Multiplying energy-saving behaviour in cities through formal social groups

Corinne Moser
ZHAW School of Engineering
Institute of Sustainable Development
Technoparkstrasse 2
CH-8401 Winterthur
Switzerland
corinne.moser@zhaw.ch

Yann Blumer
ZHAW School of Management and Law
Center for Innovation and Entrepreneurship
Stadthausstrasse 14
CH-8400 Winterthur
Switzerland
yann.blumer@zhaw.ch

Roman Seidl
ETH Zürich
Institute for Environmental Decisions, Natural and Social Science Interface
Universitätstrasse 22
CH-8092 Zürich
Switzerland
roman.seidl@zhaw.ch

Vicente Carabias-Hütter
ZHAW School of Engineering
Institute of Sustainable Development
Technoparkstrasse 2
CH-8401 Winterthur
Switzerland
vicente.carabias@zhaw.ch

Bettina Furrer
ZHAW School of Engineering
Institute of Sustainable Development
Technoparkstrasse 2
CH-8401 Winterthur
Switzerland
bettina.furrer@zhaw.ch

Keywords

broader social context, case studies, social networks, energy sufficiency, energy saving potential, local activities

Abstract

Cities are key agents of change in the ongoing energy transition in Switzerland. They promote technical efficiency measures and behavioural change to save energy – both by being role models and by addressing consumers directly. A crucial question is how cities can best elicit private consumers' full potential of energy saving through adapting their habitual behaviour or routines, or in other words, how cities can promote energy sufficiency.

This paper presents first findings of a transdisciplinary project involving researchers from ZHAW, ETH Zurich and the three Swiss cities of Winterthur, Baden, and Zug. The project's key idea is that cities can promote energy sufficiency of private consumers through middle-actors. In particular, it examines whether formal social groups (e.g., sports clubs) may function as powerful multipliers for energy-saving activities.

Thus, the aims of this paper are: i) to identify activities of the three analysed cities to promote private energy-saving, and ii) to discuss the role of formal social groups in cities when addressing private consumers.

We will present findings from three in-depth case studies in the cities of Winterthur, Baden, and Zug. For each city, we identify and structure currently applied energy-efficiency and sufficiency activities to promote energy-saving of private consumers (document analysis). Based on our findings we suggest strategies how the three analysed cities may best address private consumers to achieve energy-saving. Special attention will be given to formal social groups and their potential to motivate their members to save energy. This may concern activities that are related to the purpose of the group (e.g., members of a sports club use public transport instead of individual cars to go to away games) and potentially also members' private activities (e.g., use of public transport instead of car for private leisure activities). As an outlook, we formulate first ideas for real-world experiments to systematically test the influence of formal social groups on individual energy-saving behaviour.

Introduction

Many countries, among them Switzerland, currently face a challenging transition towards more sustainable energy systems. In the case of Switzerland, a new energy strategy follows ambitions goals regarding the promotion of renewables, substituting nuclear energy, and reduction of per capita consumption (Swiss Federal Council, 2013). Hydropower production – which already today contributes to around 60 % of Switzerland's electricity production – shall be further increased and electricity production from new renewables – which currently represents a very small share in Switzerland – shall be expanded from 2.25 TWh in 2013 (Kaufmann, 2014) to a yearly production of 24.2 TWh by 2050. Furthermore, the average per capita consumption of final energy should decrease by 54 % by 2050 (year of reference: 2000). This mainly concerns fossil fuels. With respect to the average per capital electricity consumption, a decrease of 18 % is envisioned (Swiss Federal Council, 2013). According to the new energy strategy, these goals shall mainly be achieved through increased energy efficiency (e.g., of appliances, cars, and buildings).

In Switzerland, households currently demand 29 % of final energy and mobility/transport demands 35 % (BFE, 2014).

Table 1. Examples for one-shot decisions and changes in routine behaviour structured by different energy services and required changes of behaviour. Please note that different groups of people might experience different difficulty levels for performing the same behaviours or decisions.

	Required changes of behaviour	*One-shot decisions (examples)*	*Repeated behaviour (examples)*
Transport	No or small changes	• Buying an energy-efficient car	• Driving (Ecodrive)
	Large changes	• Moving closer to place of work to avoid commuting	• Changing commuting and leisure mode of transport • Using shared transport systems
Heating/hot water	No or small changes	• Refurbishment of home	• Changing ventilation behaviour • Turning off heating when absent • Reducing heating in rarely used rooms
	Large changes	• Reducing living space	• Changing showering behaviour, showering instead of bathing • Reducing space heating, changing of clothing behaviour
Electricity	No or small changes	• Buying more efficient appliances (e.g., fridge)	• Switching off plug bar when away • Turning out lights when away • Cooking patterns (e.g., cover pots)
	Large changes	• Refraining from purchase of appliance	• Line-drying laundry instead of using tumble drier

Regarding mobility and transport, 70 % of final energy is demanded for transporting people on the road (BFE, 2013). These numbers make clear that the decisions and everyday behaviour of individuals at home as well as their travel behaviour play a crucial role for reaching the goals of the Swiss government on reducing energy consumption. Thus, isolated efficiency measures will not suffice to reach the ambitious goals of Switzerland's new energy strategy. This is on one hand because of economic and technical limitations of efficiency, but more importantly due to rebound effects (Darby, 2007; Herring, 2006). To guarantee a reduction of per capita energy consumption, energy efficiency measures need to be combined with more sufficient consumption patterns (Notter, Meyer, & Althaus, 2013).

In accordance with Breukers and colleagues (2013), we understand energy sufficiency as a change in routine behaviours or lifestyles that leads to less energy consumption. In contrast to efficiency measures, which are characterized by one-shot decisions (e.g., buying an energy-efficient fridge) and do not require behavioural changes, energy sufficiency is about changes of energy-relevant behaviour and lifestyles. Examples for energy-sufficient behaviour are: eating vegetarian food instead of meat, wearing a pullover and warm socks in winter instead of turning up the heating in one's apartment, using public transport for commuting instead of private car, or line-drying laundry instead of using the tumbler.

Table 1 gives some examples for one-shot decisions and changes in routine behaviour structured by different energy services (electricity, heating/hot water, and mobility). Here, we also differentiate the required changes of behaviour. In this respect, the column on one-shot decisions is an interesting one: Those decision that require no or only small changes of behaviour (and, of course, resources such as time and money are required) are typical energy-efficiency measures (e.g., buying a more energy-efficient car, refurbishing home, and buying more energy efficient appliances). There are, however, also one-shot decisions that require changes of behaviour or even of lifestyles, such as moving closer to workplace to avoid commuting, reducing living space per capita or refraining from consumption. Although one-shot, these are interesting patterns from an energy-sufficiency perspective. For simplicity reasons, we do refrain from further differentiating between different groups of people which might experience different difficulty levels in performing these behaviours. For a single person, it is probably less difficult to change living place or move to a smaller apartment compared to e.g., a family of two adults working at different places and schoolchildren.

There exist a variety of studies about energy-efficient and energy-sufficient behaviour (Abrahamse, Steg, Vlek, & Rothengatter, 2005; Gardner & Stern, 2008). For example, Poortinga and colleagues (2003) found out that people prefer technical efficiency measures over behavioural change to save energy. At the same time, they prefer energy-saving measures at home to measures in mobility. Another study in Switzerland identified societal potentials for sufficiency measures in different domains (Moser, Rösch, & Stauffacher, under review): While a vegetarian diet was strictly rejected by study participants, substantial sufficiency-potentials seem to exist in the domains of household room temperature, personal leisure travel behaviour and amount of per capita living space.

Still, one crucial question concerns the issue of how to motivate people to change their everyday energy-related behaviour. Here, cities might play an important role due to their role as agents of change assigned to them in Switzerland's new energy strategy (Swiss Federal Council, 2013). They act as promoters of energy efficiency and sufficiency as role models (e.g., by having energy-efficient public buildings as part of the programme European Energy Award EEA) but also by motivating inhabitants directly (e.g., in energy-saving campaigns). Furthermore, many Swiss cities have their own communal energy utility which can be a powerful lever to implement energy policy (Blumer, Mühlebach, & Moser, 2014) as utilities have a strong and direct link to the inhabitants of a city (Pavan, 2012).

There exist various insights from social or environmental psychology about how to design successful and effective interventions to change behaviour. Studies, for example, show that energy consumption feedback, including a social, competition-like situation, seems to be quite effective in reducing individual consumption (Abrahamse et al., 2005). Additionally, people tend to prefer vivid, personalized, concrete, and tailored information over abstract, impersonalized information and they perceive acquaintances as more credible in comparison with other sources of information (Breukers et al., 2013; Costanzo, Archer, Aronson, & Pettigrew, 1986). A series of studies showed, for example, that households' electricity consumption changed if feedback was given about the average consumption in the neighbourhood (Ayres, Raseman, & Shih, 2013; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007). In the area of transport, Goetzke and Rave (2010) have established that the existence of a cycling culture is an important determinant for bicycle use: the more people use bicycles in a particular community, the more attractive it will be for other individual users to do so.

These examples, along with many others point to the importance of the social context, for example social comparison among neighbourhoods or other social groups, for inducing behaviour change in the domain of energy. Thus, the seemingly individual decision to reduce energy consumptions seems to be dependent on social norms, behaviour of other group members, shared experiences and trusted sources of information (Abrahamse et al., 2005; Breukers et al., 2013; Costanzo et al., 1986). One reason why this is the case is because energy consumption – or more precisely the social practices related to energy consumption – fulfil both individual and social needs (Welsch & Kuhling, 2009). The concept of social practices embeds the individual in his or her social context by investigating "shared behavioural routines" (Spaargaren, 2011, p. 815) such as cooking, using electrical appliances, having a warm home, commuting to work, and going on vacation. This perspective appreciates the importance of norms, values, social structures, and specific contexts in which individual energy consumption is embedded (Barr, Gilg & Shaw, 2011). This contextualized approach also emphasizes the connection between practices and local effects such as local economy, community cohesion, and personal financial benefits which may reinforce perceived responsibility, e.g., with regards to energy consumption (Barr et al., 2011).

Such social embedding as well as local contextualisation of energy consumption offers interesting perspectives for cities, as social groups might be important "middle-actors" (Parag & Janda, 2014) to implement energy-saving strategies by bridging the city level (policy) and the level of inhabitants (individuals). Formal social groups are particularly promising in this context. By formal social groups we understand locally active groups of people whose members meet regularly to follow a certain purpose or goal. Examples are a football club, a hiking group, a choir, the scouts, or a district association. These groups are characterized by both strong and weak ties (Granovetter, 1973). They provide an arena to experience new energy-saving practices (Spaargaren, 2011) and to share vivid and personalized concrete and tailored information, which tends to increase its credibility and perceived personal relevance (Breukers et al., 2013). Thereby, energy-savings may be reached directly in activities that are performed in the group context (e.g., members of a sports club go to an away-game by public transport instead of using private cars). However, these experiences may trigger more energy-savings through spill-over effects to private activities (e.g., using train for visiting a friend instead of using private car, Lacasse, 2013). Such spill-over effects are in line with classical social-psychological theories (self-perception theory: Bem, 1967; cognitive dissonance theory: Festinger, 1957). In Switzerland, the potential of formal social groups is huge as a large share of the population (around 40 %) are active members in formal social groups (reference year: 2012, BFS, 2014b).

Although formal social groups might represent promising middle-actors for promoting energy-saving in cities, to our knowledge there exists no systematic empirical scientific research yet that analyses their potential in detail. This endeavour is part of a recently started transdisciplinary research project[1] carried out by ZHAW and ETH Zürich together with the three Swiss cities of Winterthur, Baden, and Zug. The key goals of the project are: i) to identify activities that cities can promote to reduce private energy consumption, and ii) to better understand and test the role of formal social groups in addressing private consumers.

This paper reports first results from the mentioned project. Its aims are: i) to identify activities that cities can realize to promote private energy-saving, and ii) to discuss the role of formal social groups in cities when addressing private consumers.

In the following, we present case studies in the three participating cities. In a first step, we analyse current activities of the cities to promote energy-saving behaviour of inhabitants (document analysis). In a second step, we present results from a workshop including research partners as well as the three cities where we identified promising activities to promote energy-sufficient behaviour. In a last step, we present first ideas for real-world experiments to systematically test the potential of formal social groups as multipliers of communal energy-sufficiency activities. Our analysis focuses on the three cases, and only those energy-sufficiency activities are considered that target individual inhabitants.

1. Project "Using formal social groups to promote energy-sufficient behaviour in cities", funded by the Swiss National Science Foundation, The project is part of the National Research Programme NRP71 "Managing energy consumption", http://www.nfp71.ch/E/Pages/home.aspx.

Contents Keywords Authors

Methods

CHARACTERISATION OF THE STUDIED CITIES

The three analysed cities lie in the German-speaking part of Switzerland, they are radially arranged around the city of Zurich, and each city is around 25 km away from Switzerland's largest city. Winterthur lies in the North-East of Zurich, Baden in the North-West and Zug in the South. Winterthur is the largest of the three cities with around 105,000 inhabitants, Baden has around 18,000 inhabitants and Zug around 26,000. Both Baden and Winterthur are towns that are characterised by their flourishing machine industry, which has developed in the 20th century (e.g., Brown Bovery & Cie in Baden; Sulzer and Rieter in Winterthur). Zug is home to many international companies (e.g., trading and finance) due to its business friendly environment. All three cities are regional centres. They represent examples of middle-to-large-sized cities, home to a large share of the Swiss population, as about three quarter of the Swiss population lives in urban areas (BFS, 2014a). The three cities have a distinct local energy policy and are certified with the European Energy Award (EEA)[2] gold status. Furthermore, each city has its own energy utility (Stadtwerk Winterthur, Regionalwerke AG Baden, and Wasserwerke Zug AG). Regarding energy sufficiency, the three cities reported the following key challenges (personal communication with representatives of each city):

- Winterthur: transition towards the 2,000-Watt-society following the public vote in 2012 where the voting population agreed that Winterthur shall cut CO_2 emissions to 2 t per person per year and energy consumption to 2,000 Watt per person by the year of 2050.
- Zug: changing behaviour and lifestyles to reduce energy consumption per capita (also in Zug, the voting population decided in 2011 to implement the goals of the 2,000-Watt-society).
- Baden: promotion of public transport instead of private car; broader dissemination of the local energy policy into the population.

DOCUMENT ANALYSIS: ENERGY-SAVING ACTIVITIES THAT ARE DIRECTED AT PRIVATE CONSUMERS

We collected activities undertaken to save energy in the three cities. We used lists of activities that are provided by the cities as a part of the EEA programme as a basis. From these lists, we extracted those activities that address private consumers and structured them according to energy services (electricity, heat and hot water, mobility and transport). We included activities fostering energy efficiency as well as energy sufficiency. Furthermore, we included middle-actors that cities collaborate with to promote respective activities.

2. EEA = European Energy Award, http://www.european-energy-award.org/home. Switzerland's equivalent programme is called 'Energiestadt'.

WORKSHOP: EXPERIENCES OF WORKING WITH MIDDLE-ACTORS

In the end of January 2015, a workshop was conducted including both research groups from ZHAW and ETHZ as well as representatives of the three cities (in total seven researchers and four practitioners). The goal of this workshop was to exchange experiences of working with middle-actors to promote energy-saving activities for private consumers. In the workshop, all the cities presented respective projects. Together with the researchers, potentials of involving middle-actors were discussed. Furthermore, possibilities for accompanying such projects scientifically were discussed, in order to learn more systematically about the underlying processes when involving middle-actors in the implementation of local energy-saving activities.

Results

ENERGY-SAVING ACTIVITIES THAT ARE DIRECTED AT PRIVATE CONSUMERS

Table 2 provides an overview of selected energy-saving activities of all the three cities that target private consumers. Each activity is performed at least by one city. Activities are not structured by cities but by area. Examining the areas of the shown activities indicates that *information* is the area with most activities, followed by *promotion or funding*, and *infrastructure* projects. Furthermore, cities are active in building *networks* and *consulting*. Regarding informing the population about saving energy, the three cities are active in the following ways: They promote energy-saving in information events and newspaper articles, they display current consumption levels in public buildings and organize neighbourhood competitions, they organize educational programs, and inform tourists about sustainable travelling and they are present at local fairs and exhibitions (e.g. construction fairs, mobility fairs). Furthermore, they offer subsidies for energy-efficient buildings, they promote natural gas-fuelled vehicles, and they fund innovative ideas to fight climate change and contribute to more sustainable energy systems. They also promote use of public transport or bikes (e.g., for sports teams to go to training or away games). Also, the cities have installed infrastructure projects that enhance saving energy by the population such as charging stations for e-cars in the city centre, central bike stations (with infrastructure to pump tyres and repair bikes) and they provide environmentally friendly transport alternatives for their employees. The cities are also active in promoting networks between city administration, civil society, local businesses, and research institutes or between different cities. Additionally, cities are active in consulting about energy saving options, for example for private homeowners that are planning a refurbishment or for companies to elaborate on a mobility strategy for their commuting employees.

Looking at the involvement of middle-actors it becomes obvious that local energy utilities are important partners of the cities. In addition, the cities also have some collaboration projects with local industry and businesses. Additional actors are NGOs, local associations (e.g., homeowners, tourism), local or regional sports clubs, research institutions, and foundations.

While the criteria catalogue of the EEA is in general rather directed at energy-efficiency measures, it is remarkable that Table 2 also indicates potentials of cities to promote energy-sufficiency.

Contents Keywords Authors

Table 2. Overview of energy saving activities targeted at private consumers.

Area	Energy-saving activity	Electricity	Heat/hot water	mobility	Involvement of middle-actors
Information	Information events on energy, campaigning (e.g., presentations)	x	x	x	Local energy utility, NGOs, association of homeowners, research institutions, etc.
	Display of electricity consumption in public buildings	x			
	Education programs for schools (energy & climate)	x	x	x	Local schools, foundation
	Articles in city newspaper on sustainable energy consumption	x	x	x	
	Sustainable travelling/tourism			x	Tourism association
	Competition between households to save electricity	x			Local energy utility
	Being present at local exhibitions and fairs	x	x	x	Canton, other communities, business networks
Promotion	Subsidies for energy-efficient buildings		x		Local energy utility
	Promotion of natural gas-fuelled vehicles			x	Local garages
	Funding for local innovative ideas to save resources and prevent climate change	x	x	x	Local energy utility
	Promotion of using public transport for football tournaments			x	Regional transport company, regional football association
	Promotion of public transport, car sharing and e-bikes during summer months			x	NGO
	Competition for sports teams and members of fitness studios to go to trainings by bike			x	Local sports clubs, regional sports associations and fitness studios
Infrastructure	Charging stations for e-mobility in the city center			x	Local industry
	Bike station in the city center			x	NGO that promotes bike use
	Provision of bikes for employees			x	
Networks	Constitution of expertise networks				Local businesses and research institutions
	Collaboration with other cities to promote sustainable energy consumption	x	x	x	
Consulting	Consulting on retrofitting strategies to increase energy-efficiency of buildings	x	x		Local energy utility
	Large employers are required to elaborate mobility strategy			x	Local businesses

WORKSHOP: EXCHANGE OF EXPERIENCES IN CITIES

During the workshop, each representative of the three cities presented past or planned activities where they involved or plan to involve middle-actors to reach inhabitants. In the following, the selected projects are briefly presented:

Winterthur

The city of Winterthur presented a project that has been carried out for the first time in 2014 and is planned to continue in summer 2015. The idea of this project is to motivate members of sports clubs and members of fitness clubs to go to trainings by bike or by foot during four summer months. If sports teams' members use the bike or go by foot to 50 % of all trainings, they qualify for a competition. A similar competition was set up for members of fitness studios. Interestingly, the campaign promotes energy-saving indirectly: the focus of the campaign lies on health and air quality improvement. But of course it also represents an energy-sufficiency measure. Here, different city departments (Department of Sports, Department of Health, Environment and Safety) closely collaborate together. Important intermediaries are local sports clubs as well as regional sports associations. Within the sports clubs, it has been important to raise acceptance within the management boards. For promoting the campaign at the team members, respective awareness creation and motivating the team, the coaches also have a very important role. Furthermore, the city of Winterthur directly collaborated with a few fitness studios that displayed flyers as well as posters to promote the campaign.

Zug

The city of Zug presented past projects as well as one that is planned to continue in summer 2015. When communicating its efforts in sustainable development in 2014, the city of Zug collaborated with local formal social groups (Stadt Zug, 2014). For each sustainability indicator in the report (in total 22 indicators), one suitable formal social group was portrayed with a picture and a short statement together with the description of the indicator as well as the assessment for the city of Zug. A large range of formal social groups participated in this endeavour, ranging from the paragliding club (indicator: air quality), to a district association (indicator: resources), and the Rotary club (indicator: investments). The city of Zug reported that the collaboration with formal social groups for the report was a great success and participating in this project offered an interesting opportunity for formal social groups to present themselves. Besides offering formal social groups a patronage of an indicator, the idea of this strategy was also to gain a broader interest of the population in sustainability issues by embedding the indicators in the lives of Zug's inhabitants. Another project – which will be continued in summer 2015 – is a campaign that motivates the inhabitants to try out public transport, e-bikes, and car-sharing during the summer months. This is a campaign that runs in several Swiss cities which is coordinated by an NGO (myblueplanet). Until now, the offer has been promoted at the inhabitants of Zug directly (e.g., through newspaper ads). One idea for the continuation of the campaign is to collaborate with formal social groups in Zug (e.g., those that participated in the sustainability report) as multipliers to promote this offer.

Baden

The city of Baden reported of close collaboration with local schools to educate about issues such as the energy-saving or climate change. They also collaborate with a Swiss foundation which organizes and carries out respective workshops with pupils. Future activities concern the closer collaboration with district associations, e.g., by involving them in future communal district development projects.

Discussion

IMPORTANT LESSONS LEARNT REGARDING CITIES' INVOLVEMENT OF FORMAL SOCIAL GROUPS IN ENERGY-SAVING ACTIVITIES

When analysing current energy-saving activities (Table 2), it is becomes clear that the three analysed cities are already very active in involving middle-actors when motivating private consumers to save energy (e.g., energy utilities, schools, local businesses). These middle-actors vary depending on the energy-saving activity as well as its target group.

The workshop offered more insights how the three cities collaborate with formal social groups in concrete projects to convey energy-saving or other sustainability issues at private consumers. Some lessons learnt are that it takes a lot of time and effort when involving formal social groups in concrete projects. Communication and marketing are crucial. For many formal social groups (at least in a country such as Switzerland), recruiting new members is a pressing concern. This is why a platform to present themselves may be more attractive compared to financial incentives for many groups. For example, in the case of the city of Zug, the sustainability report offered a possibility for formal social groups to present and position themselves to a broad audience. It is also important to reflect upon how to contact formal social groups. Personal contacts have proven to be very useful in this context. This is why this endeavour may require collaboration in city administrations across different departments, as the energy departments might not be in contact with the most suitable formal social groups for multiplying energy-saving. But other departments, such as sports departments or departments for city development might have valuable respective contacts.

Conclusions and outlook

IDEAS FOR SYSTEMATICALLY TESTING THE POTENTIALS OF FORMAL SOCIAL GROUPS AS MULTIPLIERS OF ENERGY-SAVING ACTIVITIES IN REAL-WORLD EXPERIMENTS

From a research perspective, more systematic knowledge is needed to assess the effectiveness of using formal social groups as channels to promote energy sufficiency. The presented projects offer very interesting opportunities for accompanying research in order to examine more systematically the social processes that are triggered when cities collaborate with formal social groups to motivate private consumers for energy sufficient behaviour. In order to recognize respective potentials but also barriers, such systematic knowledge needs to be acquired. In particular, it is of interest whether formal social groups represent an effective and promising 'channel' for cities for reaching private consumers, or if cities rather should invest their effort in addressing private consumers directly.

Contents Keywords Authors

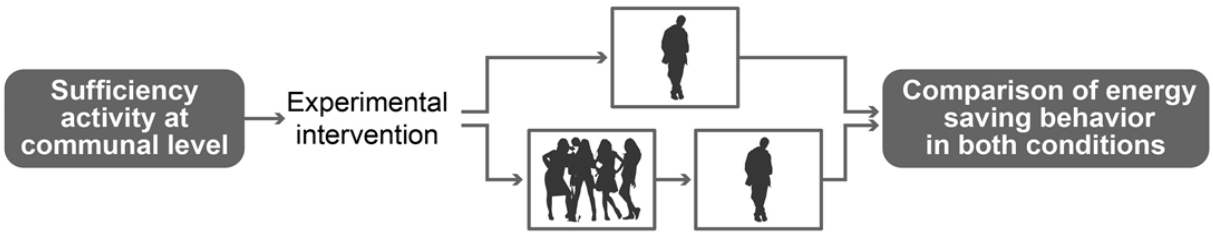

Figure 1. Basic idea for real-world experiments.

In the following, we would like to formulate first research ideas to systematically test the influence of formal social groups on energy-saving behaviour of private consumers. From our perspective, real-world experiments are a promising method to examine this issue. Real-world experiments (or field experiments) follow the logic of a psychological experiment in the sense that researchers deliberately manipulate independent variables. However, in contrast to many lab experiments, real-world experiments are situated in the context of participants' daily lives. The advantage of real-world experiments is that the behaviour or decisions of participants is contextualised in the real world, which means that is has consequences for participants. Therefore, it is more likely to reflect actual behaviour of people compared to a lab situation (i.e., higher ecological validity of real-world experiments compared to lab experiments). At the same time, confounding variables are much more difficult to control in real-world experiments compared to lab experiments, which sometimes compromises the internal validity of real-world experiments (Bortz & Döring, 2003). One example for a real-world experiment is the already mentioned study by Schultz et al. (2007) where households in a neighbourhood were randomly assigned to different feedback conditions about their electricity consumption in comparison to their neighbours' consumption.

Based on the literature, the hypothesis to be examined in these real-world experiments may read that city activities directed towards individuals through formal social groups have a stronger impact on energy-sufficient behaviour in comparison with city activities that address individuals directly.

One possible design of an experiment to test this hypothesis is displayed in Figure 1. The basic idea is that a city activity to promote energy-sufficiency is directed either at formal social groups (lower path in Figure 1, experimental condition), or at inhabitants directly (upper path in Figure 1, control condition). In a next step, the energy-saving behaviour of individuals is measured in both conditions and compared.

With respect to energy-saving behaviour, two different types of behaviour are measured and compared: behaviour as a direct response to the sufficiency activity (performed in the formal social group context) as well as spill-over effect to other private activities. In Box 1, we formulate one example how such a real-world experiment could look like. In this case, the sufficiency-activity is using public transport and as a channel, a football club is used.

When reflecting upon suitable energy-saving activities for such experiments, it becomes clear that only repeated behaviours (see Table 1 for examples) come into question. This is because one-shot decisions do only take place rarely, and a very large sample and extensive observation period would be required to be able to observe respective effects. This does not mean that formal social groups are not suitable middle-actors for these types of decisions. For example, in the city of Zurich, building cooperatives are promising middle-actors for promoting less living space per capita and shared infrastructure (e.g., shared guest rooms, shared transport vehicles, e.g., Glanzmann, Knüsel, & Sidler, 2010). However, other research methods need to be employed to more systematically investigate the potential of formal social groups for these types of decisions.

Box 1. Exemplary design of real-world experiment: Football club uses public transport for going to away-games.

Energy-sufficiency activity: The city promotes the use of public transport and has created a flyer with an attractive offer to use public transport.

Independent variable: direct intervention vs. via the formal social group (direct: randomly chosen inhabitants receive the flyer; via formal social group: the city contacts a local football club and tells about the offer, the flyer is distributed to the members of the teams of the football club.

Dependent variables: Interventions are compared: i) how many team members and how many directly contacted inhabitants use the offer, ii) general attitudes regarding the offer assessed by questionnaire, general experiences when using the offer, iii) intentions to use public transport in the future for private leisure activities (spill-over).

Table 3 gives an overview of potentially interesting formal social groups for the presented real-world experiments. The practices of these groups all have a connection to energy consumption through routine behaviours and at least some of them have strong links to city administrations. Therefore, these groups might be promising middle-actors to promote energy-sufficiency. The strength of the mentioned links to city administrations depends on the one hand on the city and its available resources. In the city of Zug, for example, many associations are supported by the city to have their own facilities (e.g., club house). On the other hand, the strengths of these links also differ for groups: sports clubs and district associations often have formalized communication channels to the respective city departments, while other groups such as hiking groups are rather loosely linked to city administrations. Table 3 also illustrates that the formal social groups attract a broad range of target groups,

Contents Keywords Authors

Table 3. Potentially interesting formal social groups, their practices relating to energy consumption, potential groups members and possible relations to (Swiss) city administrations.

Purpose of group	Examples	Practices relating to energy consumption	Potential group members	Possible relation to city administrations (in Switzerland)
Nature	• Hiking groups	• Travelling-behaviour to hiking sites/excursions	Individuals with heterogeneous backgrounds who share common leisure interest	Often only loosely linked to cities
Community associations	• District associations	• Electricity-saving programs in groups (e.g. different district associations compete against each other) • Transport: cycle/walk for short distances	Individuals that live in the same district and that are rather politically engaged	Formalized communications channels to cities established (e.g., dep. for city development)
Business networks	• Lions Club • Rotary	• Travelling behaviour (e.g., trips) • Organization of events (use of public transport, local food supply for catering)	Rather influential individuals (high education, high income), display of status through group membership	Often only loosely linked, through personal networks
Sports	• Football • Volleyball	• Travelling to training sessions, away-games, camps • Showering behaviour	Individuals with heterogeneous backgrounds (depending on type of sports) who share common leisure interest	Formalized communications channels to cities established (e.g., dep. of sports); often use of public sports infrastructure
Religion and spirituality	• Church congregation • Bible group	• Travelling to excursions, trips, holiday weeks • Organization of events (local food supply)	Individuals that rather care about spirituality, community sense	More or less formalized channels depending on topic (e.g., care for elderly, youth work)
Youth organisations	• Scouts	• Travelling to camps	Rather young people with a sense of community	Links through e.g., schools
Music	• Choir • Orchestra	• Travelling (from home to practice room, to concerts)	Individuals with heterogeneous backgrounds who share common leisure interest	Often use of public infrastructure (e.g., auditorium for practice)

OUTLOOK AND NEXT STEPS

In the realm of the project, such proposed real-world experiments will be performed in order to better understand the potential of formal social groups as channels to promote energy sufficiency. Activities as well as formal social groups will be chosen in a close collaboration with the three analysed city. Thereby, we aim to achieve significant insights for both research and practice.

For practice, our studies will serve as a basis for an energy sufficiency strategy for Swiss communities. For research, the application of real-world experiments explores the role of formal social groups as multipliers of energy-sufficiency activities in a systematic and thorough way. Thereby, the project contributes tested knowledge about the potential of middle-actors to address individuals (compared to addressing individuals directly). Furthermore, the project will shed light on the social processes triggered by middle-actors when addressing individuals. Thereby, we will also learn more about strategies how to integrate or build bridges between different societal levels (e.g., individuals and city administration levels).

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology*, *25* (3), 273–291. doi:10.1016/j.jenvp.2005.08.002.

Contents Keywords Authors

Ayres, I., Raseman, S., & Shih, A. (2013). Evidence from two large field experiments that peer comparison feedback can reduce residential energy usage. *Journal of Law Economics & Organization*, *29* (5), 992–1022. doi:10.1093/jleo/ews020.

Barr, S., Gilg, A., & Shaw, G. (2011). Citizens, consumers and sustainability: (Re)Framing environmental practice in an age of climate change. Global Environmental Change, 21 (4), 1224–1233. doi:10.1016/j.gloenvcha.2011.07.009.

Bem, D. J. (1967). Self-perception: An alternative interpretation of cognitive dissonance. *Psychological Review*, *74*, 183–200.

BFE (2013). *Analyse des schweizerischen Energieverbrauchs 2000-2012 nach Verwendungszwecken*. Bern: UVEK.

BFE (2014). *Schweizerische Gesamtenergiestatistik 2013 [Swiss energy statistics]*. Ittigen: Bundesamt für Energie.

BFS (2014a). Key population figures. Retrieved January 23, 2015, from http://www.bfs.admin.ch/bfs/portal/en/index/themen/01/02/blank/key/bevoelkerungsstand.html.

BFS (2014b). Kultur, Religion und Medien – Mitgliedschaft in einem Verein oder einer Gruppe [culture, religion, and media – membership in a formal social group]. Retrieved January 23, 2015, from http://www.bfs.admin.ch/bfs/portal/de/index/themen/01/07/blank/ind43.indicator.43018.430113.html.

Blumer, Y., Mühlebach, M., & Moser, C. (2014). Why some electricity utilities actively promote energy efficiency and others do not: A Swiss case study. *Energy Efficiency*, *7* (4), 697–710.

Bortz, J., & Döring, N. (2003). *Forschungsmethoden und Evaluation für Human- und Sozialwissenschaftler* (3rd ed.). Berlin: Springer.

Breukers, S., Mourik, R., & Heiskanen, E. (2013). Changing energy demand behavior: Potential of demand-side-management. In J. Kauffmann & K.-M. Lee (Eds.), *Handbook of Sustainable Engineering* (pp. 773–792). Dordrecht: Springer.

Costanzo, M., Archer, D., Aronson, E., & Pettigrew, T. (1986). Energy conservation behavior: The difficult path from information to action. *American Psychologist*, *41* (5), 521–528. doi:10.1037//0003-066x.41.5.521.

Darby, S. (2007). Enough is as good as a feast: Sufficiency as policy. In *eceee 2007 Summer Study* (pp. 111–119).

Festinger, L. (1957). *A theory of cognitive dissonance*. Evanstone: Row Peterson.

Gardner, G. T., & Stern, P. C. (2008). The short list: The most effective actions US households can take to curb climate change. *Environment*, *50* (5), 12–24. doi:10.3200/envt.50.5.12-25.

Glanzmann, J., Knüsel, P., & Sidler, C. (2010). *mehr als wohnen: Von der Brache zum Stadtquartier*. Grenchen: Bundesamt für Wohnungswesen.

Goetzke, F., & Rave, T. (2010). Bicycle Use in Germany: Explaining Differences between Municipalities with Social Network Effects. *Urban Studies*, *48* (2), 427–437. doi:10.1177/0042098009360681.

Granovetter, M. (1973). The strength of weak ties. *American Journal of Sociology*, *78* (6), 1360–1380.

Herring, H. (2006). Energy efficiency: A critical view. *Energy*, *31* (1), 10–20. doi:10.1016/j.energy.2004.04.055.

Kaufmann, U. (2014). *Schweizerische Statistik der erneuerbaren Energien, Ausgabe 2013 [Swiss statistics of renewable energies, edition 2013]*. Ittigen: Bundesamt für Energie.

Lacasse, K. (2013). Addressing the "go green" debate: Initiatives that encourage small green behaviors and their political spillover effects. *The Journal of Science Policy & Governance*, *3*, 1–33.

Moser, C., Rösch, A., & Stauffacher, M. (under review). Exploring societal preferences for energy sufficiency measures in Switzerland.

Notter, D. A., Meyer, R., & Althaus, H.-J. (2013). The Western lifestyle and its long way to sustainability. *Environmental Science & Technology*, *47* (9), 4014–4021. doi:10.1021/es3037548.

Parag, Y., & Janda, K. B. (2014). More than filler: Middle actors and socio-technical change in the energy system from the "middle-out." *Energy Research & Social Science*, *3*, 102–112. doi:10.1016/j.erss.2014.07.011.

Pavan, M. (2012). Tradable white certificates: Experiences and perspectives. *Energy Efficiency*, *5* (1), 83–85. doi:10.1007/s12053-010-9104-4.

Poortinga, W., Steg, L., Vlek, C., & Wiersma, G. (2003). Household preferences for energy-saving measures: A conjoint analysis. *Journal of Economic Psychology*, *24* (1), 49–64. doi:10.1016/s0167-4870(02)00154-x.

Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The constructive, destructive and reconstructive power of social norms. *Psychological Science*, *18* (5), 429–434. doi:10.1111/j.1467-9280.2007.01917.x.

Spaargaren, G. (2011). Theories of practices: Agency, technology, and culture Exploring the relevance of practice theories for the governance of sustainable consumption practices in the new world-order. *Global Environmental Change-Human and Policy Dimensions*, *21* (3), 813–822. doi:10.1016/j.gloenvcha.2011.03.010.

Stadt Zug (2014). *Wir sind auf Kurs*. Zug: Nachhaltigkeitskommission der Stadt Zug.

Swiss Federal Council (2013). *Botschaft zum ersten Massnahmenpaket der Energiestrategie 2050 und zur Volksinitiative "Für den geordneten Ausstieg aus der Atomenergie (Atomausstiegsinitiative)"*. Bern: Swiss Federal Council.

Welsch, H., & Kuhling, J. (2009). Determinants of pro-environmental consumption: The role of reference groups and routine behavior. *Ecological Economics*, *69* (1), 166–176. doi:10.1016/j.ecolecon.2009.08.009.

Acknowledgements

This project is funded by the Swiss National Science Foundation (National Research Programme NRP71 Managing energy consumption). We would like to thank the representatives of the cities of Winterthur, Baden, and Zug for sharing their experiences and their contributions to the workshop. Furthermore, we would like to thank Tilon Holtz, Tobias Kuehn, Ursula Eschenauer and Michael Stauffacher for their valuable contributions to the project. Finally we thank Sandro Bösch for designing the Figure.