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

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ABSTRACT

The gradual implementation of smart grid solutions is accompanied by an increased concern amongst researchers and policymakers for the role of users in such systems. For smart grids to perform as expected, the role of users in electricity systems must change. One approach to technology-user relationships proposes that the chance of success increases through involving users in the design and development of technologies. This article reports on a research project that set out to involve what was perceived as active and competent users in the design of feedback technologies. We explore how users were imagined in the project, and how the idea of active user participation was shadowed by an ambivalent and paradoxical view of users as knowledge deficient and incompetent. The case illustrates how the boundaries between involving users and by-passing users becomes blurred. Through this, we contribute to the knowledge on how user imaginaries and future expectations influence research and innovation processes, illustrating how traditional models of knowledge deficiency can lead to minimal user engagement.

1. Introduction

Energy systems are changing across Europe and beyond. The developments are multi-faceted, involving both the supply and demand side of the system. Key ingredients are increasing levels of intermittent renewables combined with a gradual decrease of centralized electricity production based on e.g. nuclear power, as can currently be observed in Germany. Parallel to this, there is a push for electrifying transport and other traditionally fossil fuel based services. While outcomes of the transition are uncertain, one thing seems clear: electricity grids will have to handle new, challenging patterns of electricity production, consumption, and prosumption emerging in tandem with the new technologies. To deal with these challenges, an increasing number of actors are currently researching and advocating what they call the "smart electricity grid" to be introduced as an important element of the transition [54]. 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. [23,31]).

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 a growing literature engages human-technology interaction in a smart grid setting (e.g. [21,38,25], 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 energy policy challenge in the EU for the coming years.

Thus, one question addressed in current research is how to transform passive electricity consumers into active energy system participants. One strategy with many advocates is to actively involve users in energy system decisions that might affect them (e.g. [5,15,17]. For instance, authorities and utilities could involve communities in deliberative dialogue regarding where and how new renewable energy production should be built [55]. In the context of smart grids, however, another type of decision profoundly influences the users' possibility of active energy system engagement. These are decisions regarding technology design. This is the subject of our paper.

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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 [50,46,11]. 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 [28,27,44].

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 technology 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 tensions 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 [52] 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 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 was an ambivalence with respect to the role of future users in the project – involve them, but 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 our research methods. We move on to discuss our case, before we conclude by discussing the implications of the paper for research policy and future research in this field.

2. Users, visions and technology development

Scholars in science and technology studies (STS) and related social science have a long tradition for studying relationships between technology design and future users. This also includes studies of the role of visions or imaginaries in technology development processes. One example of this is the by now quite common idea that technology developers script technologies with certain user figurations in mind [2,3]. This implies that technology developers have ideas about who future users are. These ideas encompass specific attributes and competences, as well as limitations. Technology development unfolds with such ideas about users as a backdrop. Hence, when technologies are constructed, so are the future users of these technologies [60].

This means that technology design and development is a social process, and a political process. Imagining users and scripting technologies, implies enforcing potential mechanisms of exclusion. 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 [29]. This can lead to very tangible outcomes such as gender exclusion [42,6] or the exclusion of other minorities [58].

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 [36], and later more broadly in numerous studies on the relationship between expertise and publics [55,5,46], to show how such imaginations influence strategies and decisions. A recurring theme in such studies 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 [24].

Another strand of scholarship pursuing related ideas is the sociology of expectations. This school of thought examines the role of future visions, expectations and imaginaries for contemporary navigation more broadly [10,7,53]. An example of the performativity of future expectations can be found 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 [39]. 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, use the vision of risk-free energy as a rhetorical tool to promote the nuclear energy industry [49].

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 [50,48]. At the same time, many of the 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 [47]. 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*" [52]:69). Thus, users have been understood as a systems problem or a barrier to desired transitions. Devine-Wright [16] 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. [55,5,46]).

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. Wilhite [56] 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.