Exploring energy saving policy measures by renewable energy supplying cooperatives (REScoops)

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Abstract

Cooperatives for renewable energy supply (REScoops) provide their members renewably generated energy within a cooperative model that enables members to co-decide on the cooperative's future. REScoops do not only collectively own renewable energy production facilities and supply this to their members, they also use their specific position as energy suppliers to take several actions to persuade their members to save energy. Although the activities that REScoops undertake to some extent resemble those of other organizations, because of their particular organisational and business model as citizens initiatives, the cooperative model, REScoops are supposed to be very well positioned for activities to influence and help their members to save energy. The paper discusses arguments why the REScoop model in energy supply can be an important contributor to reduce energy use by their members. Further this paper discusses measures that have been undertaken by REScoops studied in the REScoop Plus project. We use some illustrative examples to discuss if REScoops are in a relatively good position to take certain measures and succeed in persuading customers to lower their energy consumption level and elaborate on future experiments to explore the proposition that REScoop members save more energy due to actions of these REScoops towards their members.

Introduction

The transition to a sustainable energy system is not only a technological and economical challenge. It also requires behavioural change by energy users. Energy users have to use energy in more rational and efficient ways. Behavioural determinants of energy users can be targeted with policy measures to either encourage voluntary change in energy use or to change the conditions under which they make decisions on energy use. A key target group, households, however, proves difficult to reach (Bressers and Ligteringen, 1997).
All over Europe renewable energy supplying cooperatives (REScoops) have been established as citizens initiatives that foster community energy goals ((Arentsen & Bellekom, 2014; Hoffman & High-Pippert , 2010; Oteman et al, 2014; Seyfang & Haxeltine, 2012; Seyfang et.al., 2014). These REScoops can collectively own renewable energy production facilities and supply this to their members. In their position as energy suppliers they take several actions to persuade their members to save energy. REScoops are an example of active citizen engagement in the energy transition (Hoppe et.al., 2015 Oteman et al., 2014). According to the Federation of REScoops in Europe (REScoop.eu) there are currently more than 2,397 REScoops collectively having more than 650,000 members
Household energy consumption is influenced by many different factors including socio-demographics (e.g., income, age), climatic factors (e.g., temperature, wind power), economic factors (e.g., consumer pricing of

energy, purchasing power), technology (e.g., energy efficiency of household appliances), the living condition (e.g., household size, dwelling type), and the energy supplier (e.g., the exergy content of the energy carrier) (Fuchs & Lorek, 2000). These determinants are in turn influenced by both institutional factors (e.g., government policies) and cultural developments (e.g. emancipation, increasing the mobility of women). Demographic factors like attitudes, one's living situation but also the use of technology and the kind of energy carriers and the distribution of wealth are all examples of the influence of cultural developments on the other determinants. REScoops cannot directly influence cultural developments, but can be viewed as part of a cultural development itself (e.g., citizen empowerment in energy issues). Especially institutional factors influence the existence and magnitude of the determinants. For example, the government can influence spending patterns, set standards for energy efficiency of household appliances and dwellings, can stimulate innovations, etc. Institutional factors (e.g. law, governance, policy) can only be influenced by REScoops through lobbying, networking and by conducting research.

If energy consumers become member of an energy cooperative, it is expected they become more active regarding energy conservation and efficiency because REScoops organize events and take actions in order to raise their members' energy awareness. The REScoop Plus project aims to gather available information and data from the REScoops project partners and demonstrate that participation in such a cooperative raises energy awareness and contributes to accomplish the challenging goal of energy efficiency.

REScoops undertake several activities to encourage their members to save energy or to make investments in using RES. The activities that REScoops undertake, however to some extent, resemble those of other agents (e.g., governmental bodies, NGOs, other energy suppliers). REScoops use particular business and organizational models based on the cooperative model; a jointly-owned and democratically-controlled enterprise (see below). Therefore not all of the potential interventions are conceivable, like regulations, This raises the question, *whether REScoops are in a relatively good position to take certain measures and succeed in persuading customers to lower their energy consumption level*. In the project we compare in the first place REScoop members with other (commercial) energy users and non-REScoop-members and not REScoops with other energy agents. We theorize that if REScoop members save more energy than conventional energy consumers this might be due to one of the rival factors mentioned below, or a combination of these factors:

- people who join REScoops are different energy consumers in that they are (and were already) more motivated than others to lower energy consumption;
- REScoop member consumers partake in locally based energy communities, which means that they will 'automatically' reduce their energy use, as they become more aware of the importance of energy (as communicated via the social network of surrounding REScoops). Energy, then, becomes a more important issue to the consumer and his household, and as they become more conscious they are bound to waste less energy (TUN, 2016a);
- the REScoop member consumers are influenced by specific actions implemented by the REScoops themselves.

The question related to first factor is *whether REScoop members are (and were already) different energy consumers that are higher motivated for energy saving, more responsive for measures and with different energy consumption patterns.* The second factor, partaking in locally based energy communities, presumes that REScoops have a particular business and organizational model, the cooperative model, that positions them very well for activities to influence and help their members to save energy. The second question we therefore address in the paper is *what factors influence the position of REScoops to stimulate energy saving among households*. To answer this question we elaborate on arguments from practice and literature. To address the third factor that REScoop members are influenced by actions implemented by the REScoops we first will explore *what energy saving tools and actions thus far have been developed by the REScoops across Europe***.** We than discuss some examples from practice to see how the particular business and organizational model might work out on the REScoop measures, to explore the question: "*How does the REScoop model influence the way the REScoops implement their interventions and the way their members respond to these intervention*?*"* We discuss a future research agenda how through field experiments we can further explore the proposition that REScoop members save more energy than other energy users.

Methods

The stepping stone for the empirical study concerns the existing practice of REScoops in Europe on the basis of the activities of the participating REScoops federations or their representing organizations in the EU-Horizon 2020 project 'REScoop PLUS'. The REScoop partners and countries researched in the REScoop Plus are Avanzi (Italy), Coopernico (Portugal), Enostra (Italy) Ecopower (Belgium), Enercoop (France) EBO (Denmark), SEV (Italy) and SOM energia (Spain). The umbrella organisations ODE-NL (The Netherlands) and the

REScoop European federation REScoop.eu are also partners in the project, The explorative and inventory work presented in this paper are based on desk research, a literature review, primary data collected through REScoop experts (both interviews and expert group meetings), a number of in-depth illustrative case studies on interventions, and a member survey conducted in one of the REScoops.
For the primary data collection on the interventions experts from the participating REScoops were contacted, they completed a questionnaire, were interviewed, and attended two expert workshops together with academic experts to discuss the (preliminary) results. After a selection process they contributed with factsheets which contained information on certain illustrative measures. Following collection of the factsheets interviews were conducted again to learn more about the experiences, the background, context and the use of the interventions..
For the data analysis of the inventory study a classification based on psychological intervention literature and public policy instrument literature was developed to classify the interventions and strategies that were retrieved during data collection. The illustrative examples were analysed, constructed and described on the basis of interviews, desk research, secondary analysis of existing research and evaluations and statistical analysis of energy use data provided by the REScoop partners. .

REScoop members as energy consumers

The question whether REScoop members are (and were already) different energy consumers that are higher motivated for energy saving, more responsive for measures and with different energy consumption patterns, can only be researched through a survey that assesses their motivation, attitude and behaviour. Part of the REScoop Plus projects is a behavioural survey among REScoopmembers and non-REScoopmembers of which we cannot present the results yet in this paper. The type of members will depend on the particular characteristics of the REScoop at hand, the institutional and country context, and even the very moment that people became members (Bauwens, 2016). Because the REScoops in the project are very different, as our inventory showed (TUN, 2016a), at this moment we can only touch upon this matter in a specific case. Furthermore, strongly motivated REScoop membership does not have to be a positive factor for the energy saving in a REScoop when compared to other energy consumers, because much of the low hanging fruits (in terms of energy savings) might have already been harvested by these strongly motivated REScoop members before they became REScoop members anyway. We will discuss the type of membership in the illustrative cases..

The added value of REScoops as locally based energy communities

What factors influence the position of REScoops to stimulate energy saving among households? We theorize that REScoop members save more energy than conventional energy consumers due to the facts that they form parts of locally based energy communities. This presumes that REScoops have particular business and organizational models that positions them very well for activities to influence and support their members to save energy. REScoops can be defined as groups of citizens who organize themselves to collectively take action to foster the use of renewable energy and increase energy efficiency (REScoop.eu). Alternative names are “community power” or “community energy initiatives”. A cooperative is an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a jointly-owned and democratically-controlled enterprise (International Co-operative Alliance, 2016). A cooperative is a legal entity owned and democratically controlled by its members. The legal entity is laid down in private law, and the exact form differs per country. REScoops do not necessarily require the legal statute of a cooperative, but rather distinguish themselves by the ways in which they handle their business (REScoop.eu). This particular way of doing business refers to the seven principles that have been outlined by the International Cooperative Alliance (Alliance, 2016); (1) voluntary and open membership; (2) democratic member control; (3) economic participation through direct ownership; (4) autonomy and independence; (5) education, training and information; (6) cooperation among cooperatives; and (7) concern for the local community.
The following arguments can be given why REScoops as a particular organisational or business model, are in a relatively good position to stimulate energy among householders are based on lessons drawn from best practices (e.g., Hoppe et. al, 2015; Hufen & Koppenjan, 2015), REScoop policy documents (REScoop.eu, 2016b) and the academic and professional literature (e.g., Bauwens, 2016 Walker & Devine-Wright, 2008). We formulate seven arguments why the REScoop model in energy supply can be an important contributor to reduce energy use by their members (TUN, 2016a).
A first argument would be that REScoops are in a good position to stimulate energy saving because of the **scale level** of their activities, which is mostly on the local level, a level of operations close to citizens. Even if REScoops are national organizations they often work with locally organized groups. In the literature on local sustainability often the argument of proximity to citizens is used as an argument to take measures at a lower

geographical level (Coenen, 2009). The REScoop model provides a good scale to run relevant local energy efficiency projects, such as investing in thermal insulation of dwellings, and that this would be a source of inspiration for others, including non-members (TUN, 2016a). Research shows that participating in decision-making related to sustainable consumption makes people more willing to cooperate in implementation actions and contribute to attaining energy efficiency goals (Coenen, Huitema and Woltjer, 2009).
A second argument would be that REScoops have a specific **capacity and critical mass** to stimulate energy saving among their members. Implementing and using measures and equipment to save energy takes a lot of time and requires both technological expertise and bureaucratic competence (e.g., to grant legal permits or subsidies). Sharing experiences, not reinventing the wheel, and the advantages of participating in activities together (in terms of costs or time) add to the capacity for action. For REScoops it means that by facilitating consumers with measures like technological advice, administrative support, or upfront investments, a larger group of consumers can be motivated to actually participate in energy saving activities. Related to the argument of capacity is the argument of critical mass. REScoops are in a good position to contribute to energy savings because they have a certain critical mass to acquire the necessary expertise and motivate and assist citizens who are less motivated than those who are devoted to pursue sustainability goals (TUN, 2016a).
A third argument we can label as the **social network argument.** REScoops are in an excellent position to share and link their activities, including their energy saving actions, with other local actors like schools, sport clubs, local business firms and housing associations. These organizations also have a stake in the energy and low carbon debates and are willing to take their own responsibility (Seyfang, Park, & Smith, 2013). REScoops do not pursue profit maximization and often have similar idealistic and collective, community goals. Moreover, given their expertise REScoops are often viewed by the other local organizations as good partners to cooperate with in energy and low carbon projects (TUN, 2016a).
A fourth argument is the potential for **awareness raising and education** of the REScoop members. REScoops are in a good position to make their consumers more aware of energy use. They can also educate the larger community on the importance of energy efficiency by organizing and showing visible pilot projects in public buildings such as office buildings and schools, but also in individual consumer projects, and for instance the local community building (Hoppe, *et al*., 2015). Becoming a member of a REScoop presupposes already to be more aware of the importance of using energy than just being a passive consumer of a traditional energy supplier (TUN, 2016a).
A fifth argument would be that REScoops are not only in a good position to make consumers aware of energy use, but they - as active member organizations - also tend to set to energy saving as **a social norm**; viz. energy not only becomes a significant issue to the consumer and his/her household, but relative energy use and savings become less anonymous actions once users share their experiences with peers (Abrahamse, *et al.*, 2005). In this sense, REScoop energy saving goals and average group energy saving behaviour can become an element of goal steering, as a reference point for behaviour (TUN, 2016a).
A sixth argument is that REScoops are in a good position to generate **trust** towards citizens for them to take measures themselves and invest in energy efficiency or renewable energy technology appliances. This is especially important if these activities involve financial risks to be taken by the consumers in terms of making investments. Investments in thermal insulation, buying energy efficient appliances or putting solar panels on rooftops all involve risks in terms of return on investment for the consumer but might also involve radical change in the way of consumption. Dealing with REScoops, who are often viewed as a very trustworthiness partner (by local partners and citizens) to give advice, supply energy systems and appliances, might make people more willing and able to take investment risks (TUN, 2016a; Walker, *et al*., 2010).
And finally, in particular cases (like 'energy islands') the **commons argument** in sustainable energy production might occur. Commons are natural resources which are accessible to all members of a given community they are not privately owned and therefore can potentially be consumed by all of them, which presents the risk of over-exploitation and depletion of the natural resources pool (Hardin, 2009). If the energy produced by the REScoop is seen as a common good, saving energy by individual consumers also makes it possible that more people can make use of the available renewable energy production (TUN, 2016a).

Energy saving measures by REScoops

A great number of interventions has been developed targeting behavioural determinants to lower household energy consumption. In the academic literature there are basically two traditions that cope with these interventions. First, there is a literature on behavioural intervention strategy. It has a background in environmental psychology (e.g., Abrahamse et al., 2005; Frederiks, Stenner, & Hobman, 2015; Gardner & Stern, 1996; McCalley & Midden, 2002). Second, there is a literature on policy instruments and strategies, having a disciplinary background in policy studies (Scheider and Ingram, 1990). In an extended inventory report (TUN

2016a, Hoppe and Coenen, 2016) as deliverable within the REScoop plus project) the two lead authors made an inventory of REScoops interventions based on a framework where we combined insights and concepts from the behavioural and policy oriented literatures. Here we summarise this classification and the results of the inventory, to address the question: "*What energy saving tools and actions thus far have been developed by the REScoops across Europe?"*

Classification of interventions in the psychological tradition

In psychology interventions are actions that are implemented to bring about behavioural change in people. One type of intervention strategies that exists is directed towards activities to modify behaviour. Behavioural interventions may be aimed at (Abrahamse *et. al.* , 2005), viz. (i) voluntary behaviour change, by changing individual knowledge and/or perceptions; or (ii) changing the contextual factors (i.e. the pay-off structure) which may determine households' behavioural decisions (Abrahamse, *et al.*, 2005). In this paper we focus on what can be called micro-level factors (and not on macro-level or structural factors). These factors together with institutional factors and cultural developments influence the motivation, preferences, attitudes and opportunities and abilities of householders to save energy. Behaviour related to household energy saving can be divided into two types of behavioural change: (i) efficiency behaviour as a one shot action or decision to save energy (for instance buying energy efficient equipment or the insulation of houses); and (ii) curtailment behaviour with repetitive efforts to save energy (for instance lowering the temperature in a room by changing the thermostat) (Gardner & Stern, 1996).

In our inventory we used a taxonomy for behaviour change interventions developed by Abrahamse *et al.* (2005), first issued by Geller et al. (Geller et al., 1990), which addresses antecedent and consequences strategies. Antecedent strategy tries to influence one or more behavioural determinants prior to the performance of energy saving behaviour. Examples are goal setting, commitment, information provision, and modelling. On the other hand, consequences strategy tries to influence behavioural determinants after the occurrence of the energy saving behaviour by providing a consequences feedback on outcome after the occurrence of the behaviour. Examples are electronic billing, using online client accounts and smart metering. 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.

Classification of policy instruments and behavioural assumptions

Although REScoops are not governmental organizations there is an analogy between the activities of REScoops to let their members save energy and the use of public policy instruments. Public policy is made by governments and organizations which act on behalf of governments. Public policies are legitimized by elected politicians' decision making. Governments use policy instruments to influence citizen behaviour and achieve policy goals (Dahl & Lindblom, 1953). Therefore government policies use implicit or explicit behavioural theories (i.e. to help them in making assumptions and scenarios on how a certain target group is likely to respond to the implementation of a certain policy incentive). In their classic article on behavioural assumptions of policy tools Schneider and Ingram (1990) state as a basic assumption that public policy almost always attempts to get people to do things that they might not otherwise do; or it enables people to do things that they might not have done otherwise. Schneider and Ingram (1990) distinguish five reasons why people are not taking actions and that can be addressed by policy: they may believe the law does not direct them or authorize them to take action; they may lack incentives or 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 not known; and it is unclear what people should do or how they might be motivated. Policy instruments address these problems by: (a) providing authority; (b) proving incentives or capacity; (c) by using symbolic and hortatory proclamations.

Next, Schneider and Ingram (1990) discern five types of policy instruments: *Authority tools*, which are statements backed by the legitimate authority of government that grant permission, prohibit, or require action under designated circumstances. *Incentive tools* are tools that rely on tangible payoffs, either positive or negative, to induce compliance or encourage utilization. *Capacity tools*, which are tools that provide information, training, education, and resources to enable individuals (or groups and agencies) to make decisions or carry out activities. *Symbolic and hortatory tools* motivate people to take policy-related actions on the basis of their beliefs and values. A hortatory is a person or thing that strongly requests someone else to take a particular action. And finally, *learning tools*, which promote learning about the problem and the knowledge and uncertainty about both the problem and the action to be undertaken.

For the use of the classification in our framework we took into account that REScoops cannot use all types of policy tools (and neither in all circumstances). Sanctions are not relevant to REScoops. Whatever kind of information (knowledge, arguments, and moral appeal) is transferred and through what mechanism

(encouragement, persuasion, etc.) the behaviour change 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 REScoops member to act on basis of the information.

Overview of interventions by REScoops

In this section we summarize what energy saving tools and actions thus far have been developed by the REScoops participating in the REScoop PLUS project (Hoppe and Coenen, 2016, TUN 2016a). The overview links it to the nature of these measures in terms of psychological intervention strategies and type of instruments, but we do not address the impact and effects of those interventions here.

Table 1. Presentation of integrated intervention framework

Antecedent strategies	Intervention	Type of policy instrument
	Commitment	Symbolic and hortatory tools
	Goal setting	Symbolic and hortatory tools
	Information	Capacity tools
	Modelling	Capacity tools
	Tariffs	Incentive tools
	Collective purchasing	Incentive tools
	Services	Incentive tools
Consequence strategies	Feedback	Capacity tools
	Learning tools	
	Rewards	Incentive tools

Antecedent strategies used by REScoops

Figure 1 shows the number of large variety of *social and communicative antecedent strategies* we found in the eight studied REScoops. Most commonly used antecedent interventions concerned awareness raising, education and behavioural change campaigns. Information (newsletters, social media, etc.), and (local) ambassadors were also used but more infrequently. More than sixteen different interventions, including these ten, were identified

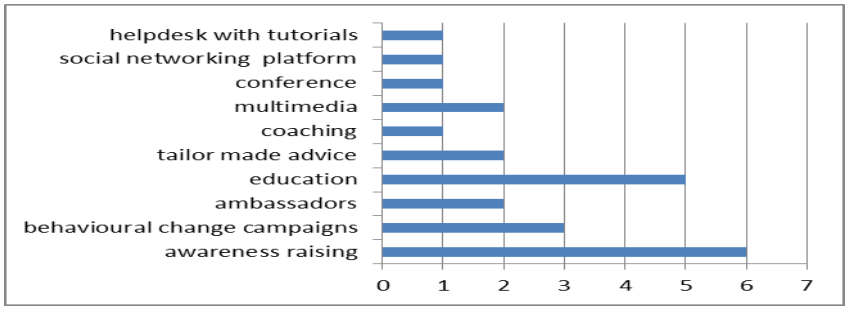

Figure 1. Overview of social and communicative interventions (antecedent strategy.)

Figure 2 shows the six main incentive antecedent strategies that were used. Most commonly transparent and single pricing was used (of renewable energy sold to householders), simple tariffs and collective purchasing. Bonuses, giving out shares and lending of money were used only incidentally. The infrequent use of economic incentives might point to the fact that many of the REScoops observed were in the phase of starting off and experimenting with local projects and related business models. Finally, it is surprising that only one of the studied REScoops mentioned giving out shares as an incentive, since this forms a key principle of cooperatives.

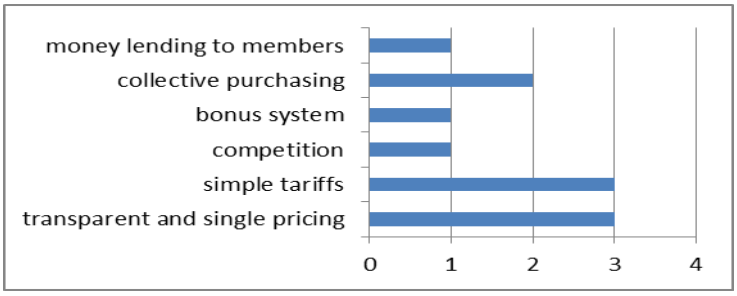

Figure 2: Overview of incentive tools used by the REScoops.

Consequence strategies used by REScoops

The main six different consequences strategies that were deployed by the studied REScoops, cover both direct and indirect feedback tools (see Fig 3). At least half of the REScoop surveyed conveyed the use of consequence strategies, i.e. electronic billing, using online client accounts, smart metering, and organizing energy audits. As may be expected with consequence strategies all tools and interventions used were technical or technology supported, often using smart (ICT) technology. Feedback from REScoop staff to their members appears to mostly happen indirectly, i.e. via billing, via online accounts of via a web-based platform. There was no mentioning of group-wise feedback or learning systems.

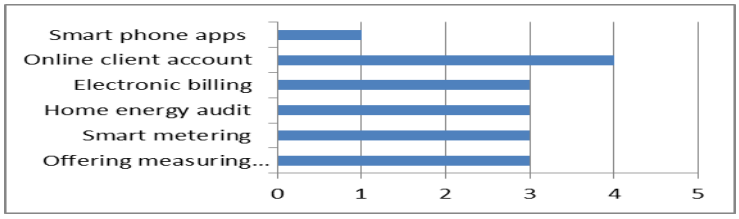

Fig 3: Overview of (technical) tools used by REScoops.

Results concerning the interventions used by REScoops

The overview shows that particular many antecedent strategies were used by REScoops. Compared with overviews of measures used by other energy agents these measures are however not unique (European Environmental Agency, 2013). Particular many of the information tools used by REScoops are rather similar to what other energy supplier or governments and NGOs use. Consequence strategies were used less than antecedent strategies. However, the consequence strategies used varied a lot, and included both direct and indirect feedback tools. Consequence strategies were found to be well supported by online platforms and smart technology (i.e., smart metering). However, many REScoops are just on the verge of using feedback tools. REScoops were found to use a lot of technical equipment to provide feedback on energy consumption to their customers. REScoop members are more willing to use this equipment. However this is not only technical equipment (but also uses other feedback mechanisms).
Measures are related to attaining goals, although one measure can serve different goals. Strictly speaking we were looking for measures that address the goals investing in RES (producing more renewable energy) and saving energy. However our inventory showed that for the studied REScoops also other goals like delivering (energy) services, enlarging the size of total REScoop membership, stimulating the green energy transition and climate change awareness raising, are important. In the end these other goals will contribute to the attainment of the first two main goals.A mix of existing policies aimed at stimulating reductions in energy can be called a policy package (Kerna, *et al.*, 2016). The overview is based on single measures or interventions on not measure packages. Next to focusing on interventions themselves, attention is also needed to address situational factors like laws, regulations, neighbourhood factors, dwelling size, household size, household income, employment status of household occupants, ownership, stage of family life cycle, geographical locations, and personal comfort. Studies show that they all correlate significantly with household energy consumption (Frederiks et al., 2015).

Examples of energy saving measures by REScoops

To explore the question: "*How does the REScoop model influence the way the REScoops implement their interventions and the way their members respond to these intervention*?, we describe here three illustrative examples.

Support measures district heating packages

The first example is a new cooperative of consumers who signed up for a conversion from natural gas, electricity or oil private heating into district heating , in a district heating expansion project in three different districts in the Hvidovre municipality in Denmark. Each project started with a marketing period that ran in three to four months. In the end of the period, 30% of the home owners in each project accepted district heating by signing a contract with the cooperative. A measure that was used to achieve this was the so called 'Package solution': a conversion package for home owners. Everybody who signed up was visited by the contractor and account manager of the cooperative. These persons explained all the details on how, when and where the equipment were to be installed. The responsibility of the account manager was to make sure that the district heating installation was completed in a way that satisfied the customers, and, moreover, to facilitate the communication between customers, contractors and the cooperative. Customers only had to take four actions: 1) sign a contract; 2) coordinate the district heating installation with the contractor and account manager; 3 & 4) open their homes twice by staying at

home, or by handing the keys to the service engineers who were responsible for installing the district heating installations. All the rest was taken care of by the cooperative. Customers become a member of the district heating cooperative (non-profit organization in Denmark). After the installation, members were offered technical support for free in order to save energy.
The new members of the new established REScoop needed not to be highly motivated before they joined the cooperative on the basis of the marketing efforts. And there were clear benefits for the individual members who also in the future will profit from the cooperative. Since they are member of the cooperative, it is in their interest to lower heating since it benefits everybody Any profits made on the district heating goes to the members and is discounted for in their energy bills. The REScoop has obligations under the Danish Energy Saving Obligation Schemes to yearly further reduce the total energy use. The REScoop members are also entitled to participate in decision-making regarding energy efficiency actions.
The level of operations of the REScoop is very close to citizens and involves direct personal contacts. These direct contacts and the fact the cooperative is not for profit will influence the factor trust. The sign up process itself was shaped in a form that will maximal motivate and support participating house owners. Facilitating the consumers with advice and support might motivate the consumers to actually participate in energy saving activities. Without this support people would probably not be able to save energy by themselves unless they would be already highly motivated and knowledgeable. The cooperative has a specific capacity and expertise to support the customers but the district expansion projects also ask for a certain critical mass because 30% of the home owners have to sign up for district heating before the district heating project takes place..
In this example case the energy use of cooperative members could be compared with non-cooperative members. In terms of a quasi-experiment the treatment group consists of home owners in particular district heating expansion projects that have accepted a conversion into district heating and signed up for the project. The comparison group exist of consumers members of 'Fors', which is a non-cooperative municipal company district heating provider. Both group[1]s were introduced to district heating, the difference is the provider-consumer relation (company versus membership of cooperative) and the support package the REScoop offered. The consumers of the new cooperative selected themselves to be part of the intervention as integral part of the membership and the choice for district heating.
Figure 4 shows the average reduction percentages in the ReScoop (represented by EBO) end-users' monthly consumption, with respect to three different baselines:
a. The average consumption of end-users before joining EBOb. The average consumption of end-users that received technical support treatment, before reception
c. The average consumption of end-users of a non-cooperative company, which received technical support treatment
As we can observe, the fact that end-users became members of the district heating cooperative lead to reductions of 16% on average, in monthly kWh/square meter values. Also, the reception of technical support for the cooperative members lead to 20% savings in monthly kWh/(square meter * HDD), on average. (p-value 0.00017, Kendall's τ 0.414). Furthermore the application of the technical support treatment on the cooperative members was more effective than that of non-cooperative members, showing an average of 1.7% more reductions in monthly kWh/HDD.

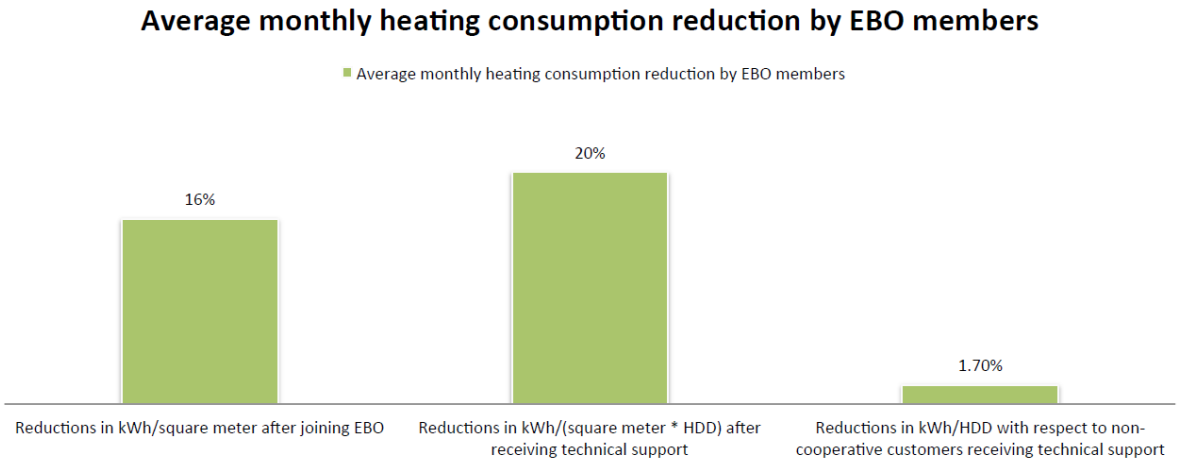

Fig 4 Average monthly heating consumption reduction

[1] Although this non-member group is comparable with the REScoop group, we did not check this on social economic factors.

The dataset included monthly heating consumption values from 300 residential customers, which are cooperative members, for the period of 5/2012-9/2016. Additionally past yearly consumption values of the members before joining EBO, and a dataset from a non-cooperative company, containing monthly data samples that indicate the consumption of 1000 non-cooperative members, were used

Case 2: The 'Dr. Watt' self-diagnosis instrument.

Launched in 2005 by French ecological and ethical business organizations, Enercoop is a 100% cooperative green electricity supplier. In 2015, it had a total of 15,000 members, and 22,000 consumers. In addition to selling green electricity, one of the main objectives of Enercoop was to decentralize energy production so as to give every citizen the opportunity to get involved in the energy transition. By supporting the emergence of new local REScoops since 2009, Enercoop has been fostering a network of cooperatives within which every citizen can invest and participate (TUN, 2016a). Enercoop started with the creation of one cooperative but has now become a network of nine local cooperatives that allow citizens to reconnect with the challenges of the energy transition on a regional level.
Dr. Watt is a training course to help consumers make a self-diagnosis of their specific electricity consumption. The aim is to help individual consumers to reduce their energy consumption by providing the tools to measure their consumption and understand it, and by reducing energy consumption while maintaining the same comfort level via tailor made advices offered through software (also entitled 'Dr. Watt'). Training sessions involve a three step approach: (a) training with an energy expert; (b) doing the self-diagnosis using a technical measurement tool (the 'Watt meter') for all in-door electrical appliances, and assisted by software; and (c) by organizing a 'feedback meeting' in which an experts analyses the collected data and addresses household consumption patterns individually, but in a group setting to allow for social dynamics, experience sharing and learning. In a later stage this is enabled online via the 'Dr. Watt' software platform. Moreover, before each meeting participants are subjected to awareness raising by Enercoop (in which multiple media are used: e.g., newsletters, social media). 'Dr. Watt' can be seen as an approach using a broad scope of both antecedent and consequence strategies. One can expect members of the Enercoop cooperatives to be highly motivated for both climate action as well as energy saving because the price they pay for energy is higher than is the traditional energy supplier. Part of the REScoop Plus projects is a behavioural survey among REScoopmembers and non-members which will compare motivation and attitude of which we cannot present the results yet in this paper. Although Enercoop is a national organization it represents nine regional cooperatives and works with locally organized groups. As a national organisations they have the specific capacity and critical mass to introduce a project like Dr. Watt. who share their experiences in the project. Thus, energy savings becomes a less anonymized action.
Since 2013 experiments with the tool were organized in three local cooperatives of the Enercoop network. More than 20 training sessions were organized. The participants who were trained and used the self-diagnosis measurement tool of their specific electricity consumption, reported an average potential saving of 40 % of all the electricity consumption of the household devices measured by them. However this measured electricity use did not count the electrical heating consumption, the electrical hot water device and some type of the cooking in these households.

Case 3: Interventions package

LochemEnergie is a citizen-led energy cooperative in the Netherlands. It is one of the most well-developed and professional REScoops in the country, and has 725 members. All members pay annual membership fees. LochemEnergie produces and sells locally produced energy, more specifically electricity from four solar parks located at multiple sites within the Lochem municipality. LochemEnergie is also working on multiple RES projects including solar projects at schools, a local swimming pool, a wind energy project. Energy is sold to 320 clients, which is only part of the membership. LochemEnergie has more than 45 volunteers that work on the RESoop's operations (TUN, 2016b). LochemEnergie used a broad array of measures that can be viewed as interventions targeted at directly or indirectly persuading their members to lower energy consumption of invest/adopt RES. A list of all measures used by LochemEnergie is presented in Fig 5. It reveals that LochemEnergie deploys a great amount of different interventions. However, they are mostly antecedent strategy interventions. The consequence strategy interventions (e.g. Smart Meters) were mostly planned but were hardly or not implemented yet.

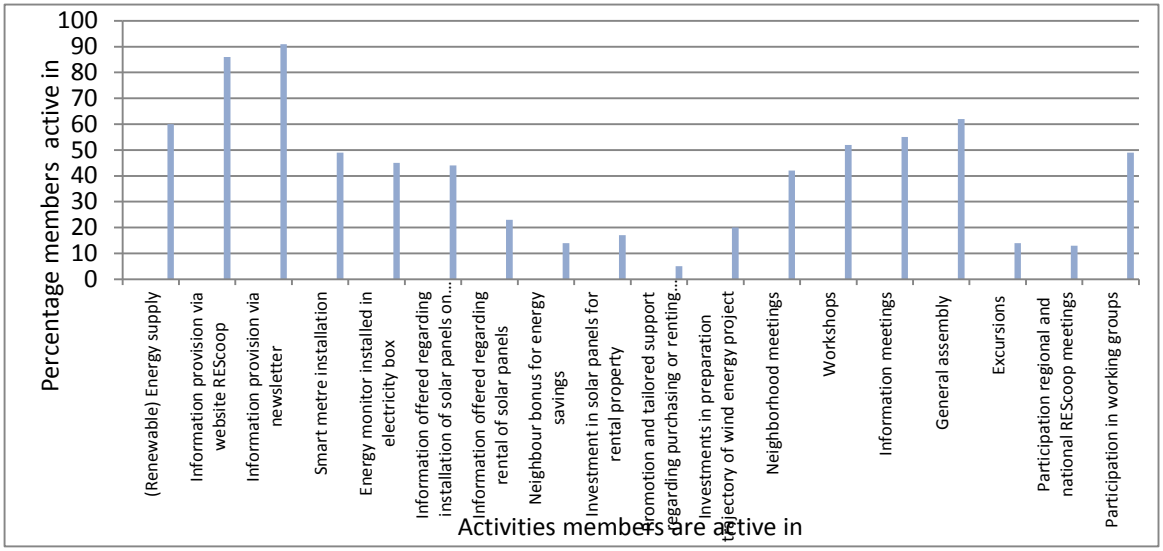

Fig 5: Percentage of members active activities in organised by LochemEnergie.. Source REScoopplus pilot survey LochemEnergie and TUN, 2016

The membership is highly motivated, not only because they are prepared to pay an annual fee but it is also shown by the very active membership volunteers.
The REScoop is within a municipal geographical area that provides a good scale to run relevant local energy production and efficiency projects. The large groups of volunteers create the capacity and critical mass to facilitating the other consumers with advice and support. The REScoop is strong in linking their activities to other local actors and the social network. Many interventions were implemented in combination with others (TUN, 2016b).The high percentage of REScoop members from the municipality involved means a good position to make not only the own consumers more aware of energy use but also other inhabitants of the municipality. LochemEnergie members state that the REScoop enables community building, strengthens social cohesion and supports the development of new collaboration modes. Half of the REScoop members conveyed to have undertaken actions in relation to (renewable) energy supply supported through promotion actions and with support of LochemEnergie. More than 30% of the REScoop members reported to be strongly involved in projects organized by LochemEnergie; e.g., solar panels installation, electric vehicle service provision, research or involvement with the energy savings project entitled 'Smart Grid Lochem'.
Results from a survey organized by (N = 65) reveal that active REScoop members lowered energy consumption by more than 20% over a five year span (TUN, 2016b). This is based on self-reporting questions in the survey, were respondents (members but not necessarily clients) had to report on the basis of their own actual use (as provided by DSO in their bills). This is higher than the average in the Netherlands over this period. Savings were mostly achieved in consumption of natural gas. Energy savings in electricity consumption were lower. Saving energy on gas consumption (used for heating spaces, cooking, heating water, etc.) appears to be more easily done than to save energy in electricity consumption (used for electrical home appliances). Although energy savings realized cannot be attributed to the implementation of particular (combinations of) interventions.

Conclusions and future research

How does the REScoop model influence the way the REScoops implement their interventions and the way their members respond? The illustrative examples shows that the REScoops business and organisation model, the cooperative model, can place the REScoops in good position to take certain measures and succeed in persuading their members customers to lower their energy consumption. It illustrates the potential difference with other energy retailers particular through the REScoop membership and the cooperative engagement between organisation and members. We also compared in three different situations the energy use of the cooperative member group that was involved in the REScoop measure with respectively (1) consumers of another energy supplier of district heating, (2) with other REScoop members and (3) with the national average. In all three cases the energy saving results were larger in the cooperative member group that was involved in the measure than in the comparative group. Given the fact that we do not have randomised control groups and there is a clear case of self-selection concerning the members who participated in the measure, no causal relation is shown. Further two of the cases are based on self-reporting of the energy use by the members and not energy use data provided by the REScoop. The illustrative cases do not prove the claim that cooperative membership and/or the cooperative

engagement are a key factor in the energy savings realized. Neither does it prove the influence of the actions on the realized savings. But it does point to the differences in the way and the background against the measures were taking within REScoops.
This background of membership and collective engagement becomes particular interesting in the case of measure packages. Measure packages in itself already show the differences between REScoops and other energy agents in the intensity of energy saving stimulation. While previous research has largely analysed the effectiveness of individual measures (Kerna et.al., 2016) to understand energy savings by REScoop members we need to a broader view and examine the mix of measures aimed at stimulating reductions in energy use. Some studies have shown that a combination of strategies is generally more effective than applying one single strategy. However, confounding of effects makes it more difficult to determine which strategies actually contributed to the overall effect. More systematic research on the effectiveness of interventions under various circumstances would be advisable in this respect (Abrahamse, et al.,2005).
In the further phase of the project we will research field experiments with interventions used by REScoops to explore the proposition that REScoop members save more energy due to actions of these REScoops towards their members. Given the specific context, nation-specific, policy and institutional context, energy consumption reduction has to be linked with specific interventions. These field experiments we study in the REScoop project for one part are ex-post impact evaluation field experiments with interventions made by the REScoops, in which the researchers did not have any control over the intervention, as usual in the policy evaluation tradition. In the traditions of the psychological interventions in energy saving are often brought about by experimenters or researchers. In this tradition we are setting up a number of new experiments within the REScoopplus project. As a consequence of using ex-post impact evaluation designs of intervention all treatment and control groups lack full random assignment and the groups (intervention versus non-intervention) were formed by means of self-selection. Control groups can be either different energy suppliers, geographical units, REScoops within their umbrella organization (i.e., REScoop federations) or all consumers in a country. And finally, consumer energy use data will be measured through energy use data provided by the REScoops and/or consumer survey data.

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References

Abrahamse, W., Steg, L., Vlek, G., Rothengatter, T., . (2005). A review of intervention studies aimed at household energy conservation. Journal of Environmental Psychology, 25, 273-291.

Arentsen, M. J., & Bellekom, A. A. (2014). Power to the people: local energy initiatives as seedbeds of innovation? Energy, Sustainability and Society, 4(2).

Bauwens, T. (2016). Explaining the diversity of motivations behind community renewable energy. Energy Policy, 93, 278-290.

Bressers, J., & Ligteringen, J. (1997). What to do with non' accessible' target groups: policy strategies for sustainable consumption. CSTM working paper nr. 66. University of Twente, Enschede.

Coenen, F. (2009). Local Agenda 21:'Meaningful and Effective 'Participation? In Coenen, F. (ed.), Public participation and better environmental decisions, Springer, 165-182 .

Coenen, F. D. Huitema and J Woltjer, Participatory Decision-Making for Sustainable Consumption. In Coenen, F. (ed.), Public participation and better environmental decisions, Springer, 89-110.

Dahl, R. A., & Lindblom, C. E. (1953). Politics, Economics and Welfare: Planning and Politico-Economic Systems Resolved into Basic Social Process: Harper.

European Environment Agency (2014), Achieving energy efficiency through behaviour change: what does it take, EEA technical report no 5/2013

Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015). The socio-demographic and psychological predictors of residential energy consumption: A comprehensive review. Energies, 8(1), 573-609.

Fuchs, D. A., & Lorek, S. (2000). An inquiry into the impact of globalization on the potential for 'sustainable consumption' in households. Report presented at the Workshop on Sustainable Household Consumption: Impacts, Goals and Indicators for Energy-use, Transport and Food, ProSus/CSTM, Enschede, 17.-19.11.2000

Gardner, G. T., & Stern, P. C. (1996). Environmental problems and human behaviour: Allyn & Bacon.

Geller, E. S., Berry, T. D., Ludwig, T. D., Evans, R. E., Gilmore, M. R., & Clarke, S. W. (1990). A conceptual framework for developing and evaluating behavior change interventions for injury control. Health Education Research, 5(2), 125-137.

Hardin, G. (2009). The Tragedy of the Commons. Journal of Natural Resources Policy Research, 1(3), 243-253.

Hoffman, S. M. and A. High-Pippert, A. (2010). From private lives to collective action: Recruitment and participation incentives for a community energy program. . Energy Policy, 38(12), 7567–7574. doi:10.1016/j.enpol.2009.06.054.

Hoppe, T., A. Graf, B. Warbroek, I. Lammers, and I. Lepping. (2015). Local governments supporting local energy initiatives; Lessons from the best practices of Saerbeck (Germany) and Lochem (The Netherlands). . Sustainability, 7(2), 1900-1931. doi:10.3390/su7021900.

Hoppe, T., and F.H.J.M. Coenen. (2016). Exploring interventions and tools used by REScoops to lower householders' energy consumption and stimulate investment in RES projects. Paper presented at the Annual Work Conference 2016 of the Netherlands Institute of Government (NIG), 24-25 November 2016, Antwerp, Belgium. Panel session on 'Energy and climate governance'.

Hufen, J., & Koppenjan, J. (2015). Local renewable energy cooperatives: revolution in disguise? Energy, Sustainability and Society, 5(1), 1.

International Co-operative Alliance; (2016). What is a co-operative? http://ica.coop/en/what-co-operative.

Kerna, F., P. Kivimaaa and, M. Martiskainen, Policy packaging or policy patching? The development of complex energy efficiency policy mixes, Energy Research & Social Science Vol 23, Jan 2017,11–25.

McCalley, L., & Midden, C. J. (2002). Energy conservation through product-integrated feedback: The roles of goal-setting and social orientation. Journal of economic psychology, 23(5), 589-603.

Oteman, M., Wiering, M., & Helderman, J.-K. (2014). The institutional space of community initiatives for renewable energy: a comparative case study of the Netherlands, Germany and Denmark. Energy, Sustainability and Society, 4(1), 11. Retrieved from http://www.energsustainsoc.com/content/4/1/11.

REScoop.eu. (2014). REScoop 20-20-20 Best practices report 1. Retrieved from https://rescoop.eu :

REScoop.eu. (2015). REScoop 20-20-20. Retrieved from https://rescoop.eu/rescoop-20-20-20.

REScoop.eu. (2016a). REScoop Plus. Retrieved from https://rescoop.eu/european-project/rescoop-plus.

REScoop.eu. (2016b). REScoop.eu. Retrieved from https://rescoop.eu/.

Schneider, A., & Ingram, H. (1990). Behavioral assumptions of policy tools. The Journal of Politics, 52(02), 510-529.

Seyfang, G., & Haxeltine, A. (2012). Growing grassroots innovations: exploring the role of community-based initiatives in governing sustainable energy transitions. Environment and Planning C-Government and Policy, 30(3), 381-400. doi:Doi 10.1068/C10222.

Seyfang, G., Hielscher, S., Hargreaves, T., Martiskainen, M., & Smith, A. . (2014). A grassroots sustainable energy niche? Reflections on community energy in the UK. Environmental Innovation and Societal Transitions., 13, 21-44. doi:10.1016/j.eist.2014.04.004.

Seyfang, G., Park, J. J., & Smith, A. (2013). A thousand flowers blooming? An examination of community energy in the UK. Energy Policy, 61, 977-989.

Steg, L. (2008). Promoting household energy conservation. Energy Policy, 36(12), 4449-4453.

Steg, L., & Abrahamse, W. (2010). How to promote energy savings among households: Theoretical and practical approaches. Psychological Approaches to Sustainability: Worldwide Current Trends in Research,10-32.

TUN. (2016a). D3.1 Report on specific tools of Supplying REScoops in Europe. Retrieved from Enschede/Delft:

TUN. (2016b). D3.2 – Evaluation Methodology. Retrieved from Enschede/Delft:

Van der Schoor, T., & Scholtens, B. (2015). Power to the people: Local community initiatives and the transition to sustainable energy. Renewable and Sustainable Energy Reviews, 43, 666-675.

Walker, G. (2008). What are the barriers and incentives for community-owned means of energy production and use? Energy Policy, 36(12), 4401–4405. doi:10.1016/j.enpol.2008.09.032.

Walker, G., & Devine-Wright, P. (2008). Community renewable energy: What should it mean? Energy Policy, 36(2), 497-500. doi:http://dx.doi.org/10.1016/j.enpol.2007.10.019.

Walker, G., Devine-Wright, P., Hunter, S., High, H., & Evans, B. . (2010). Trust and community: Exploring the meanings, contexts and dynamics of community renewable energy. Energy Policy, 38(6), 2655–2663. doi:10.1016/j.landusepol.2008.12.010.