Creating Lasting Change in Energy Use Patterns through Improved User Involvement

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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. Energy demand-side projects and the energy intermediaries operating them are key in encouraging more sustainable energy consumption patterns.

This paper is based on an ongoing EU FP7 project called CHANGING BEHAVIOUR. 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 in different parts of Europe (3) tests the conceptual model in pilot projects, 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.

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-user target group and finding the best ways to interact with it are key issues for managers of energy demand-side management programmes and projects. Also, since energy end-users are not the only parties influencing their energy use, managers might consider indirect influences such as family, community, and institutions.

The present paper draws data collected within the CHANGING BEHAVIOUR project. In particular, we draw on a meta-analysis of factors influencing success and failure in 24 previous cases of demand-side projects in different parts of Europe. In the present paper, we focus on an important set of factors conditioning success, i.e., interaction between the programme managers (energy experts) and the target groups (which in our cases, were households, SMEs or other building users).

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. 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.

In the product design and innovation literature, there is today a long tradition 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; Kelley, 2000; Koskinen, Battarbee & Mattelmäki, 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. Users may join designers 'at the drawing board', for example by participating in user groups (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 in both industrial products and some consumer products (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. They either do this because their budget is so restricted that they are forced to check their consumption regularly to make sure that they are not consuming more that they can pay for, or 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.

Some recent energy conservation programmes have adopted some of the 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 methods to come up with new ideas to save energy (Lovett 2009). Designers have also started to be interested in studying emerging user demands for more sustainable solutions, an example of which is the EU-funded EMUDE project (Manzini and Jégou, 2006; 2008). Yet such examples are still rare. In the following, we examine how a set of 24 contemporary programmes working on energy demand-side management in various parts of Europe have addressed the challenge of learning about their users.

Approaches to learning about end-users: data from a meta-analysis of 24 European cases

In the CHANGING BEHAVIOUR project (http://www.energychange.info/), we have collected data for three databases: a large database of about 100 energy demand side management programmes, a more limited database including in-depth analyses of 24 cases of more and less successful programmes, as well as a database on the goals, resources and context of 25 intermediary organizations in Europe. The 24 cases of more and less successful projects were selected to represent a selection focusing on different target groups, with at least three cases from different countries targeted at households, offices, schools and municipalities. More importantly, the cases were selected to represent a range of outcomes in terms of success and failure.

Table 1 presents the in-depth case studies included in our meta-analysis[1]. The cases were analysed using a six-step framework tracking the evolution of goals, design and process solutions and outcomes as well as the

[1] The full case studies are available at: http://www.energychange.info -> Project Output -> Case Studies.

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. forthcoming).

Table 1: Cases used for in-depth meta-analysis

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
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 established by individuals and companies
Latvia	Building energy audits	Energy audits of apartment blocks	
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 Rij	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)

Findings: User involvement in 24 European demand-side programmes

In the following, we focus on examining the interactions between the programmes/projects and the targeted energy end-users. We first present they ways in which the programmes in our database gained information on end-users and their needs, expectations, circumstances and ways of thinking about energy. We then turn to examine whether the choice of approach in learning about end-users is related to the success of the programme. We then look at 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, showing that there is no 'ultimate solution' to learning about end-users, but rather, that programme managers need to strike a balance that is most suitable for their particular context and resources.

How did the 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[2]. In some cases, the surveys were quite comprehensive and 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 focus of 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.

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, 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[3]. 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 programmes built strongly on experience from prior projects or similar examples. Most often, the programme 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 (Vadovics 2009a), the National Society of Conservationists (NSC) had implemented numerous programmes in

[2] We have grouped 'surveys' and 'interviews' in the same category for practical reasons, even though it would make sense to differentiate between the two. Interviews allow for face-to-face interaction and provide the possibility to learn something new and totally unexpected. However, only few of our cases used interviews, and even then, often as a direct substitute for a more systematic survey.

[3] Few of the programmes, however, reported having access to detailed statistics on the energy use of their particular target group of end-users. This is a situation that should improve in the future, at least in principle, as more real-time use data, especially for electricity use, is becoming available.

environmental education, had been working with teachers and school children for a long time, and had considerable knowledge about pupils' background knowledge about energy issues and climate change.

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, 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 already involved in the programme design. In the Finnish Energy Expert case, 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, however, who were later be 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 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 agreementswere partly based on 'pilot' experiences from an auditing programme conducted by the city of Helsinki in its own facilities (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 (Maier 2009). Programme design elements could be discussed with stakeholders representing various user groups, as was done, for example, in the Manchester is My Planet pledge campaign (Robinson 2009). Implementation responsibilities could be given to longstanding members of the user community, as was done in the Samsø programme (Saastamoinen 2009). Or the programme managers and delivery staff could have 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*
1. Surveys, interviews or group meetings	6
2. Prior research, particular theoretical perspectives	9
3. Experience from prior projects and similar examples	6
4. User-driven project (or pilot project)	8
5. 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 there are some task-related problems are common to all human beings. It is also sometimes recommended to focus on untypical users. Some argue that every person is unique, thus data from some users may not apply to others (Bowie 2003) . 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).

Which approaches 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 (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.

We can see that none of the approaches, in themselves, provide a 'silver bullet' for success in achieving project goals (Table 3). The second column indicates the number of cases in which a particular approach was used, and the third column the number of these cases that were successful in reaching their goals. We can see that none of the approaches to learning about end-users' needs, in itself, is a sufficient condition for success[4].

Table 3. Relation of using a particular approach to success in reaching programme goals

Approach to learning about end-users	Number of programmes using this approach	Number with relatively high level of goal achievement
1. Surveys, interviews or group meetings	6	4
2. Prior research, particular theoretical perspectives	8	6
3. Experience from prior projects and similar examples	7	6
4. User-driven project (or pilot project)	8	5
5. Familiarity and informal interaction with the target group	8	6

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 1 failed partly of 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.

Which types of programmes use different approaches?

The approaches selected also partly reflect the needs and resources of the programme: large-scale programmes addressing broad and heterogeneous target groups naturally 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 constrains.

Even though there are many similarities among our case programmes – reducing energy consumption, a focus on energy use in buildings, and a societal pressure to reduce CO_2 emissions – there are also differences. In addition to the size of the target group, the programmes can differ in related product/service lifecycles (3 months vs. 100 years) and the risks involved for the end-users (small behavioural changes vs. large investments), the degree of mass-customization, and the involvement of business vs. government stakeholders. For these reasons, the approaches used in the programmes might differ significantly, as some programmes require more planning than other.

Yet the different approaches to learning about the end-users partly reflect a slightly different approach to programme planning and design. The 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

[4] In the meta-analysis (Mourik et al. forthcoming), we have used a variety of indicators for programme successfulness, but here we focus for simplicity's sake for only goal attainment as an indicator of success.

approach implies a clear separation between research, design, implementation and evaluation. The other type of 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, *forthcoming*). Small pilots or feedback and ideas gained from stakeholders can change the course of the programme, and 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 tackle large problems and address 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, but merely require some support for this.

Pros and cons of various approaches

It is also clear that the different approaches have their benefits and drawbacks (Table 4). This serves to emphasize the fact that different approaches are more suitable for particular types of programmes in terms of goals, scale and resources.

Formal, dedicated research involving surveys and interviews is 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[5]. But our experiences shows that surveys may not always feed into programme design, for example because they are conducted at a relatively late stage when programme design features are already fixed. 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 and programmes.

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). Yet there are many – often competing and contradictory – theoretical perspectives on energy-related end-user behaviour and behavioural change (Wilhite et al. 2000). Our data revealed that an overly theory-driven programme can end up being too complex and confusing for end-users (see e.g. Feenstra 2009). Moreover, most social science theories are 'middle-range' theories that apply to a certain social context, but may not help to explain behaviour another context (Pawson and Tilley 1997).

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 educations. 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 from relying too much on prior experience, especially in the long term. 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 programmes are ideal in many ways. End-users know about their needs and circumstances and can contribute to context-tailored and user-friendly designs (Stern 1999; 2000). They can also serve as pilots

[5] Add note on survey sample bias…

to refine programme designs (MacKenzie-Mohr 2000). On the other hand, we can also ask whether end-users are always aware of their needs, behaviours or all the factors influencing them[6] (see Riquelme 2001). Energy-related behaviour, in particular, is often habitual and not subject to conscious decisions (Abrahamse et al. 2005; Darby 2000). On the positive side: It is much easier to work with end-users that are highly motivated and willing to invest their own efforts in designing a programme that can help them save energy. However, such end-users are usually few and far apart. So the programmes in our dataset that were user-driven were usually small, or at least started out small. Scaling up and 'growing' the programme into a large one involving 'ordinary' end-users may be difficult[7]. Some of our case programmes accomplished the upscaling process successfully, e.g. the Finnish Energy Expert programme and the 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 programme that have difficulties in growing beyond their original user base.

As stated above, 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 Samsoe 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). However, this approach is not always feasible: it can take a lot of time and commitment 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 around 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) 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

[6] Of course, we can also ask how aware the programme managers are of their own behaviour and the factors influencing it (see e.g. Kempton et al. 1992; Shove 1998; Parnell and Popovic-Larsen 2005).

[7] This same phenomenon has been found in product design projects working with 'lead users', i.e., users who face needs before the mass of the market and innovate in order to discover solutions to their own problems (von Hippel 1988; 2005). Christensen et all. (2003) have argued that lead user innovations are rarely appealing to 'non users'.

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 social and 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, especially small-scale ones, do about social processes and systems of provision? There are obviously issues in which programme managers are fairly powerless. Yet we found in our meta-analysis that the ability of programmes 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 5 shows some examples of parties influencing the success of energy conservation interventions in our case studies. Many of our case studies deal with energy use by people living in multi-apartment dwellings (e.g., Anttonen 2009; Breukers 2009; Kamenders 2009; Feenstra 2009). Here, households are usually the target group for behavioural interventions and additionally, more technical interventions can be addressed to facility owners and managers. Many of our case studies, however, indicated that these two types of interventions are often addressed separately. For example, in the Finnish Energy Expert case, the resident Energy Experts were poorly informed about and involved in building maintenance and technical renovation plans. Moreover, many larger energy related decisions require concerted action by residents – here boards (e.g. condominium boards in owner-occupied housing) and committees are important decision making forums, but also informal interaction between residents (especially 'opinion leaders') can be important. The ability to change energy-related practices may also depend on the availability of suitable service providers (e.g., banks, contractors, retailers and suppliers).

Another example can be taken from cases dealing with energy use at the workplace (Heiskanen 2008; Pariag 2008; Liang and Hodson 2008). 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 on change 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 naturally crucial for access to more energy-efficient equipment and services.

Table 5. Examples of stakeholders potentially influencing energy use and the potential for changing behaviour

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

Our meta-analysis (Mourik et al. *forthcoming*) indicated, in fact, 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. In particular, diverse competencies and skills needed to be involved. Successful programmes also managed to build up new networks to support the new practices.

Stakeholder networks are a 'personalised' representation of the context in which energy end-user practices are embedded. There are, naturally, also features of the context that are less clearly represented by particular stakeholders, yet need to be taken into account. These include the particular features of the national context, such as the dominant values, knowledge bases, institutions and economic situation at a particular time, but they also include more 'local' contexts, such as regional specificities, or the particular values, institutions, norms, social networks and cultures in certain sectors. Context and timing were often mentioned as critical to the success of particular energy saving programmes: a good understanding of the networks and contexts in which the end-users were embedded helped the successful programmes to overcome obstacles and turn them into advantages. Thus, we found, for example, that programmes targeted at offices in Hungary, Finland and the UK benefited from the ongoing interest in "greening businesses" and managed to position themselves as one way for businesses to address their environmental and social responsibilities cost-effectively. Likewise, programmes related to residential energy use benefited from ongoing changes in the housing sector, such as a strong investment in housing renovation in Lithuania or intensified tenant participation in housing governance in Finland.

Conclusions: Challenges of creating a toolkit for practitioners

The aim of the CHANGING BEHAVIOUR project is to use our findings to create a toolkit that helps energy practitioners to interact more effectively with energy users (including end-users and other stakeholders). Our analysis of previous programmes indicates that there is indeed a need for better involvement and understanding of end-users. Yet our findings also suggest that the crucial issue of "what works where and when" (Pawson and Tilley 1997) is not easily solved with simple instructions or a "one size fits all" toolkit. Sensitivity to context is needed when devising methods and tools for practitioners working in the field. We are trying to develop such sensitivity through a close analysis of the literature, through empirical research, and by developing our toolkit in six pilot projects, with different aims and target groups, conducted in different parts of Europe.

What can we take to this process from our analysis of user involvement? 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). Our analysis shows that none of the approaches to learning about end-users' needs, in itself, is a sufficient condition for success. Methods should be context-sensitive and allow practitioners to go "beyond method" – and beyond the view of end-users as passive recipients of approved solutions – to understand and work with a relational approach to end-users (see Guy and Shove 2000; Guy 2006). This means understanding one's own relation to the end-users and viewing the end-users in a broader dynamic context.

A relational approach suggests that 'what works where and when' depends on what one is aiming to accomplish. Our analysis shows that energy demand-side programmes come in various sizes and shapes and they are initiated and delivered by different kinds of practitioners (SURF et al. 2008). For example, some programmes aim to become persistent stakeholders in a future value chain, whereas other programmes aim to fade out when the intervention is done. These differences imply different types of 'customer relations' and different approaches to networking, among others.

An important category influencing 'what works where and when' relates to the size and heterogeneity of the end-user community or target group and to the social distance between the programme manager and the end-users. Formal methods are needed when there is great socio-cultural distance between the programme

developers or managers and the end-users, or when individual differences matter more (e.g. mass-customized products or services). The more a product or service can be customized for a particular user or user group context, the more this needs to be reflected in choice of methods, among others.

Rather than examining and working with isolated end-users, we want to develop a toolkit that addresses end-users in context. This can mean engaging other relevant stakeholders (such as families, communities or service providers) in meaningful ways in the project. Engaging stakeholders, in turn, requires particular skills in analysing and negotiating expectations and interests. Most of the existing methods for user involvement are targeted at studying individual users, and there are few established methods within this tradition for analysing groups, subcommunities and networks (e.g., Rohracher 2005).

A relational approach also starts to blur the distinction between 'users' and 'producers' (or programme developers, managers or deliverers). Firstly, programme managers are dependent on the end-users for reaching their goals of reduced energy consumption (e.g. Parnell and Popovic-Larsen 2005). Furthermore, if we acknowledge that in addition to the end-users, there are many parties that can influence the targeted energy-related behaviour, we also accept the fact that we need to work with many different players. Some of them are more at the 'receiving end' and others more at the 'producing end', but the distinction is no longer clear-cut. The larger the size of the network, the more complex it gets – thus, we may need to develop or find appropriate tools for managing complex multi-stakeholder projects and programmes.

An interesting and potentially useful finding – which may also help to reduce complexity – is that programmes can build up iteratively. Research on user involvement has shown that user feedback shapes design easier if the release-cycle is fast and the product life-cycle short, i.e. when new products or services can easily build on previous products or services (Stewart and Williams 2005). This same observation is echoed in our case studies, where pilots and upscaling of small projects were frequently a successful way to develop a user-responsive programme.

In terms of new frontiers for energy demand-side programmes, we can draw on the product design and innovation literature to suggest social media as a new source of user knowledge and living labs as a new context for user involvement. Social media refer to services like Facebook, Myspace and Twitter, which enable users interact and express their opinions about diverse topics. These, and other discussion forums are easily browsable and searchable for specific topics, which is an important source for user knowledge. Living Labs are a more systematic approach to 'piloting' or 'experimentation' from a user-driven approach (Intille 2003), which have become highly popular in Europe today. These new approaches can provide valuable tools for improving user involvement in the designing of programmes that create lasting change in energy use patterns.

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