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## Promoting residential renewable energy via peer-to-peer learning

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### ABSTRACT

Peer-to-peer learning is gaining increasing attention in nonformal community-based environmental education. This article evaluates a novel modification of a concept for peer-to-peer learning about residential energy solutions (Open Homes). We organized collective “Energy Walks” visiting several homes with novel energy solutions and engaging people beyond those with a serious renovation project. We evaluated the intervention in terms of individual, network-centric, and institutional learning outcomes. Learning outcomes were observed on all these levels. We argue that this form of peer-to-peer learning builds capacity for sustainable action in the community by supporting discussion and reflection, rather than merely social learning as modeling.

### Introduction

Research on nonformal sustainability education programs suggests that more innovative and participatory approaches to community education are needed (Tilbury & Wortman, 2008). Mere provision of information does not lead to behavior change, and interventions rarely make a persistent impact and become self-sustaining (Chan, Dolderman, Savan, & Wakefield, 2012; Mustafa 2010). Besides offering information, environmental educators need to build capacity for sustainable action (Monroe, Andrews, & Biedenweg, 2008).

Residential energy use is one of the contexts in which community-based education is needed to support energy conservation and a shift to renewable energy. Governments can promote energy renovations and renewable energy through information and subsidies. However, homeowners can be paralyzed into inertia by the complexity of finding the best solution for their own circumstances (Hamilton, 2010). Hence, alternatives to top-down, expert-based communications are needed to make information actionable.

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Color versions of one or more of the figures in this article can be found online at [www.tandfonline.com/ueec](http://www.tandfonline.com/ueec).

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Eco-homes open days, or *Open Homes* have been identified as a successful form of peer education to help homeowners learn about efficient and renewable energy systems (Berry, Sharp, Hamilton, & Killip, 2014; Hamilton, 2010; Hamilton & Killip, 2009). The original concept in the UK is based on recruiting homeowners who have made a major energy refurbishment or investment to open their doors to neighbors on a certain day. The experiences suggest that real-life, situated examples and the stories of the local people who carried out those projects offer opportunities for identification, modeling, and the normalization of new solutions. Stimulated by this example, we have participated in developing a Finnish variation on the Open Homes theme as part of a climate initiative for local governments. Our study conducts a self-evaluation of this intervention. Our research questions are: (a) What kind of learning outcomes occur at the level of individuals, networks, and institutions? and (b) What potential for self-sustaining does the intervention have?

### Theoretical background

Peer-to-peer learning has gained interest in a sustainability context (Abrahamse & Steg, 2013; de Vreede, Warner, & Pitter, 2014; Goldsmith & Goldsmith, 2011; Salazar, Oerlemans, & van Stroe-Biezen, 2013). This interest draws on Roger's (1962/2003) work on diffusion of innovations, where learning via social networks is expected to reduce uncertainty and offer social support for the adoption of new practices (McKenzie-Mohr & Schultz, 2014). Bandura's (1969, 1974) social learning theory shows that people learn complex social behavior primarily by observing other people. Vicarious peer-to-peer learning, where the outcomes of the modeled action are visible, is likely to enhance participants' self-efficacy, that is, their belief in their capability to perform the behaviors modeled by their peers (Bandura, 1982). Social norms are used increasingly to promote socially desirable behavior such as energy conservation (Schultz et al., 2007). Rettie, Burchell, and Barnham (2014) have suggested the need for a broader "social normalization" process of "green" practices.

Hamilton and Killip (2009) and Hamilton (2010) have analyzed the Open Homes events organized in the UK. They show that feedback from participants is positive, with 75%–80% of participants saying they were inspired to do more in their houses. The events were found to be good examples of social learning, raising awareness, and providing inspiration. Berry and colleagues (2014) analyzed Open Homes events organized in Australia and the UK. They highlighted that the events provide concrete examples where "technical information is situated within stories of homeowners." However, Hamilton and Killip (2009) and Berry and colleagues also note that the events, alone, might not realistically offer enough detail to help other homeowners to replicate complex low-energy renovations.

While the previous research offers encouragement concerning peer-to-peer learning and Open Homes events, there are also practical concerns. The monitoring and evaluation of outcomes can be complicated, as Berry and colleagues (2014) point out. Cause and effect can be difficult to distinguish, since participants are likely to include people who are already interested in the types of improvements

**Table 1.** Open Homes energy walk events organized and evaluated for the present study.

Where and when	Types of systems viewed in the homes	Number of participants
Mynämäki, Finland, May 17, 2011	Solar collector heating, municipal pellet burner, groundsource heat pump, electric car, electric scooter	21
Padasjoki, Finland, October 11, 2011	Wood heating, groundsource heat pump, district heating	19
Mynämäki, Finland, April 19, 2012	Groundsource heat pump, air to air heat pump, solar-collector heating, electric assisted bicycle, electric car	35
Asikkala, Finland, May 24, 2012	Groundsource heat pump, solar panels and wind power plant,	6
Mynämäki, Finland, April 24, 2013	Solar collector, groundsource heat pump, wood-pellet heating	85
Mynämäki, Finland, May 8, 2014	Solar collector, groundsource heat pump, wood chip heating	20

demonstrated. Berry and colleagues identify a need for further research on how Open Homes events compare with alternative approaches, and on the resources needed to sustain and scale up such events. In order to assess the broader potential of Open Homes events, they highlight the need for a perspective shift from individual behavior to broader systems (i.e., impacts on energy cultures and governance structures).

Going beyond the specific case of Open Homes, there is an increasing interest in incorporating community-based and social aspects in environmental education. Rodela (2011) identifies three levels of analysis: individuals, networks and institutions, and proposes that future studies should assess social learning outcomes on these different levels.

Our self-evaluation of a new Open Homes variation aimed to address the research gaps previously mentioned. We reframed the problems outlined by Hamilton and Killip (2009) and Berry and colleagues (2014) by placing the Open Homes events in the wider context of nontraditional education, and more specifically the context of Rodela's (2011) framework for analyzing community-based environmental education. In the following, we thus focus not only on learning outcomes on the individual, network, and institutional levels, but also investigate the intervention's self-sustaining potential.

## Intervention methods: Open Homes in Finland

### *The Open Homes intervention*

We participated in developing a Finnish variation on the Open Homes theme and tested it within three small municipalities (populations 3,000 to 8,000), which were among the first to join a nationwide program for carbon neutrality. Based on suggestions by locals, we designed an Open Homes variation involving a 3-hr organized walk visiting 3–4 homes with “progressive” heating systems (Table 1), and advertised in the local newspaper. The concept is fairly easy and low cost to implement in cooperation with local resident groups.

**Table 2.** Intervention evaluation design and methods.

Method	Participant observation	Quick survey at the end of the event	Participant interviews	Institutional interviews and e-mail communications
Purpose	Formative evaluation Evaluation of process	Formative evaluation Understand participant motivation and satisfaction	Summative evaluation Evaluation of outcomes: learning, networks	Summative evaluation Evaluation of outcomes: institutional outcomes and self-sustaining capacity
Types of data collected	Participation in and experience of events  Notes on participants and their questions Informal interviews Photos	Motives for participation  Satisfaction with event elements Suggestions for further improvement	New and personally relevant information gained  Memorability, retention Propensity and capacity to share information with others Action taken	Monitoring of media coverage  Views of experts and administration Number of new initiatives spawned off from the events (same and new localities)
Types of questions addressed	Satisfaction  Types of people participating Individual and network-centric learning	Satisfaction  Types of people participating Individual learning	Individual and network-centric learning	Network-centric and institutional learning

### **Evaluation methods**

Since we were testing a new intervention in real-life circumstances, an experimental design was not feasible. Instead, we wanted to learn from each event to improve the next one. We have hence applied both “formative evaluation,” that is, evaluation that was used to improve the interventions on subsequent rounds, and “summative evaluation,” which aims to assess the outcomes of the intervention (cf. Monroe, 2002).

We drew on Rodela’s (2011) framework for evaluating social learning on three levels: individual, network-centric and institutional. As concerns individual learning, we aimed to identify what knowledge was retained from the events, what capacity participants gained to pass that knowledge on to others, and what actions (if any) were engendered. These latter outcomes also relate to the types of networks created or supported by the events. In terms of institutionalization, we aimed to assess whether public authorities learned new ways of working from the events, as well as the extent to which the events generated commitment among the organizers to continue organizing events.

We used several data sources to address these questions (Table 2). Participant observation served formative evaluation and helped us improve the events. The participant observation was complemented with a “quick survey” distributed at the end of events 2–5 ( $n = 54$ ), asking people about their willingness to be interviewed later (consequently, the response rate was only 30%). Ten participant interviews were made 1–2 years after attending the events. This was a convenience sample of

people who provided their contact information on the “quick survey,” and might thus involve some bias. The interviews aimed to access the individual and network-centric learning engendered, especially in terms of new and personally relevant information gained, propensity and capacity to share information with others, as well as any actions taken in response ([Appendix A](#)). We gathered data on institutional learning via interviews and e-mail communications with local government officials and people organizing subsequent Open Homes events, and by monitoring media coverage.

The interviews were recorded and transcribed. The data were analyzed thematically, drawing on Rodela’s (2011) categorization, and attending to learning processes suggested by Rogers (1962/2003), Bandura (1969, 1982), and Rettie and colleagues (2014). Similarities and differences were tabulated, and codes were developed for emerging categories such as types of individual, network-based, and institutional learning. Participant observations and short communications with stakeholders were used to contextualize and triangulate interview findings.

## **Intervention results**

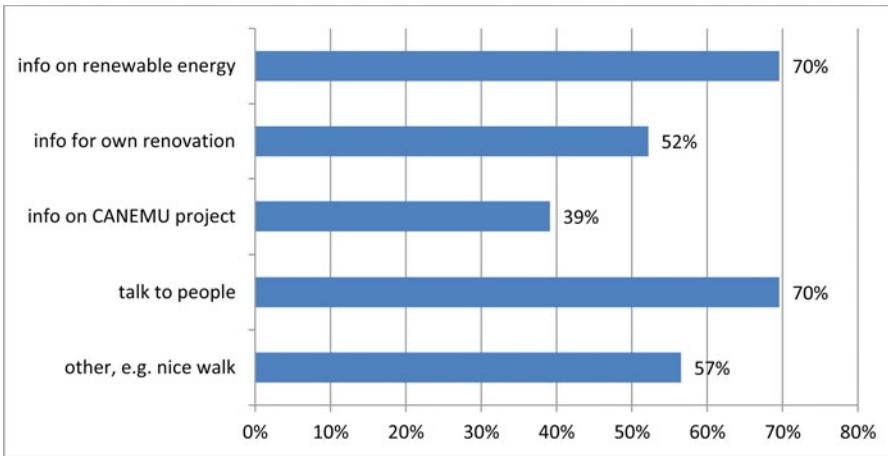
### ***Observations at events and how they influenced the planning of future events***

Our observations at the first Open Homes events showed that the organized walks offer an opportunity for people to ask practical questions. Typical questions raised included: (a) investment costs and savings; (b) sizing of heating systems, pros and cons of different models and makes; (c) time and effort needed to obtain, install, and learn to operate new heating systems; (d) available subsidies and how to obtain them; (e) maintenance issues, skills needed, and services available; (f) appearance, convenience, comfort, ease-of-use and space requirements; and (g) experiences with service providers.

Questions were also raised on topics that are not addressed in expert communications, such as how to fit a new system into one’s daily life. This was exemplified in a tour featuring a wood log boiler, where the owner was asked how much work it requires to operate. The owner told about how he obtains and chops wood, and how he agreed with his wife before purchasing the boiler that she would help with chopping and stacking wood. He also told about the (limited) effort needed to fire up the system:

I fire it up every 2-3 evenings a week. I put in a load of wood, then go and watch Big Brother, then put in another load, and usually that is enough to keep us warm for a few days.

However, when participating alongside the locals, we also noticed that there were some questions that were more difficult to ask. This is because the event participants were also “guests” who are supposed to “admire” rather than be critical of new purchases. We gained confirmation for this observation, by contrast, in a public facility we had included in the first visit, which was a small district heating system in the



**Figure 1.** Participants' motives: Combined feedback from four Open Homes events.

municipality. Since this was perceived as a public space, people became animated, walked around, opened doors, peered into the boiler, and asked critical questions. It seemed that the normal code for “polite guests” did not pertain to this public space. These observations were confirmed through informal discussions right after the event, where people said they might voice concerns more freely in a public space than in someone’s home. In consequence, we decided to end each of our subsequent walks with a concluding discussion at a public meeting space. This allowed participants to speak more about their own personal plans and potential drawbacks of new energy solutions.

### ***Motives for participation and satisfaction with events***

Hamilton and Killip (2009) indicated that Open Homes participants in the UK are often “green” homeowners who were quite enthusiastic about eco-renovation. Since not so many such people were expected to be available in rural Finnish municipalities, our events were designed to have a broader appeal. They were presented as “walks” that offer a possibility for exploration, exercise and social interaction, and were not exclusively targeted to those planning a renovation. Our observations and the feedback obtained right after the events (Fig. 1) indicated that some people participated without having any current intentions for making renovations.

While the involvement of people without a current renovation project might be seen as detracting from the effectiveness of the events, our experience suggests that there can be benefits to targeting a wider audience. Because the decision to undertake a major energy investment is a long and time-dependent process, early personal experience of new solutions can support a process of acquiring more information, which was confirmed by our findings (as follows) that participants were more attentive to related information after the events.

**Table 3.** Types of learning observed as a result of the Open Homes events.

Experience novel solutions/combinations in real life	"I hadn't seen any of the solutions, except in ads and brochures, but never in real life. This was an opportunity to see them and hear about practical experiences."
Identification in relation to owners of systems	"I got a lot more informed about solar collector systems, how they work in Finnish conditions, what works and what doesn't ... and the realities of it." "Here is a sensible, calm-looking guy, and he has the same kind of car as I have." "A brochure is a lot more complete, but it doesn't stick in your head in that way. When you discuss [these solutions with people who own them] you become more confident, but also somehow more confused, since people are so committed to their own solutions. So you need to sort out your own solution for yourself."
Practical information for own investment	"We have a four-person terraced home. We are installing groundsource heat with underfloor heating. ... moving from radiators to underfloor heating. Ground source heat will be more effective with the lower temperature allowed by underfloor heating." "The tour influenced my own solutions by helping me learn about the costs ... I made my own solutions then when changing my heating system partly on the basis of this knowledge. But I changed to a partly different system than those [ones presented in the Open Homes tour]."

### **Individual learning**

We identified three types of learning resulting from participation in the event (see Table 3). First, people experienced first-hand systems that they had only seen in newspapers and saw peers using them, which is likely to enhance their sense of self-efficacy (Bandura, 1982). Second, people gained a feel for the kind of people who own these kinds of systems, and could "test" whether they could identify with them. This did not always work to promote a certain solution (as in the first quote on row 2), but also to alert participants to the different evaluation criteria that people might have (as exemplified by the second on row 2). Third, people obtained practical information for their own purchase. Again, this could work through gaining direct knowledge that was used in the participant's own purchase (as exemplified in the first quote on row 3), or through eliminating certain solutions (as illustrated by the second on row 3).

Only two of the 10 participants interviewed had gone on to invest in similar solutions as those seen in the Open Homes tours, whereas a few had made some other type of investment, partly drawing on the lessons learned in the tour. Some said they were satisfied with their current system (e.g., based on wood heating or ground source heat), whereas others said they cannot afford to invest right now. Because many said they had joined the walk more for general information than to support a planned investment, we were satisfied that the information had even encouraged some "replication" of the solutions presented. It is not to be expected that people would rush to make an expensive investment just because they saw something similar in someone's home. However, our interviews show that people had processed the information received, and four out of 10 interviewees had used it in some way in their investment. Almost all interviewees said they were more energy conscious now than before and reported monitoring energy issues more closely in the media since the events, though other factors might have also contributed to this as well.



**Table 4.** Types of networking effects of the Open Homes events.

Stimulating discussion	<p>"We have talked about it among the people from our village. Since not everyone was there [at the event], there was just one other guy [from our village]. And also with some outsiders ... and one of the participants was a contractor for air-to-water heat pumps, so we started discussing why they were not featured in those events."</p> <p>"These events have been discussed here in Mynämäki quite a lot, usually on a positive note, like 'Hey, that house was one of the ones we visited, when we had that energy walk.'"</p>
Enabling people to participate in discussions	"It is nice to notice that I know a bit about this and a bit about that [compared to before] ... When energy comes up in a discussion, somebody has plans, then one can tell something encouraging."
Bring new items into everyday discussion	"I have discussed solar collectors quite a lot ... just about every day over a cup of coffee at the gas station—it isn't at all difficult."

Admittedly, there are types of knowledge that are less easy to acquire in this type of informal event. Many of the participants complained about missing specific solutions in the particular event they had the opportunity to attend (e.g., solar power, air-to-water heat pump). Some also missed detailed calculations and systematic presentation of evidence. However, for most interviewees, these drawbacks were compensated by the concrete, physical experience of visiting a real home, seeing equipment in their real use context, and hearing real experiences by ordinary people.

### Networking

Social networks are crucial both for diffusion (Rogers, 1962/2003) and normalization (Rettie et al., 2014; Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) of new solutions. In our interviews, the participants reported talking extensively with others during the tours, and this concurs with our observations. Moreover, they reported having spoken afterwards with other people about the events and the solutions seen. Our findings suggest that the events both stimulate discussion and support householders' capacity to participate in such discussions, as exemplified by the quotes presented in Table 4. Moreover, people gained some novel items into their discussion repertoire. Discussions also extended beyond the solutions presented in the Open Homes tour, as the common walk created new contacts, such as with the air-to-water heat pump contractor mentioned in the first quote in Table 4.

Since most of the interviewees reported having discussed their experiences with several others not attending the event, it is likely that information from the events has passed beyond the number of participating people (cf. Rogers, 1962/2003). Moreover, the events were well covered by the local media (first, advertising the event, and then covering it on-site, often featuring one particular homeowner visited and his or her "story"). Local newspapers are widely spread and carefully read, so a tour of 30 people in a municipality of 8,000 residents gains attention. This is confirmed from data from another study (Heiskanen, Jalas, Rinkinen, & Tainio, 2015), where several nonparticipants spontaneously mentioned the Open Homes events.

From our data, we suggest that Open Homes events can stimulate discussion about renewable energy, contribute to the emergence of new advocates for renewable

energy, and offer some existing advocates more confidence and a wider repertoire for their discussions.

### ***Institutionalization and self-sustaining capacity***

The institutionalization of the events shows varying patterns. We initiated Open Homes events in three localities. In one of them, they have continued on their own accord, and are now a permanent fixture in the annual plan of a local NGO. In the two others, they were not self-sustaining. However, they have spread to a few other places, for example, a larger town, following the participation of a local energy expert in one of the events. Also the City of Helsinki organized a similar event (“Green doors”) in 2014. Hence, the events seem to become established in some places and spread to some others, but this requires dedicated people.

However, in the most successful case, Mynämäki, the events seem to be firmly embedded. This is further supported by the observation that several of our interviewees had participated more than once, and all of them said they would like to participate again. The events have also made a small but visible impact on the local authority. We interviewed the building inspector and learned that she had received several phone calls after the events, with more detailed requests for information. These contacts had also spurred the local authority to publish a new web page. The local authority told us she was pleased that these events had been initiated, since they received contacts asking for information on whether “someone here has this or that kind of system.” In this way, the Open Homes events in Mynämäki have grown to complement the “official” information provided by the municipality. In another study in the same community (Heiskanen et al., 2015), local politicians mentioned the events as an established part of the municipality’s work toward carbon neutrality.

### **Discussion and conclusions**

We investigated peer-to-peer learning in a series of Open Homes events, which we organized in a new way as a collective “energy walk.” Following Rodela (2011), we paid attention to learning on three different levels: individuals, networks, and institutions. We recognized three types of individual learning from the events: “concrete experience of renewable energy solutions as a real-life option,” “identification of oneself in relation to the people owning the systems,” and “gaining practical information for investments.” Also, three types of learning occurring at the network level were identified: “stimulating discussion in the community,” “empowering people to participate in discussions” and “expanding everyday conversations towards renewable energy.”

These types of learning represent concrete and contextualized (cf. McKenzie-Moht et al., 2014) ways in which Rogers’ (1962/2003) diffusion of innovations can be stimulated. Our intervention also represents a practical application of Bandura’s (1982) concept of self-efficacy, given the concrete experiences of renewable energy solutions (including outcomes experienced by their owners),

and the later empowerment of attendees to participate in discussions. Finally, our intervention also represents a concrete application of “normalization” of green practices (Rettie et al., 2014). In this respect, our observations suggest that under favorable conditions, Open Homes events can become “self-sustaining” and create commitment for locals to continue organizing such events on their own, and they can also gain a degree of integration into more formal energy advice. However, more long-term research is needed to confirm these observations.

We studied the role of Open Homes tours in the Finnish context, where several different renewable solutions are available for homeowners. We also studied the effects of this intervention in municipalities that have made a commitment to reduce carbon dioxide emissions—in this context, there are other measures (public lectures, newspaper articles, example set by municipal buildings) contributing to increasing awareness (cf. Berry et al., 2014). In a less supportive context, such events might not offer as many opportunities for individual, network-centric and institutional learning. Moreover, our data are limited, but they offer direction for further experimentation and research in other contexts.

Our findings offer qualitative illustrations and specifications of the benefits identified by Berry and colleagues (2014). Open Homes events can provide situated, hands-on and face-to-face communications and serve to “normalize” renewable energy production in the home (Berry et al., 2014). According to our analysis, this kind of normalization works by exemplifying “normal” people (similar to you) who invest in renewable energy solutions. Going beyond Berry and colleagues, we discovered that in some cases such peer-to-peer learning events can bring new solutions like solar power into everyday discussions beyond the group of participants and offer ordinary people the vocabulary needed to participate in energy-related discussions.

While Berry and colleagues (2014) suggest that Open Homes events might offer insufficient support for independent replication of the solutions, we argue that this is beside the point from an educational perspective. Many of our interviewees were enthusiastic about the solutions they had seen but were unable to invest in them due to current circumstances. While our interviewees felt they needed more information for their final decision than their neighbors’ example, participants did acquire support for their decisions to further explore, or to eliminate, certain solutions. On the basis of our qualitative research, we argue that Open Homes events, when organized as a collective event, may not serve simply as a source of social learning in the sense of Bandura’s (1974) modeling as imitation and identification, but might also offer a way to enhance community members’ capacity to investigate, analyze, and negotiate sustainability issues (Monroe et al., 2008).

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## Appendix A: Interview protocol

**Presentation:** You participated in the Open Homes event organized in Mynämäki 2012/Mietoinen 2013. You kindly left your contact details for an eventual interview. Now we would like to hear what you retained from the event a few sources afterwards.

(Additionally, a brief overview reminder was given of the walks, for example, where they started and which places were visited).

### Before the event

- Why did you decide to participate in the walk?
- Were you familiar with the kinds of systems presented in the walk?

### About the event

- Do you remember anything that stood out?
- Do you remember which kinds of houses were visited?
- Do you remember talking to any of the other participants during the walk?

### After the event

- What did you retain from the walk?
- Have you told anyone about what you saw during the walk?
- Do you remember what you told? Was it easy or difficult?
- Have you discussed the energy systems you saw, or new heating systems in general, with other people?
- Do you feel you now have a clearer view of your own heating system needs and suitable solutions?
- Have you considered getting a new heating system or taken any steps in that direction?
  - Did you feel you got any information during the walk that helped with these steps?
- Have you started any other renovation projects in your home?
- Have you monitored or changed your energy use patterns?
- Have you monitored heating and energy related discussions, for example in the newspapers, more than before?
- Do you feel the Open Homes walk influenced your views on the CANEMU project or climate change?

### In the future

- Would you participate again?
- Would you recommend the walks to others?
- Do you have ideas on how renewable energy or energy saving could be promoted in your community?
- If you compare the Open Homes event, for example, with a brochure produced by Motiva (an official energy expert body), what are the pros and cons in your view?
- If you compare the Open Homes even, for example, with an advertisement from a company, what are the pros and cons in your view?