AMBIVALENCE, DESIGNING USERS AND USER IMAGINARIES IN THE EUROPEAN SMART GRID: INSIGHTS FROM AN INTERDISCIPLINARY DEMONSTRATION PROJECT

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Title

Ambivalence, designing users and user imaginaries in the European smart grid: Insights from an interdisciplinary demonstration project

Abstract
As the smart grid is gradually implemented, there is an increased concern amongst researchers and policymakers for the role of users in such systems. For the smart grid to perform as expected, users must change. One approach to the relationship between users and technology proposes that success is more likely if users are involved in the design and development of technologies. This, however, is no small task. This article reports on a research project that set out to engage users through inviting them to participate in the design of software and feedback technologies. Parallel to this engagement, and paradoxically, was the perspective of by-passing the user. There was a growing ambivalence amongst team members of the knowledge users have for developing smart grids. The case illustrates where the distinction between user involvement and by-passing the user is blurred. The work contributes to research of imagined users as well as future expectations in this process. It illustrates how traditional models of knowledge deficiency on behalf of users can pave the way for minimal user engagement.

Keywords: Imagined users, design, technology development, sociology of expectations

Highlights
Identifies some epistemological challenges when actors with technical backgrounds attempt to involve users in their design

User imaginaries as performative to validate acceptable views for technology development

Technology discourse of designing users within knowledge deficit which paradoxically coinciding with ambivalence to user involvement

1. Introduction

Energy systems are changing across Europe and beyond. The development is multi-faceted and involves both what has traditionally been dubbed the supply and the demand side of the system. Key trends involve increasing levels of intermittent renewables in combination with a gradual decrease of centralized electricity production based on e.g. nuclear power, as can now be seen in Germany. In combination with this, there is a push for the electrification of transport and other services that have previously been based on fossil fuels. While much is unclear about how the development will pan out, one thing seems clear: the electricity grids across Europe will have challenges dealing with new patterns of production, consumption, and prosumption emerging with the new system. To deal with these challenges, an increasing number of actors are now researching and advocating what they call the "smart electricity grid" to be introduced as an important element of the transition (Verbong, Beemsterboer, and Sengers 2013). Visions of the future smart grid often incorporate smart electricity meters, new smart household appliances, in-home displays or other feedback technologies combined with new types of home automation. Furthermore, the possibility of storing electricity has led to the expectation that electricity production is to become more distributed, with an increased share of small-scale electricity production from wind or solar combined (e.g. Katzeff and Wangel 2015, Haunstrup Christensen, Gram-Hanssen, and Friis 2013).

One of the goals for introducing smart grids is to reduce or to change the way people consume electricity, in order to relieve the grid during peak load periods. This means that it will not be enough simply to develop and dispatch new technologies. Instead, to achieve the desired goals, electricity users should become much more active and engaged than they currently are. This is recognized both in academia where we have seen a growing literature engaging human-technology interaction in a smart grid setting (e.g. Hargreaves, Nye, and Burgess 2010, Naus et al. 2014, Heiskanen and Matschoss 2011) and amongst policy makers. As an example, the EU strategic energy technology plan and its integrated policy roadmap state that activating and engaging consumers is the number one policy challenge for the coming years.

Thus, one question addressed in current research is how passive electricity consumers could be transformed into active participators. One of the strategies advocated is to actively involve users in energy system decisions that might affect them (e.g. Barnett et al. 2012, Cotton and Devine-Wright 2010, Devine-Wright 2013). For instance, users could be involved in the deliberative dialogue about new renewable energy production sites (Walker et al. 2010). In the context of smart grids, however, another type of decision profoundly influences the users' possibility of actively engaging with the energy system. These are decisions regarding technology design. This is the subject of our paper.

The user often comes face-to-face with the grid through encounters with in-home displays (IHD), or other digital feedback technologies. It is through such visual feedback that designers, policy makers, economists and engineers tend to envision altered electricity consumption practices (Strengers 2013, Skjølsvold 2014, Buchanan, Russo, and Anderson 2015). In light of this, several scholars have called for the development of new methods for involving users, for instance through making the everyday practices of households the basis of design, and thus making the users voices heard in technology design processes (Jelsma 2006, 2003, Rohracher and Ornetzeder 2002).

This paper contributes to discussions about smart grid technology design and the potential role of users in this process. We study a large European interdisciplinary research project where one of the goals was to design technology together with future users. Our study emerged from a curiosity about the role of these users in the project, and especially about how project engineers imagined users, the users' rationality and opportunity to contribute in the project. From very early in the project, we could observe tensions with respect to what role the users should have. These tensioned were anchored in different user imaginaries. On the one hand, the project's success was framed as dependent on users' mobilizing their skills and participating in design exercises. On the other hand, we observed strong skepticism. Could users really understand this complex technology to the degree that they could participate in technology design? We study how project engineers and scientists formulated ideas about the future users of the project, and try to grasp how these ideas and visions about users influenced the decisions made in the project.

Through the study, we have observed two distinct groups of imagined future technology users. First, the project participants imagine a highly techno-savvy, price sensitive and competent user who will use the technology to change his or hers future electricity consumption practices. This user resembles Sørensen's (2007) description of an ideal mix of an economist and an engineer. Second, the project has promised to involve users actively in the technology design phase. The idea was to do this through workshops on what has been labelled *user centric design*. Interestingly, however, future users were imagined to be incompetent as designers, to the degree that in the first of three consecutive workshops *with* users, users were actually not invited. Instead, project engineers and scientists literally *acted* as users. Thus, there is an ambivalence with respect to the role of future users in the project – involve them, but also avoid them!

The paper is structured as follows. We begin with a discussion about the role of users and imaginaries in technology development. We move on to discuss the background of our empirical case before we present the method. We conclude by discussing how our research has implications for developing studies in this area.

2. Users, visions and technology development

Scholars in science and technology studies (STS) and related social science have a long tradition for the study of relationships between technology design and future users, as well as the role of visions or imaginaries in technology development processes. For instance, it has been suggested that technology developers script (Akrich 1992, 1987) technologies with certain user figurations in mind. Thus, developers have ideas about who future users are. These ideas encompass specific attributes and competences, as well as limitations.

Technology is designed and developed with this as a backdrop. Hence, when technologies are constructed, so are their future users (Woolgar 1990).

This means that technology design and development is a social process, and a political process. When users are imagined and technologies scripted, potential mechanisms of exclusion are also enforced. For instance, if it is presupposed that users have certain competences, types of capital, socio-cultural attributes or similar, people without such traits by default become non-users of the technology in question (Johnson 1988). This can lead to very tangible outcomes such as gender exclusion (Oudshoorn, Saetnan, and Lie 2002, Berg and Lie 1995) or the exclusion of other minorities (Winner 1980).

Studies of designer-user dynamics suggest that user imaginaries are performative, that they influence decisions in the design and development process. Such insights have been followed up on by scholars studying how scientists imagine lay people, (Maranta et al. 2003) and later more broadly in numerous studies on the relationship between expertise and publics (Walker et al. 2010, Barnett et al. 2012, Skjølsvold 2012), to show how such imaginations influence strategies and decisions. A recurring theme is that experts tend to regard lay publics through a knowledge deficit model, which leads them to see the public as a problem to be defeated, either through clever design tactics, or through technocratic decision strategies. For instance, if you imagine local publics to be aggressive opponents to wind power, this will feed into the way you strategize if you are in the process of planning the construction of a wind farm (Heidenreich 2014).

Another strand of research where related ideas are pursued is found in the sociology of expectations. This school of thought examines the role of future visions, expectations and imaginaries for contemporary navigation more broadly (van Lente 2012, Brown and Michael 2003, Borup et al. 2006). An example of the performativity of future expectations can be seen in stock markets, where visions of brilliant future performances can send stocks to the clouds. Similarly, sinister expectations of a pandemic tends to influence the economy, politics and individual behaviors (Nerlich and Halliday 2007). In both these examples, we can easily imagine different futures. Companies can perform poorly, and pandemics can be defeated. What future you believe in is not trivial for the choices you make. Thus, different variants of the future tend to be mobilized as rhetorical tools. Advocates of small modular nuclear reactors, for instance, uses the vision of risk-free energy as a rhetorical tool to promote the nuclear energy industry (Sovacool and Ramana 2015).

The future smart grid is frequently envisioned at an aggregated systems level, or as a macro system, where key goals such as "flexibility", "load shifting" and "peak shaving" are taken for granted a priori, largely disconnected from the practices meant to produce these effects (Strengers 2013, Skjølsvold and Ryghaug 2015). At the same time, many gadgets introduced, such as in-home displays, are highly localized, catering for human-technology micro interaction. For this reason, the smart grid lends itself particularly well to studies that both keep an eye on future expectations, and imagined publics (Skjølsvold 2014). Systemic traits tend to generate grand visions of smart grids, while the need for active user participation calls for an analysis of imagined publics or users.

How, then, have electricity users been imagined in the past, and what role have they been ascribed in socio-technical energy system transitions? In summary, there has been a strong tendency amongst the experts of the electricity system to characterize consumers or users by deficits: "*of interest, knowledge, rationality, environmental and social responsibility*" (Sørensen 2007:69). Thus, users have been understood as a systems problem or a barrier to desired transitions. Devine-Wright (2007) argues that deficit model representations of users has become "common sense" to the degree that they substantially influence energy policies. Several case studies of renewable energy development illustrate these dynamics (e.g. Skjølsvold 2012, Barnett et al. 2012, Walker et al. 2010).

It seems clear that if energy users are largely considered knowledge deficient, and a problem to be defeated when implementing technology transitions, involving users in design processes will most likely be difficult. The image, however, is not entirely clear-cut. Willhite (2008) has suggested that there is a dualism in the discourse of energy technology users and new technology design. One strand of thought tends to focus on delegating as many tasks as possible to the technology, thereby bypassing the user. A competing group focuses on active user participation and behavior change.

Abi-Ghanem and Haggett's (2013) study of user engagement with PV-systems in the UK is a good example of Willhite's first strategy. The study shows how the literature tends to frame PV-users through a classic deficit model which *"calls for energy education and environmental awareness about the externalities of electricity from fossil fuels [...][and] an assumed economic rationality when it comes to energy consumption, which dismisses the social nature of energy consumption"* (p. 155). PV-systems are often treated as add-ons to buildings, which can be invisibly or tacitly integrated through what Rohracher and Ornetzeder (2002) have dubbed technical design strategies, meaning that you do not need "*the cooperation of users after the technology has been implemented"*. Willhite proposal supports this line of thinking. Thus, not much human-technology interaction is envisioned after the installation. On the other hand, much of the smart grid discourse is anchored in visions of users becoming much more actively engaged with energy issues through the new, smart energy technologies (see e.g. Strengers 2013). In this sense, the tension that we experienced at an early stage in the project we study, where ideas about user inclusion, involvement and engagement are pit against images of knowledge deficiency and the user as a problem is not so surprising.

Over the last 30 years, we have seen an increased social scientific sensitivity for the role of users in energy systems (Aune 2007, Wilk and Wilhite 1985, Lutzenhiser 1988). Building on this, there has been various calls for the incorporation of knowledge about social practice in technology development and design, both to improve chances of technical success, and to enable democratic and fair technology outcomes (Burningham et al. 2007). We study a project with an outspoken goal of adhering to such principles. How were users imagined in this process, and how did the user imaginaries influence the design process? How did the involved scientists and engineers' reason about public engagement at various stages in the project? What were the challenges involved in using data collected through user engagement activities in the design process? Before we move on to discuss such questions, let us look briefly at the background of the case studied.

3. Background of case

The case we study is a European research project that aspired to engage future users in technology design. The ambition of the project was to demonstrate the feasibility of combining "smart" micro grids with small-scale renewable energy production and the installation of battery capacity. The main goal of the project was to establish neighborhoods where locally produced renewable electricity would be shared in novel ways. One of the ideas was to develop a set of new user interfaces, computer software and apps which would provide energy feedback and allow for some control of household appliances. It was hoped that implementing these technologies would bring about rational and self-reliant use of electricity at neighborhood (community) level. On a rhetoric level, the project has emphasized the need for engaging users throughout the span of the project, from designing the technology to testing it. In this paper, our primary concern is the design phase. We study how future technology users were imagined, and how these imaginaries became active elements in the technology design process. Given the social character of the project and the need for user engagement to achieve success, we expected to see new user imaginaries, beyond the typical deficit-laden user representations of the past. This, however, was not the case.

The project was set up quite classically with seven separate work-packages. One focused on project management, while four work-packages were devoted to technical/software development and evaluation. One work-package was for dissemination and replication, and one work-package for '*User centric concept elaboration and development*'. The setup implies a need for a diverse range of skills, as well as an organization along a temporal axis. Tasks had start and end dates. As is often the case with temporary organizations, the project was goal oriented, which implies that a diverse team come together to solve a pre-defined task with tight deadlines and costs (Lindkvist 2005)

During the 1990s and around the turn of the millennium, several scholars claimed to observe that we had ushered into a new scientific era, where interdisciplinary teamwork would be the new norm. Some authors dubbed the trend "mode 2 science" (Gibbons et al. 1994, Nowotny, Scott, and Gibbons 2001), and highlighted that it was a route to unprecedented levels of problem solving, a democratization of scientific practices, and the creation of socially robust science and technology. Such ideas, however, tends to underestimate the social dynamics at play in large interdisciplinary research projects. As an example, Enberg et al. (2010) shows the emergence of an informal hierarchical project organization, distinguishing between core and non-core members. While the authors found wide spread communication and creative intellectual exchange amongst core team members, non-core members were decoupled from the project, and not considered full team members with equal opportunities to engage in ongoing communication and interaction. The distinction between core and non-core members of unequal roles is fruitful for our further discussion on the project we study.

The core team in the project we study primarily consisted of expertise in ICT software programming and engineering, photovoltaics, and electrical engineering. The project consortium involves partners in Norway, Germany, Italy and the Netherlands. Eight organizations were involved in the project including universities, private research institutes, commercial companies and local authorities. The core team consists of around 25 researchers, but the total number of involved people in the project can most likely be tripled as specific skills from people within the organizations were acquired as necessary. The smart micro grid solutions and software that was developed by this consortium would eventually be tested in demonstration sites, neighborhoods or communities located in Italy and Germany. Thus, based on earlier project experience where technology acceptance had been an issue, the project intended to recruit multiple users to take part in designing the technology, to gain *acceptance*. This was the motivation for establishing a work package on "user centric concept elaboration and replication". The goal of this work package was to identify the needs of the users, and to establish concepts for the project through engagement and interaction with the users.

The authors of this paper were involved in this task to represent a social scientist perspective. However, we do not see ourselves as part of the core team but as non-core team participants. Our roles were mainly to provide advice on methods, rather than actively participate in data collection and analysis. These tasks were primarily conducted by the leaders of the work package, who were academic experts in ICT and software programming. With this general setup as a backdrop we now move on to analyze how core team members imagined their users, and in turn, how this would influence the choices made in the project. Before we do that, we first discuss the method we used to collect our data.

4. Research methods and analysis

Since we were part of the research team, our primary methodological tool for conducting this research has been participant observation. This method has been vital in studies of scientific practices for decades (e.g. Latour and Woolgar 1979), in part because it is well established that an insider view of scientific practice is quite different from what is usually presented to outsiders (Jasanoff 1990). Participant observation is grounded in the everyday experience of specific phenomena, and is especially appropriate in case study research concerned with the production of meaning from an insider's perspectives (Jorgensen 1989). Thus, it serves our case study approach to the study of user imaginaries and their effects inside this temporary project organization quite well.

In addition to our observational notes, we have analyzed various types of project document outputs, where statements about users have been made. Thus, our paper constitutes a reflective retrospect on the project, where our key goal is to trace and follow the activities on design and user involvement. This task was initiated in October 2013 and completed in April 2014. Our analysis is mainly concerned with data collected in this period, but we also mobilize earlier accounts of users in this project, such as the project proposal. In sum our data consists of 14 online status report meeting minutes, observations from one design workshop, the project proposal as well as outputs from the design activities including visual materials e.g., photos and images of prototypes of the software being developed, project presentations, emails etc. We also mobilize observations from two project plenary meetings, where people involved in user engagement and design activities were able to discuss their activities with other project participants. These were conducted in October 2013 and February 2014.

4.1 Analysis

Our approach to the analysis of the data is anchored in a grounded and inductive reading of the data (e.g. Charmaz 2008). We have built the analysis on a reading strategy or "tactics" of noting patterns and themes and continuously questioning our findings. Miles, Huberman and Saldana argue for the virtues of this strategy in the following way:

"The important thing is to be able to (a) see added evidence of the same pattern and (b) remain open to disconfirming evidence when it appears. Patterns need to be subjected to skepticism—your own or that of others—and to conceptual and empirical testing" (2014, p.278)

The analysis involved a thorough reading of all data, and a selection of the most relevant text to understand how users were imagined throughout the project and the relationship between these imaginaries and the project work. We labelled the patterns which emerged from the data based on recurring themes such as "users designing", "designing users", "engagement", "disengagement" and "limited engagement". Another reading enabled us to cluster the data more clearly, and to produce a coherent narrative about user imaginaries in the context of the project at hand. The analysis was iterative. Each author took turns in examining extracts from the data and to reflect on the emerging concepts and patterns. This process of analysis continued until there was agreement by the authors on the relationship between the concepts, the analysis and the data. We will now proceed to discuss the results of our analysis based on the underpinning finding of an ambivalence of users in designing feedback technology for smart grids.

5. The ambivalence of users in designing feedback technology for smart grids

5.1 Initial ambivalence

Our observations from this smart micro grid demonstration project indicate significant ambivalence on behalf of the project team towards the future users. From the beginning, the underlying assumption was that many of the problems of the electricity system had its roots in problematic user behavior. Users, it was argued, acted in sub-optimal or non-sustainable ways, and the project was framed as a quest to solve this problem. The preferred way to fix the problem involved introducing new "smart" gadgets, providing energy consumption feedback, economic incentives and potentially new ways of controlling energy consumption.

The deficient user imaginary was clearly visible already on the first page of the project proposal. There, one of the challenges defined for the project success was that "*Consumers must be willing to* […] *adapt their patterns of consumption*". The proposal goes on to state that one of the ways to achieve this is to "*Teach users how their behavior will impact their energy cost and carbon footprint*" (*Project proposal*). In other words, the proposal identified a potential problem of acceptance based on knowledge deficits, and indicated that energy feedback through smart technologies could fix this. However, the proposal suggests that information alone might not be sufficient. To ensure desired outcomes, monetary rewards would be given to users who complied: "*The behavior of the smart micro-grids will be governed by reward based business models ensuring sufficient rewards to the users willing to share resources and collaborate to optimize the overall working of the power grid*" (*Project proposal*).

These statements imply deficiencies on behalf of electricity users in general. They also assume that the main motivation and trigger for behavior change is anchored in pure economic rewards. Thus, they imagine a strictly economic model of human rationality in the future users. This echoes much of the social scientific research on smart grid discourses to date (e.g. Wolsink 2012, Verbong, Beemsterboer, and Sengers 2013, Strengers 2013, Schick and Winthereik 2013, Hargreaves, Nye, and Burgess 2010). It suggests that the challenge of "activating" electricity users through technology design is a quite simple task which implies providing information and new price signals.

We observed this reasoning frequently at early stages of the project. One illustrative example could be seen at the project kickoff meeting in Italy. Here, one of the most senior project team members, an ICT engineer and programmer took the chair to discuss human-technology interaction and the rationality of the projects users. He stated: "*if it is one thing that we know about human beings, it is that they are governed by greed!"* (09 October 2013). Similar assessments were common throughout the project.

This imagination of the users as strictly economically rational individuals does suggest that project engineers and scientists believed that they would be able to activate users though providing them with very specific feedback. So far, however, little indicates that the goal was to involve the users in ambitious co-design activities. Rather, the role of users would be to "accept" installation of the new gadgets. The correct response from them would be to act and change behavior accordingly. What we have seen so far is a stark contrast to other key goals in the project. The same project proposal we cited above, also promised to involve and engage the users in the technology design stage through "*modern user-centered design approaches"* (*Project Proposal*). As the leader of this specific task, a relatively junior ICT engineer enthusiastically noted at the project kickoff meeting: "*this means that we must actually go out and make something that the people want - with the people".* The concept of designing with users was much debated at this meeting. The project manager highlighted that he was concerned about the project sounding "*far too much like some social science project"*, while another senior ICT developer loudly exclaimed: *"why on earth would we involve the users!?"*

The ambivalence within this project reflects Willhite's (2008) distinction between technology centered design and behavior centered design. In this project, different understandings of the users' capacities and rationality led to heavily opposing views on how to handle user involvement. A large fraction of engineers and scientists did not see the relevance or point of including users in the technology development process at all. They were interested in "activating" flexible electricity consumption, but preferred to do this by delegating decisions to automated software. In some instances this understanding of user rationalities also rested on an implicit distrust of users. For instance, many highlighted that one could not take statements about rationalities competing with the economic at face value. While people might *claim* to be motivated by "green" attitudes, they were imagined *really* care more about money. As one developer said in a plenary meeting:

"*You* [the user] *do not want to decide how green you want to be. How important is it for you that your appliances are running on time? What is your cost barrier? Greenness depends on the cost value*" (Technology developer – Researchers notes, second plenary meeting, February 2014)

The other fraction of researchers had experiences with users which had led them to conclude that involving the users was important to ensure that the technologies would be adopted as the engineers wanted. Thus, they had – at least initially – a more complex view of human-technology interaction, where the importance of the users' norms and attitudes were underscored. This group firmly highlighted that users had a useful set of competences, which could be mobilized when developing software concepts. This group considered *user centric design* as the key tool to achieve acceptance as well as to be mobilized in the project.

5.2 User centric design: designing with users, designing for users or designing users?

While there were clearly opposing views in the project team, user engagement had been promised in the project proposal. The method described there was a series of three consecutive workshops on "user-centric design". Here, future users would be invited to sit with engineers and developers and to take on the role of *co-designers* and were expected to help in the development of concepts for the smart energy system. This type of active engagement was intended to make the system better than what it would otherwise have been without their involvement.

The approach of user centric design would prove not to be as simple as the group had thought. As the project progressed, and as the first set of workshops approached, expectations within the group started to change. As we have already seen, critical voices were raised from numerous project engineers and developers. What would really happen once future users were gathered in a room? Could these prospective users grasp the complex technologies the project team was trying to create without some sort of introduction or crash course first? The group started visioning what it would mean to waste an entire workshop without tangible useful results. Engineers who were not involved with the user centric design were also concerned. What if everything users came up with was unrealistic or straight out foolish? In the end, the prospect of a squandered workshop in the company with what was increasingly considered ignorant lay people led to the conclusion that the first workshop on user centric design would *not* involve users. Instead, it would consist of project team members who literally *acted* as users.

On one level this is a plain illustration of some of the lessons from the sociology of expectations (van Lente 2012). Visions of the future clearly influenced the choices made, as did the beliefs about human rationality enacted in these futures. However, we also see here that such future expectations are far from static and that their content is subject to negotiations. Thus, the future represented in the project proposal is only one of many competing futures available in the project.

Now, guided by fear of poor workshops and deficient users, the goal of the first workshop was redefined. It would still be an arena for design, but it would not involve users. Instead the goal would be to design something *for the* users. The workshops would be used to create drafts, mockups and ideas, to which the users would later be given the chance to respond to in the following two workshops. As one of the project managers said to the rest of the group: *"We need to create an artifact that the end-users of the* [Project] *system can understand and continue to work with in the second workshop"* (User Centric Design Workshop (with researchers as users), December, 2013).

This workshop also provided clear insight with respect to how the project engineers reasoned with respect to the relationship between what they were designing, and their future users. Thus, we could observe in practice the process of technology scripting (Akrich 1992). While there were no users present at the workshop, fantasies and ideas about the users were very active. Part of the workshop was dedicated to formalizing these fantasies, by writing up short profile stories dubbed *personas*. These are representations of users, highlighting the aspirations and motivations that the workshop participants thought the future technology users would have. Thus, the process of scripting the technology for a particular cast of users was very visible, as were the imagined users. As the task leader on user centric design highlighted:

"Personas create a better feel of who to think about – design for the people who will use the system" (Project Manager of User Centric Task – Researchers notes, second plenary meeting, February 2014)

For us, however, personas represent an obvious source of insight with respect to how users were imagined by project staff. Through internal discussions, the project engineers came up with three ideal-typical user personas, with different motivations and attitudes that they imagined would use the technology in the future. The first persona was characterized as "environmental", with motivation for participating anchored in a desire to help the environment. The second character was described as "technical", motivated by the urge to test new technologies. Finally, a third persona was described as "financial", a character who was motivated to participate in the project because of the prospects of monetary rewards.

The motivations of these fictitious personas were then written into the products created in the workshop. At this point, the physical output were a set of product boxes which were meant to illustrate for future users what they could expect from the software solutions, feedback- and control technologies. The product box targeting the environmental persona highlighted that the use of the technology would allow users to "*Reduce your Co_2 footprint"*; the box targeting the "technical" persona highlighted that users could "*Optimize your electricity consumption";* and finally, the product box targeting the "financial" persona highlighted the possibility to "*save 1000€ a year"*. Thus, without involving a single user, the project engineers had established what kinds of rationalities and motivations future users would have, and in turn, what message they would have to convey in order to trigger behavior changes through the new technology.

In the weeks following up on this workshop, the team continued their design efforts without users. They produced several paper proto-types, which also targeted users with the same rationality and motivations as those of the earlier mentioned personas. The paper prototypes were mockups of potential design, e.g. indicating the cost of the electricity consumed at any given time. The purpose of the exercise was to give actual users something to respond to in the future. As the leader of this task explained in a plenary meeting:

"[The] *aim of the paper prototype was to build and show it to actual users […]* [imagine a] *regular person who knows nothing about electricity except paying bills. We need to explain to customers the benefits of the project*" (leader of user centric design task – Researchers notes, second plenary meeting, February 2014).

This clearly indicates that the knowledge deficit view of users now dominated and was prevalent amongst those who originally aspired to involve users in design efforts. Future users were reduced to someone who could not understand anything beyond how to pay a bill rather than a character with competences, knowledge and skills suitable for design. The engineers had designed their ideal users, defined their motivations and designed software mockups that they imagined these fantasy users would respond positively to.

These exercises served to limit what could be done in terms of co-design in the remaining set of workshops with actual users in Germany and Italy. Where the initial ambition had been to co-design, the resulting activities were rather a set of feedback sessions where the users provided their reactions to what they were presented.

The tangible outcome of the workshop with prospective users in Italy was a six-page document summarizing the event. The document describes in detail how the paper prototypes were presented to the users. Based on this, the document recorded the key points of interest from users. This section consisted of nine sentences labelled "feedback". Here, one critical remark was noted, namely that one involved user group – teachers – wanted to increase the possibility of controlling various aspects of the electricity consumption in classrooms.

The workshop with prospective German users produced similar results. The paper prototypes were presented to future users, who provided feedback. According to the written report from the workshop, the outcome was that the users had *"80-90% agreement with the paper prototypes but would like to add to it and introduce safety items"* (Researcher notes of WP2 meeting March 2014). Some prospective industry users emphasized, as the teachers did in Italy, that they wanted to be able to have more control over the system.

The results from the workshops with users were fed-back to all researchers involved in the user centric design task at a subsequent project meeting. The team was largely satisfied by having achieved desired levels of "acceptance". However, the workshops had indicated one common issue highlighted by two different sets of users. Both groups requested higher degrees of freedom when it came to controlling the actual system. The idea of giving users increased control was not well received by the engineers and programmers making the system. Such an idea was quickly rejected. The discussions at this point leaned towards skepticism with respect to user feedback, but also towards more profoundly deficient view of the users and their competence. If they were provided with too much freedom, with too much control, they might end up using the technology in a different way than the engineers wanted.

In sum, the result of all these exercises was that very little was actually done to engage prospective users, and to involve them in technology design exercises. Instead, the team collectively produced a set of ideal typical user personas, and designed solutions for these fantasy users, while input from actual users was disregarded. Interestingly, these developments did very little to influence the rhetoric of the engineers who were responsible for user involvement. While the voices of users were in reality muted from close to all aspects of the design process, "user-centric design" was continually reported as a corner stone of the project. Based on our observations in the project it is difficult to say exactly why and how this could continue. The project process has illustrated several puzzling and contradictory themes. On the one hand, the project proposal required the involvement of future users in new ways during the technology development phase. On the other hand, there was always a tension in the project team between ideas concerning user involvement and competing voices highlighting various user deficiencies. In the end, the latter voices prevailed, and the new smart technologies were scripted to fit a set of imagined users with a quite limited repertoire of potential rationalities. The findings indicate that the distinction between the by-passing of users and the involvement of users is not necessarily distinguished but blurred. This blurring occurred as the project progressed, and when the engineers advocating user centric design were filled with the ambivalence that was evident amongst members of the project team in the early stages of the project.

6. Concluding discussions

In the years ahead of us, the European energy system will change. Germany is pushing its impressive, but challenging "Energiwende", and other countries are following in their footsteps. The changes will entail more renewable energy production, more distributed energy production, a more diverse portfolio of energy sources. Many of these new sources will be intermittent; producing a range of new challenges for what in many places is a very old infrastructure for electricity distribution. As a way to mitigate the challenges, the "smart grid" in various shapes is currently being researched and advocated as a set of tools which might allow electricity users, traditional electricity customers, to participate more actively in the energy system than they currently do. Through micro renewable energy production they are expected to become "prosumers", and through more active market participation they are expected to provide flexibility, shift loads and shave peaks.

Such expectations, anchored in ideas about humans as a distinctly economically rational breed, have now been widespread amongst policy makers, engineers and economists for more than 15 years, to the degree that they have significantly influenced policies, e.g. on mandatory smart meter roll outs (Skjølsvold 2014). The expectations, however, have been poorly anchored in empirical data. As smart grid trials have become increasingly more common, it has become clear that the task of changing passive consumers to active energy system resource managers is a tremendous challenge (e.g. Löfström 2014, Katzeff and Wangel 2015, Hargreaves, Nye, and Burgess 2013, 2010, Gangale, Mengolini, and Onyeji 2013, Christensen et al. 2013, Buchanan, Russo, and Anderson 2015, Broman Toft, Schuitema, and Thøgersen 2014).

The recognition of this challenge is most likely one of the reasons why funding bodies such as the European Commission are increasingly asking researchers to focus on the social challenges related to smart grid implementation. There is a growing recognition of the need to understand how users make sense of and understand the gadgets installed in their homes and businesses, and to further investigate the links between new technologies and practice changes.

It is in this light that we should understand the focus on user centric design in our case project. The funding call in which our case project was accepted into requested novel and innovative approaches involving users and therefore such approaches were promised. Colette Bos et al. (Bos et al. 2014) have illustrated similar dynamics within European science policy, highlighting how cycles of “big words” (e.g. “democracy”, “engagement”, “sustainability” etc.) tends to dictate both what is written in calls for proposals, and in the actual proposals – often without having much impact on what is actually done. Thus, one way to think about the focus on users in a project such as the one we have reported on here is as a kind of sugar coating, to hide what is really a quite traditional technology development project. Related to this argument, Göran Sundqvist (2005) have pointed out that much of the rhetoric around “inclusion” and “participation” is anchored in a form of hypocrisy. This bill seems fitting for the project we have studied here.

Social scientists anchored in practice theory and STS have spent the last 20 years calling for design approaches that script technologies to better correspond with the daily lives and diverse existing patterns of electricity use and understanding (e.g. Jelsma 2006, 2003, Strengers 2013, Nicholls and Strengers 2014). In a project such as the one we have studied here, the social science competence was marginal. Despite the rhetoric of user involvement, the technological understanding of the problem, and the economic framing of users remained hegemonic. In light of earlier research, the result is not very surprising, but it does raise some interesting questions with respect to how funding bodies should think about structuring calls for proposals in the future. Perhaps it is now time to seriously re-think whether the problem at hand is really a technological challenge in need of a social component? In our view it is probably not much better to rephrase the problem as a purely social problem either, but a more balanced view to the socio-technical might be in order (Wilhite 2008).

As for the project at hand, it is not yet completed, and the question of whether or not flexibility will be “activated” through the mobilization of this technology is still empirical question to be answered in the future. Based on our experiences and pervious research, we however, remain skeptical.

References

Abi-Ghanem, Dana, and Claire Haggett, eds. 2013. *Shaping People's Engagement with Microgeneration Technology: The Case of Solar Photovoltaics in UK Homes*. Edited by Patrick Devine-Wright, *Renewable Energy and the Public: From NIMBY to Participation*.

Akrich, Madeleine. 1987. "Comment décrire les objets techniques?" *Techniques & culture* (9):49-64.

Akrich, Madeleine. 1992. "The de-scription of technical objects." *Shaping technology/building society*:205-224.

Aune, Margrethe. 2007. "Energy comes home." *Energy Policy* 35 (11):5457-5465.

Barnett, Julie, Kate Burningham, Gordon Walker, and Noel Cass. 2012. "Imagined publics and engagement around renewable energy technologies in the UK." *Public Understanding of Science* 21 (1):36-50. doi: 10.1177/0963662510365663.

Berg, Anne-Jorunn, and Merete Lie. 1995. "Feminism and constructivism: Do artifacts have gender?" *Science, Technology & Human Values* 20 (3):332-351.

Borup, Mads, Nik Brown, Kornelia Konrad, and Harro Van Lente. 2006. "The sociology of expectations in science and technology." *Technology analysis & strategic management* 18 (3-4):285-298.

Bos, Colette, Bart Walhout, Alexander Peine, and Harro van Lente. 2014. "Steering with big words: articulating ideographs in research programs." *Journal of responsible innovation* 1 (2):151-170.

Broman Toft, Madeleine, Geertje Schuitema, and John Thøgersen. 2014. "The importance of framing for consumer acceptance of the Smart Grid: A comparative study of Denmark, Norway and Switzerland." *Energy Research & Social Science* 3 (0):113-123. doi: http://dx.doi.org/10.1016/j.erss.2014.07.010.

Brown, Nik, and Mike Michael. 2003. "A sociology of expectations: retrospecting prospects and prospecting retrospects." *Technology Analysis & Strategic Management* 15 (1):3-18.

Buchanan, Kathryn, Riccardo Russo, and Ben Anderson. 2015. "The question of energy reduction: The problem(s) with feedback." *Energy Policy* 77 (0):89-96. doi: http://dx.doi.org/10.1016/j.enpol.2014.12.008.

Burningham, Kate, Julie Barnett, Anna Carr, Roland Clift, and Walter Wehrmeyer. 2007. "Industrial constructions of publics and public knowledge: A qualitative investigation of practice in the UK chemials industry." *Public Understanding of Science* 16:23-43.

Charmaz, Kathy. 2008. "Constructionism and the grounded theory method." *Handbook of constructionist research*:397-412.

Christensen, Toke Haunstrup, Ainhoa Ascarza, William Throndsen, Kirsten Gram-Hanssen, and Freja Friis. 2013. "The role of households in the smart grid: A comparative study." *eceee 2013 Summer Study on energy efficiency*.

Cotton, Matthew, and Patrick Devine-Wright. 2010. "Making electricity networks" visible": Industry actor representations of" publics" and public engagement in infrastructure planning." *Public understanding of science*.

Devine-Wright, Patrick. 2007. "Energy citizenship: psychological aspects of evolution in sustainable energy technologies." *Governing technology for sustainability* 63.

Devine-Wright, Patrick. 2013. *Renewable Energy and the Public: from NIMBY to Participation*: Routledge.

Enberg, Cecilia, Lars Lindkvist, and Fredrik Tell. 2010. "Knowledge integration at the edge of technology: On teamwork and complexity in new turbine development." *International Journal of Project Management* 28 (8):756-765.

Gangale, Flavia, Anna Mengolini, and Ijeoma Onyeji. 2013. "Consumer engagement: An insight from smart grid projects in Europe." *Energy Policy* 60:621-628.

Gibbons, Michael, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott, and Martin Trow. 1994. *The new production of knowledge: The dynamics of science and research in contemporary societies*: Sage.

Hargreaves, Tom, Michael Nye, and Jacquelin Burgess. 2010. "Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors." *Energy Policy* 38 (10):6111-6119.

Hargreaves, Tom, Michael Nye, and Jacquelin Burgess. 2013. "Keeping energy visible? Exploring how householders interact with feedback from smart energy monitors in the longer term." *Energy Policy* 52:126-134.

Haunstrup Christensen, Toke, Kirsten Gram-Hanssen, and Freja Friis. 2013. "Households in the smart grid – existing knowledge and new approaches." In *Making sense of consumption: Selections from the 2nd Nordic Conference on Consumer Research 2012*, edited by U. Holmberg L. Hansson, & H. Brembeck. Centre for Consumer Science, University of Gothenburg.

Heidenreich, Sara. 2014. "Blowing in the wind: The socialization of offshore wind technology."

Heiskanen, Eva, and Kaisa Matschoss. 2011. "Exploring emerging customer needs for smart grid applications." Innovative Smart Grid Technologies (ISGT Europe), 2011 2nd IEEE PES International Conference and Exhibition on.

Jasanoff, Sheila. 1990. The Fifth Branch: Scientific Advisors as Policymakers. Cambridge: Harvard University Press.

Jelsma, Jaap. 2003. "Innovating for sustainability: Involving users, politics and technology." *Innovation: The European Journal of Social Science Research* 16 (2):103-116.

Jelsma, Jaap. 2006. "Designing 'moralized'products." In *User Behavior and Technology Development*, 221-231. Springer.

Johnson, Jim. 1988. "Mixing humans and nonhumans together: The sociology of a door-closer." *Social problems*:298-310.

Jorgensen, Danny L. 1989. *Participant observation*: Wiley Online Library.

Katzeff, Cecilia, and Josefin Wangel. 2015. "Social practices, households, and design in the smart grid." In *ICT Innovations for Sustainability*, 351-365. Springer.

Latour, Bruno, and Steve Woolgar. 1979. *Laboratory life: The social construction of scientific facts*: Princeton University Press.

Lindkvist, Lars. 2005. "Knowledge communities and knowledge collectivities: A typology of knowledge work in groups*." *Journal of Management studies* 42 (6):1189-1210.

Lutzenhiser, L. 1988. "A pragmatic theory of energy use and culture." *University of California*.

Löfström, Erica. 2014. "Smart Meters and People Using the Grid: Exploring the Potential Benefits of AMR-Technology." *Energy Procedia* 58 (0):65-72. doi: http://dx.doi.org/10.1016/j.egypro.2014.10.410.

Maranta, Alessandro, Michael Guggenheim, Priska Gisler, and Christian Pohl. 2003. "The reality of experts and the imagined lay person." *Acta Sociologica* 46 (2):150-165.

Miles, Matthew, B., Michael Huberman, and Johnny Saldana. 2014. *Qualitative Data Analysis: A Methods Sourcebook. Edition 3*. London: Sage Publications.

Naus, Joeri, Gert Spaargaren, Bas JM van Vliet, and Hilje M van der Horst. 2014. "Smart grids, information flows and emerging domestic energy practices." *Energy Policy* 68:436-446.

Nerlich, Brigitte, and Christopher Halliday. 2007. "Avian flu: the creation of expectations in the interplay between science and the media." *Sociology of health & illness* 29 (1):46-65.

Nicholls, Larissa, and Yolanda Strengers. 2014. "Changing demand: flexibility of energy practices in households with children: interim report findings from interviews with 44 family households."

Nowotny, Helga, Peter Scott, and Michael Gibbons. 2001. *Re-thinking science: knowledge and the public in an age of uncertainty*: SciELO Argentina.

Oudshoorn, Nelly, Ann Rudinow Saetnan, and Merete Lie. 2002. "On gender and things: Reflections on an exhibition on gendered artifacts." *Women's Studies International Forum* 25 (4):471-483. doi: http://dx.doi.org/10.1016/S0277-5395(02)00284-4.

Rohracher, Harald, and Michael Ornetzeder. 2002. "Green buildings in context: improving social learning processes between users and producers." *Built Environment (1978-)*:73-84.

Schick, Lea, and Brit Ross Winthereik. 2013. "Innovating Relations-or why smart grid is not too complex for the public." *Science & Technology Studies* 26 (3):82-102.

Skjølsvold, Tomas Moe. 2012. "Publics in the Pipeline. On Bioenergy and its Imagined Publics in Norway and Sweden." In *Past and present energy societies*. Bielefeld: Transcript Verlag.

Skjølsvold, Tomas Moe. 2014. "Back to the futures: Retrospecting the prospects of smart grid technology." *Futures* 63:26-36.

Skjølsvold, Tomas Moe, and Marianne Ryghaug. 2015. "Embedding smart energy technology in built environments. A comparative study of four smart grid demonstration projects " *Indoor & Built environment*.

Sovacool, Benjamin K, and MV Ramana. 2015. "Back to the Future Small Modular Reactors, Nuclear Fantasies, and Symbolic Convergence." *Science, Technology & Human Values* 40 (1):96-125.

Strengers, Yolande. 2013. *Smart Energy Technologies in Everyday Life: Smart Utopia?*: Palgrave Macmillan.

Sundqvist, Göran. 2005. "Expertisens gränser och samhälleliga utbredning." *Exemplet slutförvaring av kärnavfall, Scores rapportserie* (2-2005).

Sørensen, Knut Holtan. 2007. "Fra hvite kull til grønn varme? Utfordringer for enegrgi. ." In *Mellom klima og komfort*, edited by Margrethe Aune and Knut Holtan Sørensen. Trondheim: Tapir.

van Lente, Harro. 2012. "Navigating foresight in a sea of expectations: lessons from the sociology of expectations." *Technology Analysis & Strategic Management* 24 (8):769-782.

Verbong, Geert PJ, Sjouke Beemsterboer, and Frans Sengers. 2013. "Smart grids or smart users? Involving users in developing a low carbon electricity economy." *Energy Policy* 52:117-125.

Walker, Gordon, Noel Cass, Kate Burningham, and Julie Barnett. 2010. "Renewable energy and sociotechnical change: imagined subjectivities of'the public'and their implications." *Environment and planning A* 42 (4):931-947.

Wilhite, Harold. 2008. "New thinking on the agentive relationship between end-use technologies and energy-using practices." *Energy Efficiency* 1 (2):121-130. doi: 10.1007/s12053-008-9006-x.

Wilk, Richard R, and Harold L Wilhite. 1985. "Why don't people weatherize their homes? An ethnographic solution." *Energy* 10 (5):621-629.

Winner, Langdon. 1980. "Do artifacts have politics?" *Daedalus*:121-136.

Wolsink, Maarten. 2012. "The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources." *Renewable and Sustainable Energy Reviews* 16 (1):822-835. doi: http://dx.doi.org/10.1016/j.rser.2011.09.006.

Woolgar, Steve. 1990. "Configuring the user: the case of usability trials." *The Sociological Review* 38 (S1):58-99.