

Promoting energy-saving behaviour: formal social groups as promising middle actors for municipal interventions

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Abstract City governments worldwide are trying to motivate their citizens to reduce their energy use—a particular challenge as they try to reach individual households. A promising strategy to engage the public broadly entails collaborating with middle actors to multiply the effects of municipal interventions. Some of these middle actors are formal social groups (e.g. sports clubs and neighbourhood associations). We conducted an online experiment ($N = 136$) to determine whether such interventions were more effective when they are communicated through formal social groups than when communicated through city governments. Participants received letters containing advice for saving energy in

the household. Willingness to participate was higher when the letters came from formal social groups than when they came from a city agency. Furthermore, actual members of formal social groups generally were more willing to participate. Our evidence suggests that formal social groups are promising middle actors for energy conservation campaigns and that city governments should engage more often with these groups to communicate with residents.

Keywords Intervention · Energy-saving behaviour · Social influence · Formal social group · Middle actor · Behaviour change

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Introduction

Energy conservation and the role of cities

Nations around the world are pledging to reduce their fossil-fuel energy use carbon emissions to promote energy independence and combat climate change (Lilliestam et al. 2014; Lilliestam and Hanger 2016; United Nations Framework Conventions on Climate Change 2015). To reach these ambitious reduction goals in energy consumption and emissions, technological measures alone are not expected to be sufficient and must be accompanied by societal changes through residents' behavioural changes (Harris et al. 2008; Notter et al. 2013; Schultz 2011).

In Organisation for Economic Cooperation and Development (OECD) countries with high living

standards, households make up a substantial part of national energy use. One such country is Switzerland, where households were responsible for 26.5% of final primary energy use in 2014 (BFE 2015). Thus, behavioural changes in households can have a substantial impact on energy demand. Through both reductions in energy use and increased efficiency in home appliances, they can substantially reduce energy consumption and carbon emissions (Dietz et al. 2013).

Urban areas, in particular, are key for energy conservation: in Switzerland, seven million residents live in urban areas, compared with 1.8 million in rural areas (Federal Statistical Office 2017). Due to decentralisation efforts, cities are also becoming recognised institutional policy units with the ability and authority to operate in a flexible and innovative manner (Capello et al. 1999). Thus, city governments (i.e. local authorities in cities, towns and other municipalities) have an important role in motivating citizens to reduce energy consumption.

To engage citizens in energy-saving efforts, city governments must communicate with households. Their usual methods involve postal or electronic mail, ads, newspaper articles and exhibitions or other public events. A shortcoming of these communication channels is that they mainly attract individuals who are already aware of or already engaged in energy conservation. Accordingly, evidence from many intervention programs shows the difficulty of recruitment, especially among residents who are less environmentally conscious (Geller et al. 2015; Sütterlin et al. 2011). The question remains of how city governments can reach and motivate target groups of households not yet engaged in energy conservation. If successful, sustainable lifestyles could proliferate from a niche phenomenon to mainstream participation.

Formal social groups as middle actors

The social context has a strong influence on energy behaviour (Axsen and Kurani 2012; McMichael and Shipworth 2013; Moezzi and Janda 2014). One way to engage the broader public is by engaging social groups, which are third parties suited for bridging the gap between public institutions and households. More concretely, Stern et al. (2010) refer to formal social groups (e.g. neighbourhood associations and civic clubs) as informal ‘marketers’—community assets that are more effective at generating trust than direct and

broad public communication through government agencies. Moreover, McKenzie-Mohr (2000) proposed involving these groups in their community-based social marketing approach to promote sustainable behaviour.

Formal social groups are thus a promising communication channel. We define them as locally active groups whose members meet face-to-face on a regular basis and engage in collective action to pursue certain goals (adapted from the definition by Schulz and Baumgartner 2013). Examples include sports and leisure clubs; music clubs (e.g. orchestras and choirs); youth and senior citizen groups; neighbourhood associations; and charity and environmental groups. Our definition does not include virtual social groups in online social media (e.g. Facebook and LinkedIn). Formal social groups are characterised by personal social ties (Granovetter 1973). Such ties are fostered by group identification, which is the degree to which individuals feel that they belong to a community, are connected with other members and are engaged with the community (Mannarini et al. 2012). Formal social groups usually strengthen social ties in a community by means of networks, norms and trust, which facilitate coordination and cooperation for mutual benefit (Putnam 1993). People usually interact more regularly within their formal social groups than with local governments, and trust is built through long-term interactions. High levels of involvement facilitate group processes (Kriesi and Baglioni 2003), and group norms are especially effective in altering behaviour (Hogg and Reid 2006). Formal social groups are widespread. In Switzerland, for example, 44% of inhabitants are members of at least one formal social group and actively participate in regular activities. Another 30% are passive members who do not regularly participate in activities (Federal Statistical Office 2016a). This suggests that formal social groups can be effective multipliers of municipal-intervention messages to reach the public broadly.

Formal social groups can take the role of middle actors—intermediaries between city governments and households (Parag and Janda 2014). Due to this position and their agency and capacity (i.e. willingness and capability to decide and take action), they can improve the levels of agency and capacity of other actors. They are active participants in the system, capable of creating (and sometimes preventing) changes among other actors (Parag and Janda 2014). As middle actors, formal social groups can shape social norms and practices. They do not always have a formal role in the energy sector, as

would, for example, energy utilities, but they have agency, capacity and access to different information channels and often are perceived as more trustworthy than government authorities (Parag and Janda 2014). They have an important network function in influencing social norms and have a key role in local communities. Thus, they can support communication between cities and their citizens (Parag and Janda 2014), resulting in a multiplier effect to foster energy-saving behaviour.

Formal social groups and energy conservation

Various studies show that membership in social networks can have a positive impact on energy behaviour. Individuals who were living within supportive communities during the oil embargo of the 1970s were more willing to conserve energy (Dietz and Vine 1982). Macias and Williams (2016) found that the more time people spent with neighbours as community members, the more environmental-friendly practices they engaged in regularly.

Formal social groups can influence behaviour through descriptive norms (i.e. what people perceive others to be doing) more than injunctive norms (i.e. the behaviour that people perceive that others expect from them) (Schultz et al. 2007). Highlighting descriptive social norms can foster energy conservation, e.g. by giving individuals information about their neighbours' energy use for comparison (Allcott 2011; Ayres et al. 2013; Schultz et al. 2007) or combining such social comparisons with energy-saving competitions (Carrico and Riemer 2011; Dixon et al. 2015; Senbel et al. 2014). Interventions addressing certain groups such as neighbourhoods or also associations can strengthen descriptive norms about energy-saving in the respective group (Dixon et al. 2015; Senbel et al. 2014). Descriptive norms in smaller communities (e.g. neighbourhood and provincial norms) often have even stronger influence than general societal norms (Goldstein et al. 2008), and comparative feedback is especially effective when the comparison group is a peer network (Peschiera et al. 2010), such as a formal social group. Moreover, these groups provide a catalyst to experience new or alter energy-consumption practices (Shove 2004; Spaargaren 2011). Also, addressing opinion or neighbourhood block leaders can be an effective approach for city governments to elicit or alter energy-related or other environmentally impactful behaviour (Clancy and O'Loughlin 2002; Hopper and Nielsen

1991). Simulation studies have shown the same positive effect through opinion leaders in innovation diffusion, e.g. in online gaming (Van Eck et al. 2011), green products (Janssen and Jager 2002) and energy-saving technologies, such as water-flow restrictors, clock thermostats and home insulation (Darley and Beniger 1981).

Informal social interaction in groups may help foster households' willingness to participate in energy-saving interventions (Heiskanen et al. 2013), and the adoption of energy-efficiency measures is more likely when people seek information from their social networks than from standard media and other public campaigns (McMichael and Shipworth 2013). Therefore, personal interactions and social networks are a cornerstone of our research.

The present intervention study

Summarising the above literature, formal social groups may influence members' behaviour through group norms, social interactions, opinion leading and social support, and interaction in these groups is often characterised by trusted personal relationships. Yet, to the best of our knowledge, no study exists that systematically analyses whether formal social groups may be suitable communicators in energy-saving interventions. Hence, in the present study, we focus on formal social groups primarily in their role as potential middle actors of communication between city governments and households. We examine whether a municipal intervention with formal social groups as middle actors is more effective than one in which the city government addresses citizens directly.

In the experiment, participants were asked to participate in an energy-saving intervention. Interventions can help engage people in changing their energy-related behaviours (Abrahamse et al. 2005), which are often characterised by routines (Verplanken and Wood 2006) that are difficult to change (Jager 2003). Various well-studied intervention methods have been found to alter energy behaviour among individuals and households (Abrahamse et al. 2005; Steg 2008), ranging from feedback systems (e.g. smart metering) to social comparisons (e.g. neighbourhood competitions) and prompts. Prompts are small reminders to perform a targeted behaviour (Abraham and Michie 2008); they aim to implement existing intentions to save energy (Bamberg 2013) and are generally described as enabling factors

or techniques to foster pro-environmental behaviour (Breukers et al. 2013; Mosler and Tobias 2007). They have been shown to effectively impact energy-use behaviour (Luyben 1982; Osbaldiston and Schott 2012; Tetlow et al. 2014). Prompts are especially suited for behaviours that are simple, low cost and habitual—cases in which the motivation to change a behaviour is already present, which can include energy-saving behaviour in households (Schulz and Baumgartner 2013). Their function as reminders in this realm is especially well-suited because energy is ‘invisible’ in everyday activities (Lutzenhiser 2002). Due to these considerations, we decided to consider energy-saving prompts as an intervention in the experiment.

Communication via middle actors differs primarily in the communication source or ‘sender’ (Eun-Ju et al. 2002). In our study, the sender of the intervention was framed either as the city government (official) or the formal social group (personal). The following formal social groups were included: sports clubs, music associations (orchestras, choirs, etc.), neighbourhood associations and charity groups. This study used three measures of willingness to participate for gauging the communication channel’s effect. First, we assessed how many prompts were ordered by the participants. Second, we measured the willingness to use the prompts at home. Third, we measured the general willingness to participate in energy-conservation interventions. As described above, formal social groups might be more influential in fostering energy-saving behaviour than a more anonymous actor, such as a city government (Peschiera et al. 2010). Therefore, we expected participants to be more willing to participate in an energy-saving intervention when the sender was a formal social group than when the sender was a city government:

H1: Individuals contacted by a formal social group show higher willingness to participate in an intervention compared with individuals who are contacted by a city government.

Furthermore, we were interested in whether there are predisposed differences among study participants between formal social group members and non-members. To date, differences were found regarding some traits: formal social group members show higher overall indicators of social capital (e.g. political involvement, participation and interest; trust and reciprocity within a community; willingness to do one’s share in collective

endeavours), engage more often in political discussions and participate more often in community activities (Stolle and Rochon 1998; Teorell 2003). Trust, commitment, engagement and social ties (Granovetter 1973) in formal social groups could lead to members in general being more willing to participate in interventions. Thus, we investigated how participants who are actual members of formal social groups differ in their willingness to participate, compared with participants who are not members of formal social groups, which leads to the second hypothesis:

H2: Formal social group members (a) show higher willingness to participate after receiving intervention prompts and (b) show an overall higher willingness to participate in energy conservation compared with non-members.

Method

Transdisciplinary intervention planning

This study is part of a larger research project designed in collaboration with research partners and representatives of three Swiss city governments. The experiment’s designers took a participatory approach, including several meetings and workshops between scientists and representatives from city governments (Pohl et al. 2010). Jointly, researchers and city administrators opted for energy use in the household as the target behaviour. This was largely driven by prior research that had shown that household energy-conservation intentions are high among Swiss individuals (Moser et al. 2015) and that interventions focusing on household energy use are more societally acceptable than, for example, interventions to alter travel behaviour or meat consumption (Seidl et al., Navigating behavioral energy sufficiency potential. Results from a survey in Swiss cities. *PLoS ONE*, forthcoming). Next, the researchers proposed suitable and effective interventions adapted from literature (Abrahamse et al. 2005; Mosler and Tobias 2007). Discussions between researchers and city representatives focused primarily on practical feasibility and on the applicability, design and visual appeal of interventions. In the end, we jointly selected prompts in the household as an intervention technique. Prompts are well known, easily applicable in practice and expected to effectively

influence pro-environmental behaviour (Luyben 1982; Osbaldiston and Schott 2012; Tetlow et al. 2014). From the perspective of city governments, it is highly relevant to better understand how such prompts are most effectively distributed, either via direct mail or via middle actors such as formal social groups.

Design

We tested for differences in communication channels between formal social groups and city government using (i) a quasi-experimental design comparing members of formal social groups (groups meeting at least once per month) with non-members and (ii) a full experimental manipulation contrasting formal social groups and city governments as intervention messengers. *Full experimental* means that groups were built by randomly assigning participants to the two conditions (formal social group and city government). *Quasi-experimental* means that groups were not randomly assigned, but rather built by an inherent trait—in this case, formal social group membership. Both conditions were combined resulting in a 2×2 between subject design. All groups received a fictional letter from a sender as indicated in Table 1. This allows for balancing strengths and weaknesses of experimental and quasi-experimental designs. The quasi-experiment suffers from a self-selection bias, allowing for correlational, but not causal, effects; yet, it tests the hypotheses in a more realistic setting. The full experimental manipulation, which guarantees internal validity, occurs in an unrealistic setting, as the group membership is merely imagined. We combined both approaches, allowing for a more nuanced picture.

Table 1 Experimental design—dependent variables (IV)

		IV ₁ membership in formal social group	
		Non-/inactive member	Active member
IV ₂ sender (randomised)	Formal social group	Letter from imagined formal social group (N = 41)	Letter from own formal social group (N = 24)
	City administration	Letter from city (N = 35)	Letter from city (N = 36)

Participants

Participants were recruited by an online panel in Switzerland. The sample was split by whether they were active members of formal social groups, so that half the sample consisted of active members. A total of 259 people participated in the experiment. We used a strict manipulation check to determine whether the experimental manipulation had been successful. An open question was asked about the intervention's sender, i.e. we tested whether participants correctly remembered who sent the letter. A total of 136 participants passed this test. A total of $N = 45$ said they did not remember the sender, and $N = 78$ named incorrect senders, such as energy utilities. Only participants who passed the manipulation check were included in further analyses. This strict procedure yielded measurable effects that were not apparent in the full sample, which we will examine further in the “Discussion” section. The mean age of the sample was 42.1 ($SD = 14.8$) years, and 63% were women, which is higher than the Swiss population (50.5% women, Federal Statistical Office 2016b). Participants' highest level of education was 4% primary education, 46% apprenticeship, 13% high school and 37% some higher education. As with mean age, the sample statistics on education are comparable to those for the Swiss population: mean age in the Swiss population is 41.8 years (Federal Statistical Office 2016a) and 48% of the population have secondary training (such as an apprenticeship) and 33% have completed tertiary, higher education (Federal Statistical Office 2015).

Procedure

Participants were first split into two groups of active members in a formal social group and non-members, then randomly assigned to the control and experimental condition (letter from the city government or from a formal social group, see Table 1). Group 1 (non-members of any formal social group, formal social group as sender) received an imagination task, i.e. a text advising them to imagine they were members of a certain formal social group. First, they were asked to indicate their preferred leisure activity among several choices (playing football, doing yoga, playing an instrument, singing, helping others, meeting people). The subsequent text about their fictional membership in a formal social group was personalised based on their stated interest (in the same order: football club, yoga

club, orchestra, choir, charity association or neighbourhood association). The imagination task aimed to elicit high identification with their formal social group by emphasising the importance of the groups for them personally and suggesting that many group members were at the same time close friends (following Mannarini et al. 2012). Group 2 (members of a formal social group, formal social group as sender) received detailed questions about their own group and their group identification. Subsequently, both experimental groups were instructed to imagine that they received the intervention letter from the described group. Groups 3 and 4 (control groups) received letters from their city governments. Group 4 (members of a formal social group) was asked the same questions about its own group and its group identification as group 2.

In the letter, participants were asked to save energy, and they received energy-saving tips (heating, lighting, standby, water use and ventilation). The letter had identical wording for all groups, with only the sender's identity changed for each group. Additionally, letters from the city government addressed participants formally with the German 'Sie', whereas letters coming from their formal social groups addressed their members informally with the German 'Du'. For all groups, the letter carried the sender's logo, except for the formal social group members, who received the letters from their own groups, as it was impossible to customise letters with their real groups' logos.

All groups could order different energy-saving prompts (depicted in Fig. 1) for their own households, as well as for colleagues and friends. Subsequently, participants reported their willingness to use the prompts and their general willingness to participate in different energy-saving behaviours. They also evaluated the prompts and the letter and answered items on social norms and social support (see "Measures" section

below). Afterwards, they worked on the manipulation check and were asked about past energy use and demographics.

When analysing the results, we applied analysis of variance (ANOVA) to check for main and interaction effects of the two factors 'sender' and 'formal social group membership' on willingness to participate (Field 2013). Further *t* tests were used to check exploratively which of the four subgroups in the 2×2 factor design differ. Control variables such as socio-demographic variables were tested for group differences using Chi-square tests, group differences for past household energy saving or social norms were tested using one-way analyses of variance (Table 3). For all statistical test, results are considered significant if $p < .05$.

Measures

The interventions' impact was assessed by three dependent variables assessing the willingness to participate: *Prompt orders* served as a behavioural measure. Participants could order each of the five energy-saving prompts (Fig. 1) separately. They could order up to eight of each of the five stickers, both for themselves and for colleagues/friends. They could order up to a possible total of 80 prompts ($2 \times 5 \times 8$). *Self-reported willingness to apply prompts* was measured by the willingness to use the prompts at home on a 7-point Likert scale ranging from 1 = 'I would not apply this in my household' to 7 = 'I would definitely apply this in my household'. *Self-reported willingness to participate in energy conservation* was measured by items specified in Table 4 on a 7-point Likert scale, ranging from 1 = 'I would not apply this in my household' to 7 = 'I would definitely apply this in my household' (Cronbach's $\alpha = .90$).

Personal norm was measured with the item 'By my personal values, I feel obliged to save energy', following Schwartz (1977); *descriptive norm* was measured with



Fig. 1 Prompts offered to participants. Note: prompt 1: 'Warm enough? Regulate the heating'. Prompt 2: 'Stop the water when brushing your teeth and using soap'. Prompt 3: 'intermittent ventilation instead of hopper windows'. Prompt 4: 'Appliances off? Plugs pulled?'. Prompt 5: 'Lights out'

‘My family/friends/community take care to save energy’, following Karlin et al. (2012); *injunctive norm* was measured with ‘My friends/family/community approve if I save energy’; and *social support* was measured with two items (Cronbach’s $\alpha = .83$): ‘Someone encouraged me to save energy’ and ‘I received support for saving energy’ (Molloy et al. 2010). All items were measured on a 7-point Likert scale from 1 = ‘I do not agree’ to 7 = ‘I completely agree’.

Energy-saving behaviour as past energy behaviour was measured on a five-item scale (Cronbach’s $\alpha = .73$) based on how often participants usually save energy in lighting, heating, water use, standby and room airing on a 7-point Likert scale ranging from 1 = never to 7 = always (based on Sütterlin et al. 2011).

Socio-demographic variables were age, income, education level, gender, house or car ownership and political preferences.

Results

Group descriptives

The four groups did not differ in any significant respect (Tables 2 and 3). No differences could be found with respect to participants’ age ($\chi^2 (df) = 0.47 (3), p = .71$), education level ($\chi^2 (df) = 15.30 (12), p = .23$), gender ($\chi^2 (df) = 0.83(3), p = .84$) or income, $F(3, 94) = 1.66, p = .18$. Also, the variables of home ownership ($\chi^2 (df) = 2.42(3), p = .45$) and car ownership ($\chi^2 (df) = 4.28(3), p = .23$) did not differ between the groups. Only 52 participants stated their political preferences, so this variable could not be used further. Table 2 shows

Table 2 Differences between group members and non-members

	Active members ($N = 60$)		Non-members ($N = 76$)		t	p
	M	SD	M	SD		
Energy saving behaviour	4.28	0.83	4.57	0.92	1.94	.06
Social processes						
Personal norm	5.73	1.29	5.58	1.51	-0.63	.53
Descriptive norm	4.56	1.01	4.43	1.15	-0.72	.47
Injunctive norm	5.08	1.24	4.72	1.34	-1.60	.11
Social support	3.26	1.58	2.38	1.33	-3.54	<.01**

Notes: $N = 136, df = 134$. All variables except social support range from 1 = does not apply to 7 = does fully apply. Social support: 1 = never happened to 7 = happened very often

Mean values (M) and standard deviations (SD) are given

Table 3 Results: dependent variables ($N = 136$)

	Prompt ordering M (SD)	Willingness to apply prompts M (SD)	Willingness to participate in interventions M (SD)
City to non-member ($N = 35$)	5.63 (8.81)	3.14 (2.29)	3.00 (1.25)
City to member ($N = 36$)	17.72 (18.61)	4.72 (2.25)	3.85 (1.53)
Formal social group to non-member ($N = 41$)	15.51 (17.56)	4.34 (2.19)	3.23 (1.25)
Formal social group to member ($N = 23$)	19.54 (18.32)	4.67 (2.30)	3.42 (1.47)

Note: Prompt ordering range = 0–80 prompts; willingness to apply prompts and willingness to participate in interventions: 1 = not willing to 7 = very willing

Mean values (M) and standard deviations (SD) are given

further descriptive variables of the three dependent variables to detect differences between active members and non-members of formal social groups. No difference was found between past household energy saving behaviour by active members and non-members. Descriptive and injunctive norms to save energy were the same for formal social group members and non-members, meaning they equally felt that their peers saved energy and that their peers expected them to save energy. However, formal social group members perceived higher social support in energy saving than non-members. In group 2 (formal social group to member, $N = 24$), a broad field of formal social group types could be found, ranging from

sports clubs and music associations to humanitarian and religious groups.

Prompt orders

Table 3 provides an overview of dependent variables. In accordance with hypothesis 1, participants ordered more prompts if the intervention came from an (existing or fictional) formal social group than from city governments, $F(1, 132) = 4.24, p < .05, \eta_p^2 = .03$. Also, as hypothesis 2a suggests, members generally ordered more prompts than non-members, $F(1, 132) = 8.05, p < .01, \eta_p^2 = .06$. The interaction effect was not significant, $F(1, 132) = 2.02, p = .16$ (Fig. 2).

Willingness to apply prompts

The willingness to apply prompts at home did not differ between the city government or the formal social group as senders ($H1$), $F(1, 132) = 2.11, p = .15$. Members were more willing to use prompts at home than non-members ($H2a$), $F(1, 132) = 5.86, p < .05, \eta_p^2 = .04$. The interaction effect between the two factors ‘sender’ and ‘formal social group membership’ was not significant, $F(1, 132) = 2.54, p = .11$, meaning that both groups’ (member and non-member) willingness to apply prompts did not vary between the different senders of the information (city or formal social group). Given the tendency of significance for the interaction effect ($p = .11$), we explored the subgroup differences in more detail. A t test including only the two non-member experimental and control groups showed a tendency

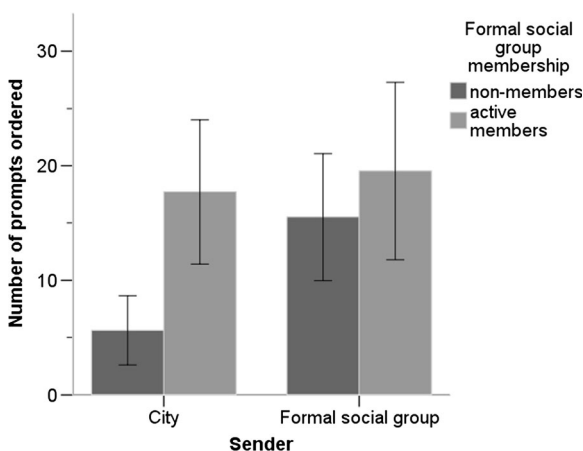


Fig. 2 Prompt ordering by members and non-members. Mean values (M) and standard deviations (SD) are given: $M \pm 1 SD$ ($N = 136$)

for non-members to be more willing to apply prompts if the sender was a formal social group ($M = 4.34, SD = 2.19$), compared with the city government as a sender ($M = 3.14, SD = 2.29, t = 2.33, p < .05, D = 0.54$).

Willingness to participate in interventions

For willingness to participate in other interventions, we found that most suggested interventions were not well-received by participants (Table 4). Participants were more willing to accept feedback systems that intervene only when action was required, but rather reluctant to pursue more time-intensive interventions.

Finally, we assessed whether formal social group members are more willing to participate in energy conservation interventions in general ($H2b$). Formal social group members ($M = 3.68, SD = 1.51$) were more willing to participate than non-members ($M = 3.12, SD = 1.25, t = 2.36, p < .05, D = 0.40$).

Discussion

In recent decades, many city governments have increased their use of energy conservation interventions (European Green Capital Award 2017), and the inclusion of middle actors has been suggested (Parag and

Table 4 Acceptance of energy-saving interventions

	M	SD
App or appliance that reports electricity use in real time in my home	4.30	2.14
Display showing water usage and temperature in the shower	4.24	2.05
Using prompts at home	3.91	2.05
Heating control that signals room temperature rise above 21°	3.82	1.99
Hanging up a table with information about energy use (practices, e.g. washing)	3.30	2.00
Hanging up prompt at front door to turn down/off heating and appliances	3.15	1.96
Taking part in a workshop or course about energy conservation in different areas (house, mobility, nutrition, consumption)	2.77	1.80
Ask close people to remind me to save energy	2.60	1.83
Push messages on mobile phone as a reminder to save energy	2.22	1.66

Notes: Range: 1 = I would not do this, 4 = indecisive, 7 = I would definitely do this

$N = 132$. Mean values (M) and standard deviations (SD) are given

Janda 2014). To address this demand and, arguably, to enhance the impact of such interventions, we examined the role of formal social groups as middle actors between public institutions and households. In an online experiment, we tested first whether participants would be more willing to participate in interventions when approached by a formal social group than by their city government (hypothesis 1). This could be confirmed in part: when contacted by a formal social group, participants ordered more energy-saving prompts than when contacted by the city government. However, when contacted by a formal social group, participants did not state a higher willingness to apply prompts at home than when contacted by the city government. This is because formal social group members were equally willing to apply prompts at home, whether contacted by their group or by the city government (Table 3).

Second, we tested whether formal social group members ordered more prompts and were more willing to participate in interventions overall, which was the case, supporting hypothesis 2a. In line with hypothesis 2b, formal social group members reacted more positively to various interventions (e.g. participating in studies and campaigns). This might be because they are more socially integrated in their communities. Accordingly, Stolle and Rochon (1998) found that members scored higher on indicators of social capital. Due to better societal inclusion, members are more often exposed to social norms and social support for energy conservation. In the study at hand, members reported perceiving higher social support for energy saving; yet, injunctive and descriptive norms did not differ between members and non-members. This could be because group members might receive more social support, as regular group meetings and joint activities might increase everyday social interactions by group members, whereas social norms result from observation of other people's behaviour (Schultz et al. 2007), which is not expected to differ between members and non-members. In the case of household energy saving, that would mean that group members would not see more energy-saving behaviour than non-members. Stolle and Rochon (1998) found that most associational groups (e.g. arts and education associations, peace and professional associations) consisted of more people with higher education and professional jobs compared with the population in general. This could be an underlying factor explaining both group membership and higher engagement in pro-social behaviour (e.g. volunteer activities for the community).

Yet, in the study at hand, we found no difference in education level between members of formal social groups and non-members.

On a side note, acceptance of energy-saving interventions was very low overall. Only feedback systems such as apps or displays showing energy or water use were viewed as acceptable, whereas for all other suggestions, including the proposed prompts, participants reported they would rather not implement them. It is likely that participants prefer energy interventions that only intervene in energy-relevant situations, but they are not ready to invest additional efforts or do not want to be interrupted in their everyday lives by exchanging information or participating in workshops. A body of literature underscores the significance of feedback and confirms our finding that recipients are accepting energy conservation efforts only if information is tailored to the energy user's knowledge and background (Abrahamse et al. 2005; Fischer 2008; Steg 2008).

Strengths and limitations

As a strength of the study, the effect of the formal social group as a sender and the effect of being a group member as a recipient could each be examined separately, thanks to the 2×2 design. The sender's effect could be studied, thanks to the imagination task, in which non-members imagined being members of a formal social group. It seems that formal social group members, in general, are more willing to participate in energy-conservation interventions, but non-members have the same level of willingness to participate if they are addressed as members of fictitious formal social groups.

A limitation of the study was that only 136 out of 259 participants passed the manipulation check by correctly remembering who sent them the intervention letter. Because the intervention's sender was the relevant variable, it was vital that participants were aware of the sender. On the one hand, this was a successful procedure in that there were measurable effects with the remaining sample, so we can be sure that the intervention worked as intended. On the other hand, this finding shows that many participants paid little attention to the sender, which may hint at a general problem with the online-experiment setting. As another drawback, all letters had group logos as cues except for letters sent to formal social group members, as we could not customise the letters with individual logos. Logos can, of course, serve as reminder cues, which might explain why this group

was the smallest in size. To solve this problem, future studies in the same vein as ours could be designed to address members of certain pre-selected formal social groups, using their official logos in the manipulation. Also, the online experiment was limited in its external validity and applicability in the field, as the willingness to participate was only assessed in self-reporting and simulated prompt ordering. For these reasons, findings about real-life reactions to energy interventions will accordingly need to be replicated in field experiments planned later in our research project.

Policy implications and further research

Our results are especially relevant for city governments that look for ways to engage citizens in energy-saving behaviour to foster household energy conservation. Engaging formal social groups in energy conservation seems to be a promising approach and should be pursued. The general impact of interventions was higher for members than non-members. More so, even the mere association with formal social group membership resulted in greater acceptance of the intervention, whether people were actually members or not. This indicates the potential of such groups as middle actors for energy-saving campaigns. This knowledge can be put to use. In Switzerland, roughly 40% of the population is part of formal social groups (Federal Statistical Office 2016a). However, policymakers must carefully monitor their cooperation with formal social groups. There is a thin line between benevolent educational policy methods (e.g. nudging individuals toward green behaviour, see Reisch 2016) or providing incentives (Abrahamse et al. 2005), and patronising or manipulating (e.g. Satyanath et al. 2014)—a line that should not be crossed.

Social processes such as norms and support provided an initial idea of possible underlying mechanisms, and their role should be further tested in more detail in an experimental setting to better understand the causal mechanisms between formal social groups and energy-saving interventions. A sense of community, ‘a feeling that members have of belonging and being important to each other, and a shared faith that members’ needs will be met by the commitment to be together’ (Chavis et al. 1986, p.11), is one likely factor underlying the mechanism. In future research, it would be interesting to focus on different types of formal social groups and which

ones would be best for inclusion in interventions fostering pro-environmental behaviour.

Insights from this preliminary online experiment will be pursued by consecutive field experiments in our collaborative research project with three city governments, as mentioned above. Formal social groups seem to be suitable communicators of energy conservation interventions, which leads to various questions that demand further research: Can group interaction, opinion leadership and common engagement in energy conservation topics additionally foster energy saving by strengthening social norms? Miller and Buys (2008) find that fostering social capital will lead to sustainability only if community norms are sustainable, with people potentially adopting prevailing community norms, values and behaviours.

Conclusion

As city governments are increasingly confronted with the task of energy conservation (Swiss Federal Council 2013; United Nations 2015), it is essential for them to find effective energy-saving interventions, as well as relevant middle actors. This study supports other studies’ initial findings on the significance of social influence (Axsen and Kurani 2012; McMichael and Shipworth 2013; Moezzi and Janda 2014), especially from peer groups such as formal social groups (Goldstein et al. 2008; Peschiera et al. 2010). Furthermore, the study demonstrated the extensive potential of formal social groups as middle actors for policymakers when addressing citizens in the case of energy conservation. Future research might show whether incorporating formal social groups in energy-saving interventions results in actual behavioural changes in the long run. This study provides initial evidence that as messengers of energy-conservation interventions, formal social groups may have a substantial impact on public motivation.

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Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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