) were found to significantly and positively relate to energy savings (since becoming a REScoop member). Moreover, users were generally satisfied with them. For EnergieID users also indicated increased importance and contribution to energy savings. Increasing portions of the respondents indicated use (e.g., EnergieID: from 20 per cent in 2017 to 30 per cent in 2018 at Ecopower; Dr. Watt: from 3 per cent of Enercoop members to 37 per cent 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 intention to save energy, but not energy savings itself (Coenen & Hoppe, 2018).

Longitudinal time series trend analysis revealed a number of important findings (Sifakis et al., 2018). 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 per cent, cumulatively (Sifakis et al., 2020). More specifically, joining a REScoop was found to lead to a more than 20 per cent reduction in electricity consumption. And installing solar panels on one's home reduces REScoop members' electricity demand by more than 45 per cent, with those having 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 per cent of the respondents were found to be prosumers, generating their own green power, locally. The share of

Ecopower members having installed solar panels at home did also increase sharply over recent years, encouraged by Ecopower's agency (Sifakis et al., 2020). Further, 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: i.e., those who register with EnergieID save 10 per cent in energy consumption; those who partake in Dr. Watt training sessions at Enercoop were found to consume 13 per cent less electricity than others who did not partake; and those who had smart meters installed were found to consume over 26 per cent 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 with regard to the influence of smart meter installation to total household electricity consumption.

8.5.4 Support Structures and Energy Communities Cooperating with Government

To get an impression of which interventions are used, a case study of the Netherlands was used to provide more in-depth insights into how this works at the national level. A 2020 survey reveals that almost half of the energy cooperatives indicate that they are engaged in promoting energy saving measures. Energy cooperatives are active in providing information via their website, newsletters and district or via regional meetings. A number of cooperatives also use energy coaches. Energy coaches are local residents that have been trained in home energy affairs, and who make an inventory of wishes, and answer questions about measures that lead to energy savings. The advantage of this approach over business initiatives is that energy coaches are more familiar with the local situation and therefore have more confidence. Some energy cooperatives offer an integrated approach: with a local approach, a personal approach to households, with a network of local entrepreneurs and active

cooperative members who act as energy coach and neighbourhood ambassador, and with guidance during implementation (Schwencke, 2021).

An important observation made is that energy cooperatives rarely operate alone. For example, they often collaborate with local government (in the implementation of local 'energy front offices', giving advice, coaching and cooperating in local projects) and other social initiatives that are also involved in energy saving, such as 'Buurkracht' (which, incidentally, was once founded as an initiative from a distributed system operator). Research by 'HIER opgewekt' shows that when municipalities work together with energy cooperatives, they reach more households than without (ibid.). Another form of cooperation between energy cooperatives and governments is by making use of a public (subsidy) scheme ('Energy Consumption Reduction Scheme') aimed at encouraging households to take saving measures. This finances the training of energy coaches or the organization of residents' actions with small savings measures—such as with an 'energy box'. Ever since local governments and energy cooperatives started to collaborate, both the number of trained energy coaches and the number of coaching conversations (with local households) have increased. For this reason it is argued that local governments view energy cooperatives as a good cooperation partner for reaching households (ibid.).

Another observation is that a national energy cooperative ('Hoom') has been established by the cooperative movement that specifically functions as an umbrella and as a platform to support other energy cooperatives to build capacity to properly prepare and perform their energy saving activities. 'Hoom' shares knowledge, makes expertise available, trains energy coaches, develops smart tools and offers practical support. However, in line with its vision 'Hoom' assumes that local cooperatives follow their own approach, in collaboration with local partners and implementers. To support local initiatives, 'Hoom' has developed the "Cooperative Energy Desk", which supports local approaches from a national organization with IT support and additional services. In 2020, seventy-seven local energy cooperatives were affiliated to 'Hoom' (out of a total of 623 energy cooperatives nationwide). An inventory among 'Hoom' members showed that the total number of realized energy saving measures (such as thermal insulation, but also replacement of heating elements) has recently increased sharply (ibid.).

8.5.5 Conclusion

This chapter started with raising two research questions. First: How do energy communities encourage their members (and other households) in home energy savings? And second: To which extent are energy communities effective in doing so?

Three ways were presented in this chapter in which energy communities can influence households in general, and more specifically their members. First, via the social structure and norms that pertain to energy community membership, assuming that households obtain (or maintain) energy community membership. Second, via active engagement of households but in a general sense (e.g., reaching out to them by organizing energy community meetings). Or third, by implementing certain dedicated actions and measures to persuade households to save energy (e.g., via energy ambassadors, providing tailored advice, or using a team approach that also features feedback on home energy consumption performance). Results from empirical studies show that all three are used by energy communities.

Regarding membership it can be argued that by becoming an energy community one is influenced by its social environment to develop a certain attitude that contributes to setting intentions to save energy. Between 36 per cent (Enercoop) and 64 per cent (Ecopower) of the surveyed energy community members indicate to use less energy savings after obtaining energy community membership. And 44 per cent of the respondents argue that energy community membership has contributed to household energy savings. According to the 'REScoop plus' project survey energy savings are on average in the range of 4–6 per cent, and according to longitudinal trend analysis even range up to more than 10 per cent. Results also show that the longer one holds energy community membership the more one engages in energy savings behaviors and the more one actually succeeds in saving energy. Regarding engagement, a number of indicators (like attending meetings organized by energy communities) were found to have a significant positive statistical relationship to energy savings reported by energy community members. With regard to the implementation of dedicated energy community actions and

measures several strategies were found to have a significant and positive statistical relationship to energy saving behaviors and achieving energy saving, and were also found to be highly appreciated. These in particular concern the Dr. Watt program, Smart Meter installation, and EnergieID and InfoEnergia. Energy communities encouraging their members to install solar panels and become 'prosumers' was also found to have an impact (Sifakis et al., 2020). Moreover, the in-depth case study revealed that using energy ambassadors and local energy front offices ('energieloket' in Dutch) also seems to work effectively as they are well-practiced in this work and are valued by different stakeholders (Schwencke, 2021).

In sum, it looks like the three forms of engagement (i.e., membership itself, engagement activities, and the use of specific measures) contribute in a positive way to households' energy saving intentions, behavior and eventually energy savings. One may argue, though, that energy community membership and engagement strategy are necessary conditions that influence household energy saving behavior. Although some results indicate that these factors alone can already encourage household energy saving behaviors, results of the analysis of dedicated measure implementation reveal that they can trigger and reinforce these conditions. In summary, membership, engagement activities and specific measures appear to reinforce each other, and are, arguably, jointly best possible to trigger energy-saving behaviours among REScoop members. To answer the second question: energy communities are well positioned and fairly capable of encouraging household energy savings (taking into account that many households, and in particular those having energy community membership, already hold predispositions that favor energy saving behaviors).

Insights from the case study of the Netherlands revealed that energy communities do not stand alone in encouraging household energy savings. First, the energy community movement managed to establish a dedicated cooperative ('Hoom') to serve as an intermediary agent to support individual energy communities (most of them local energy cooperatives) in becoming knowledgeable about energy saving interventions, offering a dedicated toolbox and building capacities. Recent developments indicate that energy cooperatives are increasingly using the services 'Hoom' offers, while at the same taking more energy-savings actions (mostly by using energy ambassadors, by offering 'energy box' kits to

households, and by using the customer journey approach to persuade and support households), while managing to get more thermal insulation and other energy saving equipment installed. On the other hand, energy communities encouraging home energy savings also appear to increasingly cooperate with government. First, by using a national government funded scheme to finance the training of energy ambassadors. And second, by cooperating with local government in shaping and implementing local energy front offices and reaching out to citizens that are difficult to reach for local governments themselves. These can be viewed as energy communities 'co-producing' local climate policy and implicate energy communities operating on arm's length of government.

Transposition and implementation of CECs and related issues from the Internal Electricity Market Directive into national and decentralized legislation could potentially cover these kind of policy schemes at the national level that address capacity building and co-production of energy saving services by energy communities. This would arguably encourage and secure ongoing practices of energy community agency in energy savings in front-runner countries, and disseminate a potential institutional framework to countries in which energy communities still have to start up activities with regard to encouraging household energy savings.

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