

LEARNING ABOUT USERS AND DEVELOPING CO-DESIGN CAPABILITIES FOR ENERGY SAVING ON THE LOCAL LEVEL

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Abstract

European energy policy aims to shift the European energy market toward an increased focus on energy services based on end-user needs. This requires a close understanding of the role of end-users and their needs and practices. Our paper is based on a EU FP7 project called CHANGING BEHAVIOUR and focuses on interaction between energy users and managers of projects to change energy use. It draws on two sets of data: a meta-analysis of previous more and less successful projects to change energy use, and a set of ongoing pilot projects in different parts of Europe. We present some of our insights gained in trying to find improved, yet practical, ways for energy efficiency practitioners to interact with energy end-users.

Large projects and programmes can build on extensive, dedicated research on the needs and practices of the target group. Small, local projects rarely have this possibility, but they have other advantages. We identified a number of ways in which small local projects learned about and interacted with users, such as close face-to-face contacts, membership in the user community, user participation, ‘mini-pilots’, as well as drawing on existing experience in their organizations and networks. Our presentation discusses ways of building user knowledge, co-design capabilities and user engagement into the design of projects and programmes to change energy use on the basis of previous experiences and our ongoing pilot projects.

Keywords

Co-design, energy saving, energy efficiency, local, energy end-users

1. Introduction

Europe has ambitious goals for reducing energy consumption and greenhouse gas emissions. The aim is to shift the energy market toward an increased focus on energy services based on end-user needs (e.g., light and warmth rather than electricity). Such a shift requires the adoption of radically innovative solutions entailing significant behavioural and social change. This requires a close understanding of the role of end-users in technology adoption, appropriation and changing use patterns.

This paper is based on the EU FP7 project CHANGING BEHAVIOUR¹. The project aims to support the shift toward end-user services in European energy policy. It (1) develops a sophisticated but practical model of end-user behaviour and stakeholder interaction, based on previous experience, (2) tests the conceptual model in workshops with energy practitioners (3) and in pilot projects in different parts of Europe, and (4) creates a toolkit for practitioners to manage the sociotechnical change involved in energy demand side projects. CHANGING BEHAVIOUR works through intensive co-operation between researchers and energy practitioners from nine European countries. Our particular focus is on intermediary organisations such as local agencies, companies and NGOs promoting climate action and change in energy use in their own region.

The present paper focuses on interaction between energy end-users and energy practitioners. For energy experts and energy intermediaries, energy efficiency is often the most logical thing in the world. It saves money, saves the environment and reduces carbon emissions. Unfortunately, energy end-users rarely see the world in the same way. For energy end-users, energy use is often 'invisible' and rarely the subject of conscious decision. Thus, getting to know the end-users and finding the best ways to interact with them are key issues for managers of energy efficiency projects. Also, since energy end-users are not the

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only parties influencing their energy use, managers might consider indirect influences such as family, community, service providers and institutions.

The paper draws on data collected within the CHANGING BEHAVIOUR project. We draw on a meta-analysis of factors influencing success and failure in previous cases of demand-side projects and programmes in different parts of Europe, as well as on experiences gained from six ongoing pilot projects. In the present paper, we focus on how local projects learn about users and how co-design capabilities can be built up in different ways. We also examine the challenges of engaging users and stakeholders in project design.

2 The difficulties of understanding the end-user

Energy means different things to different people. Studies have found that people do not know much about how and where energy is used and with what consequences. While such findings suggest that more public education is necessary, they can also be criticized for exhibiting a 'deficit model' of lay knowledge concerning energy. It is assumed that because lay people do not have the same kind of knowledge as experts do, they know nothing. Other authors consider the problem of energy knowledge from the opposite perspective (Shove, 1998; Guy and Shove, 1998). Experts simply frame energy use in different terms – often ones that are distant from ordinary households' or organisations' needs and concerns. They fail to understand why households behave 'irrationally' because they fail to grasp the logic of energy use (e.g., Parnell and Popovic-Larsen, 2005).

The exchange of energy efficiency knowledge among experts and lay people reflects a fundamental problem in product innovation. Von Hippel (1998) has termed this a problem of "sticky information": information about users' needs and manufacturers' capabilities is highly contextual, tacit and difficult to transfer from one site to another (von Hippel 2005). This problem slows down the uptake of innovative solutions – many rounds of information exchange are needed in order to establish facts and clarify perspectives. For example, in a Finnish project to promote low-energy housing, the project designers failed to anticipate the users' desires to tailor prefabricated housing designs – which interfered with the low-energy designs – and also underestimated the lack of trust between users and prefabricated house providers – which led to limited uptake of the new designs (Heiskanen and Lovio 2010).

The product design and innovation literature offers a plethora of approaches to solving the problems of 'sticky' information and helping designers and users to understand each other

better. In recent years, methods and “tools” for user involvement have proliferated. In addition to conventional methods of concept testing and usability, product developers today employ field studies, participatory design, co-design, contextual design and user participation (Greenbaum & Kyng, 1991; Beyer & Holtzblatt, 1998; Kaulio, 1998; Koskinen, et al. 2003; Maase & Dorst, 2006). These methods involve intensified interaction between the world of designers and the world of users. Designers may go to visit the users at home, at their workplace or in their communities and use ethnographic observation to understand the users’ world. Or users may join designers ‘at the drawing board’ in co-design exercises (Tomes & Armstrong, 1997; Jégou and Manzini, 2008). Workshops and idea-generating assignments for users provide a more streamlined version of intermittent or quasi-participation (e.g., Magnusson et al. 2003; Kristensson et al. 2004). Inventions by ‘lead users’ are proposed as a source of innovation (Lüthje, 2004; Franke & Shah, 2003; von Hippel, 2005).

There is also a stream of research in the energy conservation literature that aims to understand energy end-users better. Early sociological research on energy use focused on demographic patterns and lifestyles as key determinants of energy use (Lutzenhiser 1993; Aune 2006). This type of – often qualitative – research has highlighted that people do not actively consume energy; energy use is a consequence of action with some other purpose, such as raising a family or running a business (Wilhite et al. 2000). As energy provision has historically become based on centralized systems, energy end-users have less involvement and less responsibility in how they consume energy (van Vliet et al. 2000). Nevertheless, there are certain groups of people who do monitor their energy consumption quite closely because their budget is so restricted that they are forced to check that they are not consuming more that they can pay for, or because they belong to a newly emerging group of people who aim at reducing their carbon emissions and thus keep watch on their energy bill.

However, energy use is still mostly ‘socially invisible’ (Lutzenhiser 1993) and is driven by evolving expectations and standards of normal everyday life (Shove 2003; Quitzau and Røpke 2008). When we want people to become aware of their energy consumption, we are thus asking them to do something that they are not used to doing. There are also large variations in energy use that cannot easily be explained by attitudes toward energy, but that are a side-effect of other demographic and lifestyle factors. Hence, there is indeed a need to bring the energy end-users’ and energy experts’ worlds closer to each other.

Some recent energy programmes have adopted ideas from user involvement in product design and innovation. For example, Kirklees Council in the UK, a forerunner local authority in promoting energy conservation, has teamed up with global design agency IDEO to use ethnographic user research to find new ideas to save energy (Lovett 2009). Designers have also developed an interest in emerging user demands for more sustainable solutions, as in the EU-funded EMUDE project (Manzini and Jégou, 2006; 2008). Yet such examples are still rare. In the following, we examine how 24 contemporary programmes to change energy use in various parts of Europe have addressed the challenge of learning about their users.

3 Approaches to learning about end-users: findings from a meta-analysis of previous European projects/programmes

3.1 Data and methods

In the CHANGING BEHAVIOUR project (<http://www.energychange.info/>), we have collected data for three databases on previous experiences in promoting energy efficiency and saving. The first is a large database of 100 energy demand side programmes and projects compiled by the consortium led by the Central European University (<http://www.energychange.ceu.hu/>). The second is more selective database including in-depth analyses of more and less successful programmes and projects (Mourik et al. 2009). Thirdly, we assembled a database of the goals, resources and context of 25 intermediary organizations in Europe (Hodson et al. 2009).

We focus here on 24 cases of more and less successful projects/programmes included in our meta-analysis of factors contributing to success and failure (Mourik et al. 2009). The cases were selected to represent different target groups, with at least three cases from different countries targeted at households, offices, schools and municipalities, as well as a range of outcomes in terms of success and failure.

Table 1 presents the in-depth case studies included in our meta-analysis. The cases were analysed using a six-step framework tracking the evolution of goals, design and process solutions and outcomes as well as the influence of context factors and stakeholder networks. Finally, a meta-analysis was conducted to identify core issues influencing success. We present our overall findings elsewhere (Mourik et al. 2009).

Table 1: Selection of cases analysed in terms of user interaction

Country	Programme	Aim of the programme	Type of intermediary running the programme
Estonia	Energy Saving Competence Centre	Promotion and knowledge networking on energy saving measures in apartment buildings	Public agency
Finland	Energy Efficiency Agreements	Negotiated agreement to promote energy audits and investments in municipalities	Ministry/Public energy agency
Finland	Energy expert programme	Training of volunteer residents promoting energy efficiency in housing associations	Public energy agency, housing company
Germany	SANIT	On-site advice service for energy efficiency renovations provided by consumer NGO	NGO
Germany	Standby	State-wide campaign to create awareness of standby energy among consumers and retailers	Public energy agency
Germany	EcoTopTen initiative	Nation-wide information and rating service for energy efficient products	Research institute
Germany	Contracting Rommerskirchen	Implementation of energy performance contracting for municipal buildings	Municipality/small for-profit company
Hungary	Energy Trophy	Competition for saving energy in office buildings through change in employee behaviour.	Public agency / NGO
Latvia	Building energy audits	Energy audits of apartment blocks	Small for-profit company (consultancy)
Latvia	EnERLIn - Efficient Residential Lighting Initiative	Increase residential lighting efficiency by 50% increase in CFL penetration via promotion campaign and quality charter	University / small for-profit company (consultancy)
Lithuania	Taupukas residential awareness campaign	Communicate the benefits of energy and water consumption efficiency and stimulate energy and water saving	Public energy agency
Lithuania	Multi-apartment buildings modernization programme	Promote energy modernisation of multiapartment buildings via demonstrations and subsidies	Ministry of environment
Netherlands	Green Energy Train Leidsche Rijn	Reduce the energy, heat and water use in apartment houses by 5% through a specific education and communication approach	NGO/ Small for-profit company (consultancy)
Netherlands	Green Energy Train Leidsche Rijn	Reduce the energy, heat and water use in apartment houses by 5% through a specific education and communication approach	NGO Small for-profit company (consultancy)
UK	Metropolitan Police Energy Efficiency Programme	Improve energy efficiency in existing buildings and practices of the Metropolitan Police Service	Public agency
Denmark	Samsø Renewable Energy Island	Creation of a renewable, energy self-sufficient island municipality	Local municipality
Finland	Green Office programme	Certification and management scheme to reduce CO ₂ and resource consumption in offices	NGO established by individuals
Finland	Climate Change Campaign for Schools	School climate change awareness campaign implemented by environmental and youth NGOs	NGOs
Hungary	Carbonarium Association	Produce information on participants' personal climate change impacts and promote public awareness	NGO established by individuals
Hungary	Global Environmental Social Business Mechanism	Implement energy renovations in apartment blocks	Small for-profit company
Hungary	Climate Watch	Educational and award programme for school groups to reduce CO ₂ emissions	NGO established by environmental NGOs
UK	CIS Co-operative Insurance Society Solar Tower	Renovate a landmark building using solar panels	For-profit company (consumer cooperative)
UK	Manchester is My Planet (MiMP) programme	Increase policy development/implementation on Climate Change among Greater Manchester local authorities	Small non-profit company (consultancy)
UK	MiMP Climate Change Pledge	Attract citizens in Greater Manchester to sign up to a Climate Change Pledge and encourage a switch to less carbon-intensive lifestyles.	Small non-profit company (consultancy)

In the following, we focus on examining the interactions between the project managers and the targeted energy end-users. We first present the ways in which the programmes and projects in our database gained information on end-users and their needs, expectations, circumstances and ways of thinking about energy. We then examine whether the choice of approach in learning about end-users is related to the success of the programme and how the approach to learning about end-users relates to the scale and planning style of a programme. Finally, we identify pros and cons of the various approaches.

3.2 How did the projects/programmes learn about their end-users?

When examining the case study data as a whole, we identified a variety of ways in which programme managers learned about the needs of the end-users. We classified them into five categories of approaches: (1) Surveys, interviews or group meetings, (2) Prior research and/or particular theoretical perspectives (3) Experience from prior projects and similar examples, (4) User-driven project (or pilot project) and (5) Familiarity and informal interaction with the target group (see Table 2). All categories were almost equally represented in our cases.

Surveys or interviews with end-users were applied by six of the projects to assess the needs, attitudes and knowledge of the target group. In some cases, the surveys were quite sophisticated, and they were used extensively and thoughtfully in the design of the project. For example, the EcoTopTen campaign in Germany (Bürger and Bern 2009) built on a very thorough survey of current consumer lifestyles and interests, and used it to design the programme. In addition, focus groups discussions were organized to gain more user input into the programme development. In some of the other programmes and projects, the main purpose of the surveys was to identify a baseline for evaluation, or to design messages for a communication campaign. In some cases, the surveys or interview data did not feed into the programme design, which was set before the research was conducted.

Eight of the programmes/projects built on prior research or particular theoretical perspectives, yet of very different kinds. In some cases, a particular theory of human behaviour and behaviour change was very dominant, e.g., the Green Energy Train projects in the Netherlands (see Feenstra 2009; Breukers 2009) built on a concept called 'Long Live Energy', which aimed to challenge end-users' world-views very fundamentally. In other cases, less specific social science perspectives were used as a basis for working with the

target group (e.g., active learning in schools, social marketing approach in a campaign). Some of the prior research was more empirical than theoretical, dealing with, e.g., statistics on energy use and opportunities for change in commercial or residential buildings. In the UK, *The Rules of the Game* guideline published by Defra, which combines both theoretical insights and findings from current surveys, was mentioned as a key resource for understanding end-users (Robinson 2009).

Some of the case projects built strongly on experience from prior projects or similar examples. Most often, the project manager had been working previously with the same end-users in similar – or even partly different – projects and had thus accumulated experience or even formal research and statistics in that previous context. They had thus gained impressions of the end-users' needs, capacities and culture that helped them design their programmes. For example, in the Hungarian Climate Watch Programme for climate education in schools (Vadovics 2009a), the National Society of Conservationists (NSC) had implemented numerous programmes in environmental education, had been working with teachers and schoolchildren for a long time, and had considerable knowledge about pupils' background knowledge and the general context of schoolwork.

Eight of the cases were completely or partly initiated and designed by (at least part of) the end-users. In three of these cases, these end-users were members of organizations (municipality, municipal department, company). In one case, Carbonarium – a climate action club to reduce members' carbon footprints – the project was designed and implemented completely by private citizens (see Vadovics 2009b). In the remaining cases, end-users were involved at an initial stage, but later the programme grew to address other end-users not originally involved in the programme design. For example, in the Finnish Energy Expert case – a volunteer-based energy monitoring and advice programme – the initiative came from active residents in the housing association that first implemented the programme. However, the programme has since extended far beyond these initial residents or the housing association, and changed along the way (Anttonen 2009). In Samsø, the initiative to become an energy self-sufficient island came from the municipality, which entered a competition to gain state support for this effort (Saastamoinen 2009). Not all inhabitants who were later involved were consulted at this stage. In some cases, early user involvement was explicitly used to pilot programmes that were later expanded to a broader user base. In particular, the Finnish Green Office programme – promoting climate-friendly practices at the workplace – was built up after a two-year pilot phase, conducted in close co-operation with eight

customer companies (Heiskanen 2009). Similarly, the Finnish Municipal Energy Efficiency agreements were partly based on 'pilot' experiences from an auditing programme conducted by the city of Helsinki (Salminen 2009).

Even where the end-users themselves were not the initiators of the programme, and no formal pilot phase was organised, user experience could influence design in more informal ways. Some of the projects modified their design as a result of feedback and experiences gained during the course of the programme, as was the case in the SANIT project (Maier 2009). This project, providing on-site advice for energy efficiency renovations, specified its target group as a result of initial interest. In some of the cases, programme design elements were discussed with stakeholders representing various user groups, as was done, for example, in the Manchester is My Planet pledge campaign (Robinson 2009). In others, implementation responsibilities were given to longstanding members of the user community, as was done in the Samsø renewable energy island project (Saastamoinen 2009). In some cases, the project managers and delivery staff had prior personal experience of being 'one of the users': for example, the Ilmari climate change campaign for schools was run by young people, very recently out of school themselves (Rask 2009).

Table 2. Approaches to learning about end-users applied in the case projects

Approach to learning about end-users	Number of cases applying this approach*
Surveys, interviews or group meetings	6
Prior research, particular theoretical perspectives	9
Experience from prior projects and similar examples	6
User-driven project (or pilot project)	8
Familiarity and informal interaction with the target group	7

* NB: the number of cases is larger than the total number: some projects used multiple approaches

The different approaches resonate with findings from the broader literature on user involvement in technological design (Akrich 1995, Muller et al. 2001, Stewart & Williams 2005). This literature suggests that different ways of learning about and involving users are sometimes, though not always, coupled with specific ways of seeing and representing the end-users. For instance, designers of certain kinds of products or services can focus on the 'average user' (Johnson 2007). Ergonomics and usability studies often draw on feedback

from 3-5 typical users (Nielsen and Landauer 1993), assuming that some task-related problems are common to all human beings. The use of one's own experience is often cautioned against (the "I-methodology", see Akrich 1995), as this is based on the assumption that the users are similar to the designers. Yet there are also cases where the designers' own experience may be a valuable resource, and also help to make designers more sensitive to input from other, different types of users (Kotro 2007).

We noticed that none of the case projects/programmes applied observational or ethnography-based methods (see e.g. Leonard 1997; Beyer & Holzblatt 1998) to learn about end-users and their contexts. If we agree with the literature arguing for the importance of the everyday routines and shared cultural conventions in shaping energy use (e.g. Wiljhite et al. 2000), then it would make sense to learn about end-users' contexts and energy routines on-site (Parnell and Popovics-Larsen 2005; Bell and Summerville 2006). However, ethnographic research can produce large amounts of data which may be overwhelming for designers – even in well resourced design teams. For small intermediary organizations, it seems that personal experience, familiarity and informal interaction to some extent provide the same functions as more formal ethnographic research might in another context.

3.3 Which approaches to learn about end-users lead to success?

It might be tempting to say that one approach is better than the others. One might argue that it is imperative to build programmes on dedicated research into the target group's attitudes and barriers to behavioural change and on pilot projects (McKenzie-Mohr 2000). One can also argue that it is important to build programmes on existing theoretical insights (Dahlbom et al. 2009). It also makes sense to say that the programme manager's experience and/or dedication are crucial for success. Similarly, some may argue that it is really important to build programmes on the basis of end-users' needs and capacities (Parnell and Popovic-Larsen 2005), or that familiarity and informal interactions are critical for success.

Our analysis shows, however, that none of the approaches, in themselves, provided a 'silver bullet' for success in achieving project goals. For example, of the six projects applying surveys, interviews or group meetings, four were successful in reaching their goals. A similar ratio of success applies to all the other ways of learning about users. We found no systematic relation between applying a certain method and achieving the goals of the project (Breukers et al. 2009).

Many of the case programmes, in fact, used a variety of approaches in combination. And indeed, the use of a variety of approaches appears to increase the programme's chances for success (see Stern 1999; 2000): of the 11 programmes that made use of a variety of approaches, only one failed partly or fully to reach its goals, whereas of the 13 programmes that used only one approach, there were four that did not reach all their goals. This observation is, however, to some extent confounded by the fact that the larger and better-resourced projects tended to use more diverse approaches, and also to be more successful, probably partly due to access to more resources.

3.4 Which types of programmes use different approaches to learn about end-users?

The approaches selected also partly reflect the needs and resources of the projects and programmes: large-scale programmes addressing heterogeneous target groups need to gain representative data on characteristics of the target group, whereas smaller, more 'local' projects can build on more informal experiences – and in fact, must often do so due to resource constraints.

Even though there are many similarities among our case projects/programmes – reducing energy consumption, a focus on energy use in buildings, and a societal pressure to reduce CO₂ emissions – there are also differences. Some programmes aim to become persistent stakeholders in a future value chain, whereas other projects aim to fade out when the intervention is done. Also the risks involved for end-users vary (small behavioural changes vs. large investments). There are also differences in terms of how much the intervention can be tailored or customized to various user groups. Some projects involve business interests or government funding, whereas others are grounded more in the user context. For these reasons, the approaches used in the projects/programmes might differ significantly, as some require stricter and more formalized planning than others.

Yet the different approaches to learning about the end-users partly reflect a slightly different philosophy of planning and design. The projects/programmes building on more 'distant' resources, such as surveys, prior theoretical concepts and previous research are designed more from 'top down'. This type of planning approach implies a clear separation between research, design, implementation and evaluation. The other type of projects/programmes builds more on practical experiences, informal contacts and initiatives taken by the end-users (or some of them) themselves. Here, the planning approach is usually more 'bottom up' and less tightly planned (see Mourik et al. 2009). Small pilots or feedback and ideas

gained from stakeholders can change the course of the programme. Research, design, implementation and evaluation occur more concurrently.

We can thus see that quite similar problems may be addressed by more 'bottom-up' types of projects that are grounded in end-user needs and experiences, and more 'top-down' projects that are grounded in preconceived goals and a more 'distant' approach to steering energy use. It is perhaps not entirely fair to compare such projects with partly different goals and objectives. The 'top down' projects usually try to address larger and more 'difficult' end-users groups, whereas the more 'bottom up' projects build on, or at least interact more closely with, end-users who often are already motivated to change their energy behaviour. On the other hand, these bottom-up projects can be quite ambitious in promoting far-reaching lifestyle changes.

3.5 Pros and cons of various approaches

It is also clear that the different approaches have their benefits and drawbacks (Table 3). This serves to emphasize the fact that different approaches are more suitable for particular types of programmes in terms of goals, scale and resources. In the following, we summarize the pros and cons of different approaches based on our analysis of the cases.

Formal, dedicated research involving surveys and interviews is obviously useful. It provides a systematic format for data collection. Representative samples of end-users can be surveyed and thus there is at least a chance of learning the views of 'less enthusiastic' members of the end-user population. At best, surveys and interviews can bring up new knowledge that challenges the designers' preconceptions. However, our analysis shows that surveys may not always feed into programme design, for example because they are conducted at a relatively late stage. Moreover, surveys may be designed to confirm existing preconceptions, or they may be read tactically for the same purpose (see, e.g. Akrich 1995). Conducting high-quality surveys or interviews may also require specialized skills that are expensive to gain for small-scale projects. Moreover, current sociological research on energy use (Wilhite et al. 2000) suggests that surveys may fail to capture the particularities and practicalities of how energy use is embedded in everyday life.

There is also obvious merit in building one's programme on a **sound theoretical base** of prior research. A sound theoretical basis in the behavioural and social science literature can provide useful concepts that help to make sense of seemingly irrational end-user behaviour

(see e.g. Kempton et al. 1992; Stern 2000). For example, prior research can help understand the factors underlying users' short payback time expectations for energy efficiency investments (e.g. Golove and Eto 1996). Research on habitual behaviour and the processes involved in making and breaking habits can help design interventions that deal with behaviours that are puzzling even for the end-users themselves. Research on "descriptive social norms" (i.e., influencing people by telling them what others are doing and hence what is normal behaviour in a certain community) can help project designers to recognize and utilize social dynamics in promoting energy-saving practices (e.g. Goldstein et al. 2008).

Yet there are many – often competing and contradictory – theoretical perspectives on energy-related end-user behaviour and behavioural change (Wilhite et al. 2000; Breukers et al. 2009). Social science theories are "middle-range theories" that apply in certain contexts and not in others (Pawson and Tilley 1997). Disciplinary research usually highlights certain aspects of human behaviour and downplays others: yet everyday life problems usually cut across disciplinary boundaries (Fourez 1997). Our data revealed that an overly theory-driven programme can end up being too complex and confusing for end-users, while disregarding issues that are important for them (see e.g. Feenstra 2009). In real life, it may be difficult to consistently implement a design that is based on, e.g., controlled laboratory experiments, which are designed to eliminate the influence of 'confounding factors'.

Previous experience, especially with the same end-user group, is obviously useful and speeds up the learning phase. This is evidenced in our data, for example, by the highly professional way in which the Hungarian NGO, NSC, organized the Climate Watch programme, building on previous experience in environmental education. Their success is also partly due to the fact that their local member organizations took part in project implementation. Obviously, they had information about and also direct links to the end-user group. A sound experience base also creates confidence and provides an arsenal of practical skills and solutions that are difficult to learn in any other way.

Yet we can also speculate that there might be drawbacks in relying too much on prior experience, especially in the long term and in a changing environment. Management scholars are familiar with the term 'competence trap' (Levinthal and March 1993), which means that an excessive focus on core competencies and well-established skills can deter organizations from learning new skills required by changing environments.

User-driven projects are ideal in many ways. It is much easier to work with end-users who are highly motivated and willing to invest their own efforts in designing a project that can help them save energy. User-driven projects can also serve as pilots to refine programme designs (cf. MacKenzie-Mohr 2000). End-users know about their needs and circumstances and can contribute to context-tailored and user-friendly designs (Stern 1999; 2000).

On the other hand, energy-related behaviour is often habitual and not subject to conscious reflection (Abrahamse et al. 2005; Darby 2000). Hence, end-users may not always be aware of their needs, behaviours or all the factors influencing them. Moreover, end-users who are motivated to participate in designing projects to change energy use only constitute a small segment of the entire population. So the programmes or projects in our dataset that were user-driven were usually small, or started out small. Scaling up and ‘growing’ the programme into a large one involving ‘ordinary’ end-users may be difficult. Some of our case projects accomplished the upscaling process successfully, e.g. the Finnish Green Office programme. Yet, upscaling often requires new resources and more formal ways of organizing, so our cases also include ones like the Hungarian Carbonarium project that had difficulties in growing beyond their original user base.

End-user interaction and learning about end-users can also be informal, based on face-to-face contacts or longstanding membership in the user community. Informal interaction allows for a rich exchange of information (including non-verbal information), and familiarity creates trust and mutual confidence. This is evidenced, for example, in the case of the Samsø renewable energy island, where the entire project built on close interaction within a tight-knit rural community (yet also employed more organized events to ensure participation by the islanders). Familiarity and immersion in the user community allows project managers to access the end-users’ everyday routines and the meanings attached to them (Parnell and Popovics-Larsen 2005). However, it can take a lot of time, commitment and informal interaction to build up the level of familiarity needed to execute a successful behaviour change programme. Moreover, programme managers’ personal contacts may not be so representative of the target group as a whole. They usually center on the more active and positive people in the target group, and may thus obscure more marginal, but also more critical voices (see Heiskanen et al. 2007).

Table 4. Pros and cons of particular approaches to user interaction in energy demand-side programmes

Approach to learning about end-users	Pros	Cons
Surveys and interviews	Systematic approach to data collection Surveys provide the possibility to poll representative samples	May not always feed into programme design Surveys may be designed to confirm existing preconceptions, may fail to bring up new insights Conducting good research may be expensive and require specialized skills
Prior research, particular theoretical perspectives	Sound theoretical base can guide observations and help to make sense of energy-related behaviour	Strong commitment to prior findings or theories may lead to overlooking contextual particularities Overly theoretical background can lead to complex and confusing designs
Experience from prior projects and similar examples	Sound experience-base creates confidence and practical skills/solutions that are difficult to codify	'Competence trap': overconfidence and failure to learn new skills in new contexts
User-driven project (or pilot project)	End-users know about their needs and circumstances and can contribute to context-tailored and user-friendly designs End-users are motivated and engaged from the start, thus 'less work' is left for the programme manager	End-users may not be fully aware of their behaviour and all the factors underlying it 'Upscaling' from small user-driven pilots to broader groups of end-users can be difficult
Familiarity and informal interaction with the target group	Informal interactions allow for a rich exchange of information (including non-verbal information) Immersion in the user community helps to understand users' everyday routines Familiarity creates trust and mutual confidence	It can take a lot of time and commitment to build up the level of familiarity needed to execute a successful programme Contacts may be biased: some end-users are more familiar than others

3.5 Isolated end-users – or embedded in context?

Until now, we have focused mainly on how programme managers interact with the energy end-users that they are targeting, and whose behaviour they aim to change. Yet an important observation arising from our analysis is that interacting merely with end-users is not sufficient. Energy end-users are not the only parties influencing their energy usage behaviour. Sociologists have argued that we should not examine energy consumers in

isolation; energy consumption (and conservation) is always a result of social processes on the family, community and institutional level (Lutzenhiser 1993; Wilhite et al. 2000). Individual choice is limited by the way cities, energy supply systems, housing designs, service networks and products are configured (Wilhite et al. 2000). Thus, change in energy-related behaviour is part of a larger change in the socio-technical organization of 'systems of provision'. The systems of provision define the opportunities and limits for individuals' patterns of energy usage (Rohracher 2001).

What can individual programmes or projects, especially small-scale ones, do about social processes and systems of provision? There are obviously issues in which project managers are fairly powerless. Yet we found in our meta-analysis that the ability of projects to reach their goals was often dependent on the engagement of not only end-users, but other relevant stakeholders in the end-user context. These stakeholders can be viewed as 'secondary users' or 'indirect target groups' (Oudshoorn & Pinch 2003).

Table 4 shows some examples of parties influencing the success of energy conservation interventions in our case studies. Many of our cases deal with energy use by people living in multi-apartment dwellings. Here, households are usually the target group for behavioural interventions and additionally, more technical interventions can be addressed to facility managers. Many of our case studies, however, indicated that these two types of interventions are often made separately. For example, in the Finnish Energy Expert case, the residents were rarely involved in building maintenance and technical renovation plans (Anttonen 2009). Moreover, larger energy related decisions require concerted action by residents. Here, residents' and tenants' boards and committees are important decision making forums. Informal interaction between residents (especially 'opinion leaders') can also be important. The ability to change energy-related practices may also depend on service providers (e.g., banks, contractors, retailers and suppliers).

Another example can be taken from cases dealing with energy use at the workplace. The possibility to change energy-related practices is essentially conditioned on the relations and responsibilities of management and employees. Successful programmes need to engage employees and empower them to act. There are also particular groups of staff (e.g., IT managers in offices) who have an impact on procurement and management decisions that influence others' possibilities to save energy. The organisations' motivations, capacities and the availability of positive feedback also depend on how the organisations' clients value energy efficiency. Co-operation with facility owners and managers influences the possibilities

to change premises to accommodate energy-conserving practices, and suppliers and service providers are crucial for access to more energy-efficient equipment and services.

Table 4. Examples of stakeholders potentially influencing changes in energy use

Refurbishment and energy management in a multi-apartment dwelling	Energy and carbon emission reductions in offices
Households (tenants, owner-occupiers)	Management
Resident boards and committees, informal groups	Employees
Facility owners and managers	Staff in charge of particular functions (e.g. IT)
Banks	Trade, labour and professional organisations
Contractors, technology suppliers	Clients
Government (national and local)	Facility owners and managers
	Suppliers and service providers
	Government (national and local)

Our meta-analysis (Mourik et al. 2009) indicated that the ability to engage diverse stakeholders and align their interests was a critical factor for success in many cases. Understanding existing stakeholder networks and building on them was crucial for gaining access to the different parties whose participation and resources was needed for completion of the change programme. Successful projects/programmes also managed to build up new networks to support the new practices.

Understanding the user context is also stressed in the co-design literature. For example, contextual design (e.g., Beyer and Holzblatt 1998) recognises the importance of “secondary users”. However, there is a strong emphasis on getting “past all kinds of middle-men” to the “real users” in the more practice-oriented literature. When applied to projects to change energy use, this might lead to a problematic focus on users alone, as if they were the only parties determining how they consume energy. The “middle men” should of course not be relied on to supply information on user needs, but various stakeholders do influence people’s energy consumption and they need to be taken into account.

4. Co-design efforts in the CHANGING BEHAVIOUR pilots: eye-openers and challenges

In CHANGING BEHAVIOUR, we have applied the lessons learned from our meta-analysis in six best-practice pilot projects (see <http://www.energychange.info/six-best-practice-pilots>),

through which we are developing a ‘toolkit’ for energy project managers. Many aspects of this toolkit aim to enhance co-design capabilities, for example by:

- helping project managers to learn to know their target groups better, e.g., by providing advice on various ways to do small scale research (surveys, interviews, field observations, focus groups and meetings) as well as highlighting questions about the target group (energy end-users) which need to be answered.
- suggesting ways to analyse and reflect on the user context and identify relevant stakeholders
- providing examples of how to design projects in co-operation with members of the target group and suggesting ways to assess where the project design can be kept flexible so that user input can be accommodated
- suggesting ways to adapt ‘generic’ instruments (such as energy advice or audit formats) to the user context
- providing examples of how to test initial project designs with the target group and collect feedback from end-users during the course of the project.

Many of the pros and cons of various approaches to end-user interaction identified in the previous section were also confirmed and specified in the pilot projects. We will thus not reiterate them here, but will instead focus on illustrating some eye-openers, but also some of the challenges experienced in attempts to develop best practices.

4.1 The importance of combining formal research with informal observations

The experiences gained in our pilot projects emphasize the importance of informal interaction and immersion in the user community, in addition to the use of formal methods. This is illustrated by a pilot project run by Ekodoma in Latvia, which aims to promote energy renovations in multiapartment buildings (see Breukers et al. 2010). Ekodoma had previously identified cost-effective energy renovation options using energy audits. The current project focused on getting residents to agree to make the necessary investments. Even though there are generous grants available in Latvia, the renovations imply significant up-front costs for residents, and at least 51% need to agree to the proposed renovation. Many residents were still hesitant.

Ekodoma conducted a survey of the residents’ main motives and barriers to investing in energy renovations, as well as on their sources of information. This was helpful in deciding which arguments to use in promoting the renovations and in identifying which personal

contacts were important in swaying residents' decisions. However, there are limits to what you can learn in a survey, and the project managers also learned a lot by spending time with the residents and getting to know them.

One example of the importance of informal interaction and familiarity arose in a building in which it was difficult to get residents to attend the information meetings organized by Ekodoma. These were organized in a nice hotel outside the building, but few people showed up. The project managers had observed that residents usually meet and discuss important common issues in the stairwell of the building, and they decided to move their meetings there. Residents merely had to open their apartment doors to join the meeting. It was an unusual experience for the project managers but resulted in a much better turnout.

4.2 The challenge of co-design: aligning diverse interests

Alongside the value of involving users, our experiences also highlight some of the challenges encountered when trying to involve users. As an example, we take a short story from one of the pilots, Micro-ESCOs, which aimed to promote heating systems upgrades in a semi-rural residential area in Finland. Heating system upgrades are expensive investments. People will not make them unless they are absolutely confident that the promised benefits will be achieved and that the systems will work as planned. The project managers recognized the importance of planning this type of project in close co-operation with members of the target group.

In order to design a project that meets the residents' needs, the project managers engaged in co-design with the residents at various stages. Initial ideas were collected at public meetings organized for the residents. The project managers also attended a number of events organized by the residents or the local municipality to gain input on the project plans. These meetings gauged the residents' interest in heating systems upgrades and alternative solutions (including a common residential-scale heating system) and collected their concerns and ideas. Project details were planned at smaller meetings with actively participating residents (though this group changed in composition over time). Here, decisions were made concerning how to implement the heating system upgrade. The project changed greatly at this final stage. Instead of a common heating system, the project decided to opt for individual ground source heat pumps, but ask for and evaluate the suppliers' bids collectively.

The project design was very flexible. Many different options for organizing and financing the heating system upgrades were explored and discussed together with residents. This also

brought up some of the problems in developing a project in such a flexible way. Users came up with lots of ideas and needs – not all of which could be fulfilled in a single project. So the project managers had to decide which of the ideas to implement, and make suggestions for fair and equitable solutions. Moreover, as the project changed significantly during the long planning stage, and the same people did not show up at each meeting, intermittently participating users were often confused by the “sudden” turns taken by the project. It was difficult to keep and communicate a clear focus for the project. Getting enthusiastic and developing energy for each new plan also took its toll on the project managers. Moreover, simply managing the social dynamics of a continuously changing group of residents planning a large and important investment was exhausting. Many fundamental principles of project planning had to be thrown overboard and the project managers had to “play it by the ear”.

5. Conclusions and implications for practice, policy and research

Our meta-analysis and the experiences from our own pilot projects show that there is indeed a need to increase interaction between project managers and energy end-users when promoting changes in energy use. Our findings also highlight the need to involve stakeholders and anchor projects in the social and physical context of the users. Interaction can be enhanced by providing project managers with the means and resources to explore the user context and user needs before they start planning. It can also be enhanced by engaging end-users and other stakeholders in project implementation and evaluation. However, the practical implications of our experiences and analysis go beyond this need for ‘methods’.

User involvement is not merely a matter of applying certain methods. It is clear that no one method for learning about end-users is best, and this is echoed in the broader literature on user involvement (Stewart and Williams 2005). This is because energy end-users are not merely passive recipients of approved solutions, simply in need of methods to fit the solutions to their needs (see Guy and Shove 2000). Hence, project managers also need to develop sensitivity to the end-users’ everyday practices. Extensive informal interaction with users – spending time with them and keeping in touch throughout the project – is crucial for developing such sensitivity. One practical implication of our analysis is thus that informal interaction and immersion in the user community serves much of the same function as more formal methods such as field observations.

Additionally, formal methods for user involvement and co-design rarely address the interpersonal skills needed when working with users. User involvement and co-design are

complex forms of interpersonal interaction, raising conflicting feelings, requiring human judgment on fairness, and challenging the project manager's entire personality. We thus suggest that project managers should pay attention to the personal toll that interacting with users can take on them, and devote sufficient time for 'de-briefing' and reflecting on what is going on in the project together with colleagues.

A final practical implication concerns funding bodies, which often set the framework for projects promoting energy efficiency, conservation or climate action on a local level. User involvement and co-design require some flexibility in project planning. Yet many government-funded projects require very detailed plans, which cannot usually be changed easily in response to new information or user feedback gained during the course of the project. If funding bodies want their projects to really make a difference, they should allow some flexibility to change project plans. Additionally, funding for projects to change energy use should include time for research prior to project design.

For the user involvement literature, our analysis of user interaction and co-design in energy projects suggest some contributions. In particular, we provide new empirical evidence for a discussion that questions the concept of "users", until now primarily in the development of IT and medical equipment (Stewart and Williams 2005; Hyysalo et al. 2006). There are many different "users" of such products, including retailers and maintenance staff (for IT), or various categories of healthcare providers, patients and their families (for medical equipment). The same applies to energy saving projects – many different stakeholders influence the end-users' capacities and opportunities to save energy. This is not fully recognized in the existing methods for co-design and user involvement, which mostly focus only on individual users. There are few established methods within this tradition for analysing groups, communities and networks (e.g., Rohrer 2005).

Our findings also speak to social science research on energy efficiency and energy conservation. Decades of this research have provided valuable insights into why it is so surprisingly difficult to save energy. However, applying these insights in practice is easier said than done. Many of the sophisticated research approaches and solutions suggested by sociologists of energy use (e.g. Wilhite et al. 2000) do not easily fit into the world of project managers working to save energy (Parnell and Popovics-Larsen 2005). Learning about users' worlds through extensive ethnographic research and challenging broadly shared conventions and social structures are too demanding tasks for intermediary organizations working on the ground to promote changes in energy use. Our study, however, suggests that

intermediary organizations have other routes to the same end. They can learn about end-users through prolonged informal interaction and membership in the user community. To some extent, they can also shape the social context of energy end-users by engaging stakeholders such as service providers and other 'gatekeepers'.

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