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Making sense of *sensing* homes: exploring 'regimes of engagement' in a smart urban energy context

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ABSTRACT

Visionary imaginaries of desirable 'smart' urban energy futures entice city governments into innovation and collaboration aimed at large-scale urbanism. As part of attending to actualizations and materializations of 'smart' urban imaginaries, this paper contributes to moving beyond idealized framings of smart urban publics, towards more embedded reflexive accounts of how 'real people' in urban contexts make sense of and reason about smart urban developments. Through a living lab intervention in Bergen, Norway, we open up a space for critical deliberation, to explore situated imaginations and geographies of smart urban futures. We analyse how people reason about their experiences with smart technological devices, expanding on existing practice-oriented urban studies by applying the pragmatic framework of 'regimes of engagement'. We analyse shifts people make between different regimes of argumentation and justification, showing how participants pragmatically handle their (simultaneous) status as energy consumers, urban citizens, and responsible users in an urban energy grid.

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Towards a critical understanding of smart urbanism: expanding conditions for civic engagement in smart city contexts

Contemporary cities have become "key strategic sites through which climate change responses are being mobilized" (McGuirk et al., 2016, p. 146). Following this, research within urban studies, urban geography and science- and technology studies (STS) have addressed the role of cities and urban infrastructures in sociotechnical energy transitions, responding to challenges such as climate change adaptation, energy security and urban resilience and sustainability (e.g. Hodson & Marvin, 2009; Rutherford & Coutard, 2014). Visionary imaginaries of *smart cities* are reshaping debates about desired futures for cities and energy infrastructures and transforming urban governance, by enticing city governments and urban actors into innovation and collaboration aimed at

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large-scale smart urbanism (Luque-Ayala et al., 2014). Such sociotechnical imaginaries (Jasanoff & Kim, 2009, 2013) of smart urban futures are typically *weakly structured* (cf. Bowker & Star, 1999) in common use, characterized by a lack of context and particularity, allowing for different interpretations in individual sites (see also Wiig, 2015). This enables processes of urban policy mobility (Peck, 2011; Prince, 2012), where circulating imaginaries can be strategically mobilized and operationalized by heterogeneous actor networks. As such, 'smart' imaginaries can serve to guide and coordinate action or contribute to increased connection and integration of different domains such as law, politics, science or industry. Expanding on Haas (1992) notion of *epistemic community*, we conceptualize such emerging networks of urban and institutional actors as *techno-epistemic networks* (Ballo, 2015; Rommetveit et al., 2015, 2020), operating through various degrees of technical and regulatory expertise of smart urban developments. Such heterogeneous techno-epistemic networks emerging around smart urban developments and imaginaries can be conceived of as processes of cohering or 'gathering together' of diversely constituted elements. These (net-)work across a heterogeneous 'dispositif', producing governance capacity (Braun, 2014; McGuirk et al., 2021).

Smart urban governance is allegedly becoming data-driven, increasingly drawing on real-time data flows from digitally instrumented devices and algorithms (Barns, 2016; Townsend, 2013). As such, networks of devices and sensors are becoming built into the fabric of urban environments, so that various urban flows and processes (such as traffic, air quality, waste management and energy consumption) can be monitored, optimized and controlled. This can be understood a form of 'big data urbanism', projected as a frictionless and non-ideological way of improving or optimizing the 'post-political' city (Mouffe, 2005; Swyngedouw, 2007). However, narrowing complex urban dynamics into that which can be coded has broad social implications (Kitchin, 2014). Following this, urban scholars have argued for a more critical understanding of smart urbanism (Luque-Ayala & Marvin, 2015). For instance, urban literature has been critical of the forms of governmentality (Gabrys, 2014), subjectivities (Introna, 2016) and spatial geographies of power (Klauser et al., 2014) that such algorithmic governance produces. Furthermore, smart urban imaginaries are typically underpinned by techno-centric, corporate and neoliberal agendas (Sadowski & Bendor, 2018; Söderström et al., 2014), providing seemingly simple technological solutions to complex urban challenges (Viitanen & Kingston, 2014). Within such imaginaries, urban and national governments are portrayed as entrepreneurial facilitators of new markets, with corresponding narrow conceptualizations and (re)framings of urban publics as passive recipients of economic development strategies from urban governmental or business elites (Bulkeley et al., 2016). This strengthens the perception of such imaginaries as apolitical, as technological innovations belonging solely to a market sphere, and not to a civic or political sphere. Such explicit and implicit views of publics can be essential for the framing of lay-expert interactions, affecting the conditions under which people may assert themselves as meaning-makers and political subjects (Rommetveit & Wynne, 2017; Walker et al., 2010). For instance, preferences for public engagement mechanisms can be a function of specific characteristics attributed to '*imagined publics*' (Barnett et al., 2012; Irwin & Wynne, 1996). Furthermore, there is also a disjuncture between such loosely structured 'smart' urban imaginaries and actual empirical findings or localized material developments. While the anticipated future city and the actual city are of course co-constituted,

urban scholars have pointed out the need for attending to the actualizations and materializations of smart interventions and developments (e.g. Hollands, 2008; Shelton et al., 2015), and for considering the local urban capacity and networks of expertise for actually realizing such grand visions (Hodson et al., 2018). This entails exploring the ways that smart urban imaginaries become *strongly structured* (cf Bowker & Star, 1999) or '*made local*' (Peck & Theodore, 2012) as they meet specific place-based material, political and infrastructural conditions and developments.

This paper adds to the critical urban literature on smart imaginaries and developments, engaging with 'real people' in a smart urban context, and exploring possibilities for '*opening up*' new urban spaces for critical deliberation and public engagement. Through an *urban living lab* intervention in Bergen, Norway, we engage with urban actors, studying and analysing what happens as information and feedback of smart energy devices become part of a pre-existing fabric of urban infrastructures and complex household dynamics with well-established habits, practices and meanings (see also e.g. Skjølsvold et al., 2017). The living lab which forms the basis for this empirical research was part of a Joint Programming Initiative (JPI) Urban Europe (2019) called the PARTicipatory platform for ENergy managemenT (PARENT) project: a research project running from 2016-2019 across three European cities; Bergen, Brussels and Amsterdam. The living lab activities in Bergen were led and organised by researchers at the University of Bergen,[1] and included the installation of smart or *sensing* energy monitors, the use of a 'community-centric' online energy management platform,[2] followed by focus group discussions where participants deliberated about their experiences. These discussions showed that practices of energy consumption were intrinsically linked, not only to household dynamics and materialities, but also to broader imaginaries of urban futures, politics and infrastructures. Such arguments and justifications included complex orderings of expectations and imaginations of the role of smart homes as part of the future smart city, and of the normative acceptability and legitimacy of smart technological developments. As such, these deliberations can be analysed as efforts to critique, make sense of, negotiate, and justify smart urban policies and technologies. For this analysis, we draw on Boltanski and Thévenot (1999, 2006) theoretical framework of 'pragmatic regimes', arguing that engaging with and drawing on different argumentative regimes, such as a regime of 'familiarity', 'planning' or 'justification' require different forms of agency, related to different moral conceptions of the good to which actors are committed (Thévenot, 2001). We identify and analyse the ways in which participants in the Bergen urban living lab draw on different pragmatic regimes as they reason about their experiences with smart technological devices, creating novel linkages across everyday energy practices and imaginaries of smart energy systems and smart cities.

On taking the claims of actors seriously: beyond deficit- and obstacle models of 'smart' urban publics

As part of attending to the actualizations and materializations of 'smart' urban developments, there is a need to move past narrow representations of 'smart' urban publics (Cotton & Devine-Wright, 2010; Silvast et al., 2018), and corresponding 'deficit models' (Irwin & Wynne, 1996) for public engagement; in which people are typically regarded as being 'in deficit' if their everyday practices or meanings differ from idealized, technology-centric expectations. In this section, we outline constructions of publics that

are implicitly part of urban and national smart imaginaries. As mentioned, in an effort to move towards more reflexive conceptualizations, we mobilise the theoretical framework of 'pragmatic regimes' (Boltanski & Thévenot, 1999, 2006; Thévenot, 2001), which acknowledge people's critical capacities and competences. Notably, however, the regimes of engagement available to people in a particular urban context is predicated upon institutional, political, material, and infrastructural conditions, which calls for starting out with a further description of this urban context.

The city of Bergen, the urban context for the living lab intervention, is the regional center of Western Norway and the country's second largest city, with a population of about 280 000 people. A smart city initiative and -network was established in 2015 (Nordic Smart City Network, 2019), and at the time of our urban living lab, smart meters had been installed in most households (The Norwegian Water Resources and Energy Directorate, 2019).[3] Bergen has an ambitious *Green Strategy* (Bergen municipality, 2016) and the city has been part of national urban networks promoting sustainable urbanization since 2009 (see also Oseland & Haarstad, 2022). The ambitious urban environmental goals can be understood against the backdrop of Bergen being characterized in governmental white papers as a particularly vulnerable supply area in terms of urban energy infrastructure (see e.g. The Norwegian Ministry of Petroleum and Energy, 2012, p. 167), which has a significant effect on the region's electricity prices[4] at times of scarce energy supply. The Green Strategy also acknowledges Bergen's many grassroots- and community-led initiatives, present in most urban areas, addressing urban sustainability issues[5] and also questioning models of increased production and economic growth (Bergen municipality, 2016). Bergen's municipal plan also includes a description of the city's imagined urban public:

> People from Bergen are known for having strong opinions about what is going on in city life (…), for being engaged, big-mouthed, with a twinkle in their eye. (…) [They] are not afraid to be different and are easily engaged. (Bergen municipality, 2015, p. 24; 49, our translation)

Yet, despite this recognition of the city's engaged inhabitants, this is not necessarily mirrored in possibilities for participation in on-going smart urban developments. To a large extent, such smart developments have been expert-driven and technocratic processes led by regional energy institutions, as with the introduction of smart meters; or public-private smart city innovation projects with the private sector as the main initiator. In both cases, there have been few possibilities for public involvement and the municipality's role has mainly been as an enabler for private sector initiatives in a networked urban governance (Gohari et al., 2020). Following this, our urban living lab intervention in Bergen aimed to 'open up' a space for broader public engagement related to smart urban energy developments, recognizing people's critical capacities and being open to the many ways that people deliberate about and critically assess smart urban imaginaries and developments, as an important step for moving towards more inclusive and socially robust place-based urban futures.

The kind of urban interventions or experiments that are imagined possible or found acceptable in a specific local context also depend on national imaginaries and priorities (Hodson et al., 2018; Jasanoff, 2005). Imaginaries of smart energy futures at the national scale in Norway typically include idealized and de-contextualized constructions of publics, with consumer – or user engagement being emphasized as a way of legitimating

and increasing social acceptability (Ballo, 2015). Users are often foregrounded as having a *key role* in the realization of the smart urban energy grid (see also e.g. Hansen & Borup, 2018). This entails expectations of the role of users as economic rational actors or a kind of 'Resource Man' (Strengers, 2013), providing flexibility to the city's energy grid by adapting domestic energy practices to price signals. Although the Norwegian energy sector has traditionally been characterized by strong local ownership and involvement, and empirical studies highlight environmental concerns as a significant motivation for people to engage in energy efficiency practices (Karlstrøm & Ryghaug, 2012), there is generally a strong emphasis on market measures in Norwegian energy policy contexts (see e.g. Boasson, 2013). To some extent, this can be explained by a gradual increase of the significance of market rationality over the past few decades, following the liberalization of the Nordic energy markets in the 1990s. In the context of 'smart' developments, smart grid demonstration projects exploring technological possibilities for increased user engagement have typically emphasized individual economic incentives (Skjølsvold & Ryghaug, 2015). Furthermore, cost efficiency arguments were highlighted as the main reasoning behind having few possibilities for opting out of the Norwegian smart meter deployment[6] (The Norwegian Water Resources and Energy Directorate, 2011), and expectations of consumers as economic actors are mirrored in the new price tariff model for electricity consumption (The Norwegian Water Resources and Energy Directorate, 2022).

However, economically rational constructions of smart publics have gradually been replaced by historically well-established 'deficit models' of Norwegian consumers being "spoiled", with a lack of interest in and knowledge about energy efficiency measures. For instance, the smart meter roll-out did not include sub-metering technologies for domestic energy management, based partly on expectations of low consumer interest (Ballo, 2015). Such constructions of the public are partly due to the country's extensive hydropower production, which historically has meant relatively low electricity prices (Eurostat, 2019). Consequently, the average domestic electricity consumption in Norway is high compared to other European countries, with widespread use of electricity as the main energy source for domestic heating (Bøeng et al., 2012). Notably though, conflicts and extensive public engagement related to hydropower production have been prevailing since the 1970s, pertaining to issues such as costs of investments, nature conservation and a lack of transparency. Despite this, deficit models of consumers having a lack of interest prevails. Arguably, one can observe a corresponding shift within smart urban energy imaginaries towards a focus on automation and instrumentation (Karlstrøm et al., 2012; Rommetveit et al., 2021), with tasks and responsibilities related to domestic energy efficiency increasingly being delegated to third parties. As a consequence, the idea that there no longer is a need to be concerned with public engagement seems to be gaining traction (Throndsen, 2017). Rommetveit and Wynne (2017) describes this as an epistemic shift where predominant meanings involved in the legitimation of mainstream public initiatives change, which they consider to be a move towards an 'obstacle model' of publics; with publics' issues being viewed as potential threats to imagined futures of necessary (technological) progress and thus needing to be removed or bypassed.

With such a mismatch between tacit views of publics and actually apparent public engagement, it is perhaps not unexpected that public debates and controversies have

emerged both at the urban and national scale regarding smart technological developments, such as with the introduction of smart electricity meters, with questions being raised about various public issues related to privacy, security, health and costs (see e.g. Vigsnæs, 2018) and some conflicts even ending up in court.[7] The last stage of the smart meter rollout in the Bergen area was characterized by increasing contestation. The conflict level has further intensified due to major technical issues with the smart meters (Kjellevold, 2022a; 2022b), coupled with a significant increase in electricity prices. A high reliance on electricity for domestic heating, especially in urban contexts, also constitute a vulnerability related to price fluctuations. These public debates had begun to gain momentum at the time we conducted the urban living lab activities and were on-going as our intervention progressed. This shows how this urban context is characterised by relatively low level of public trust in urban and national energy institutions (see also Ballo, 2015; Rommetveit et al., 2021), but also demonstrate an actual public engagement far beyond what is captured by predominant smart urban imaginaries.

Differentiating types of agency: from 'what is energy for' to 'pragmatic regimes' of engagement

A prevalent theoretical entry point for addressing the gap between optimistic smart city imaginaries and empirical findings related to everyday urban practices has been to apply practice-oriented approaches (e.g. Shove, 2003; Shove & Walker, 2014), often explored through various forms of urban interventions or experiments (Bulkeley et al., 2015). As urban households are increasingly integrated with, and becoming part of, sensing networks of the 'sentient city' (Thrift, 2014), the way people consume electricity have implications far beyond the home. However, in order to understand urban energy demand, we have to understand social practices or *what energy is for* (cf. Shove & Walker, 2014, p. 42). Urban households or homes are meaningful, affective, and relational places (Cancellieri, 2017), characterized by intimate familiarization (Blunt & Dowling, 2006), and "*an accustomed dependency with a neighborhood of things and people*" (Thévenot, 2001, p. 77). Thus, as smart technologies become part of the complex taken-for-granted set of values, rationalities and practices that make up households' moral economies (Hargreaves et al., 2010), attending to the relational practices and spatial geographies of energy demand (Hui & Walker, 2018; Simonsen, 2007) can improve our understanding of forms of 'domestication' and social acceptability of smart objects and technologies (Hargreaves et al., 2017) and ultimately of what kind of smart urban energy futures that might actually become realized. This includes understanding the 'concepts of service' that smart technologies sustain, such as comfort, cleanliness or convenience (Shove, 2003), as well as the role of objects and socio-material urban infrastructures in preconfiguring and co-structuring social practices (Bulkeley et al., 2016; Latour, 2005). Practice-oriented approaches also provide insights about how smart technologies may reduce the familiar capacity of a home or be a source of conflict (Hargreaves et al., 2017). Strengers (2008), for instance, argues that the social and domestic world is guided by what Bourdieu would call 'practical reason/knowledge', while smart energy devices can be located as part of the field of resource management, guided by a 'predict and provide' logic (Marvin et al., 1999). A home is a 'space-in-becoming'

(Nowicka, 2006, p. 73), which means that the introduction and use of digital devices as part of smart urban developments, may transform its interpersonal relations and spatiality (Huber, 2015).

The empirical data from our urban living lab intervention shows, however, that as people are making sense of smart sensing devices, this does not just entail negotiations of potential changes in social practices or households' moral economies. Importantly, it may also include critique and justifications of technological changes as part of broader social and urban developments. Thévenot (2001) criticizes the lack of separation between different forms of agency, or frames of reference, in the notion of 'practice'. Following this, he suggests distinguishing between different 'pragmatic regimes', which he describes as "*social devices that govern the way we engage with our environment*" (p. 14). He describes three main regimes that actors may engage with or draw on; (i) the regime of familiarity, (ii) the regime of regular planned action and (iii) the regime of justification, where each requires different forms of agency, related to different moral conceptions of the good to which actors are committed. Together with Luc Boltanski, he later expanded on the regime of justification (1999, 2006), identifying different 'orders of worth' that constitute common forms of legitimate public evaluation and critique, and a grammar of modes of justification belonging to different 'worlds', such as the civic, domestic, market and industrial world. Later, other justificatory logics have also been included, such as a 'green' or 'ecological' world (Latour, 1998; Thévenot et al., 2000), and a 'project-oriented' or 'network' world (Boltanski & Chiapello, 2005).[8] We thus expand on current practice-oriented approaches by applying the framework of 'pragmatic regimes' (Boltanski & Thévenot, 1999, 2006; Thévenot, 2001), to identify and analyse the regimes of engagement and argumentative registers available to people, as well as the shifts participants make between various regimes. Following this, we wish to contribute to expanding the account of registries under which people in smart urban contexts can recognize and assert themselves as members of a larger collective normative order. We argue that there is a need to recognize the multiplicity of legitimate perspectives in the context of 'smart' urban developments and imaginaries (see also Ballo, 2015) and contribute to a more nuanced account of how smart technologies, imaginaries and logics comes to matter in urban and domestic everyday life.

Opening up spaces for critical engagement: urban living labs as experimental interventions

The approach of geographically embedded living labs acknowledge urban environments as effective arenas for addressing sustainability issues, situated at intersections of the smart energy grid and the city (Bulkeley et al., 2016), with partnerships typically consisting of city governments, industry actors, community organizations, universities and research institutions (Evans & Karvonen, 2011; Voytenko et al., 2016). Urban living labs can be understood as an open-ended research methodology, emphasizing knowledge production through collaborative and participatory processes and the involvement of urban actors in a real-life setting (Dell'Era & Landoni, 2014). We consider urban living lab interventions as having the potential to "*open up and explore alternative circuits of urban knowledge*" (Harris & Moore, 2013, p. 1505); providing a space for the articulation and exploration of alternative imaginations and geographies of smart urban futures,

and for organizing efforts to re-constitute fragmented urban knowledge and capacity to act (Hodson et al., 2018).

The Bergen urban living lab was led and organized by researchers at the University of Bergen, as part of a Joint Programming Initiative (JPI) Urban Europe (2019). Being a university-led and research-focused initiative seemed to increase the legitimacy of this intervention, contributing to an open collaboration and dialogue with participants. The living lab explicitly aimed to 'open up' an inclusive space for critical engagement and deliberation, for people to engage with on-going actualizations of smart city developments and reconfigurations of urban governance. We initially mapped and reached out to urban actors with expertise on local smart urban energy developments, who in this sense could be seen as part of a 'techno-epistemic network' (Ballo, 2015; Rommetveit et al., 2015; 2020) of smart city developments for this area. Drawing on a network of situated expertise and knowledge facilitates place-based reflections, deliberation and imagination. This can also contribute to transcending the project logic of urban experimentation (Torrens & von Wirth, 2021), by involving actors from established communities that are already operating across existing institutional and political boundaries. Sampling was based on a strategy of maximum variation (Bradshaw & Stratford, 2010), which resulted in a local steering group for the intervention consisting of urban actors from the municipality, the regional DSO, an NGO, a prosumer organisation, a local university, a grassroots urban community initiative and a local solar panel company. The steering group functioned throughout the urban intervention and contributed both to the recruitment of participants and to adjusting the living lab to local urban place-based conditions and aspirations. The participants for the broader living lab activities were recruited through an open city-wide public call, which was also circulated within the networks of the steering group actors. A total of 46 urban households from different areas of the municipality, including three prosumers, were recruited for the living lab.

The living lab activities included the installation of smart or *sensing* energy monitors[9], which generated data and visuals on domestic energy consumption that could be accessed in an app and in a customised 'community-centric' online energy management platform, which included analytics for comparisons with other participants and simple gamification elements.[10] The time period for conducting this urban living lab and pilot (2016-2019) coincided with the official roll-out of smart electricity meters, which was being finalised by January 1st, 2019 (The Norwegian Water Resources and Energy Directorate, 2008; 2015a). Notably, however, the official smart meter rollout did not include smart sub-metering devices or access to online energy management platforms. During the intervention, which lasted for 18 months, we cultivated regular contact with the participants, and circulated (monthly) newsletters. Three sets of focus groups were conducted with 5-10 participants, each lasting ca. 2–3 h, led by researchers at the University of Bergen. Open invitations to the focus group discussions were sent out to all participants. Some participated in all of the focus group meetings, others in one or two. Each focus group followed a thematic structure, including participants' reflections on (i) their experiences with smart technologies, (ii) whether and how this potentially transformed domestic (energy) practices, and (iii) whether and how such empirical experiences were linked to the broader urban, political, and infrastructural landscape and imaginaries of smart electricity developments. However, our experience was that

participants switched between these topics on their own initiative starting early in the group discussions, which shows how they pragmatically handled their (simultaneous) status as energy users, household members, citizens, and members of an urban public. Our main empirical sources are qualitative data from these three sets of focus groups, which were recorded, transcribed, and thematically coded based on our theoretical lens of pragmatic regimes (Boltanski & Thévenot, 2006; Thévenot, 2001); familiarity, regular planned action, and modes of justification (mainly civic, domestic, industrial, market, ecological and project-oriented/network). In parallel with the living lab activities, three meetings were organised with the local steering group. Towards the end of the intervention, the participants were also asked to complete a closing survey questionnaire.

We now move on to our analysis of these deliberations and arguments as regimes of justification (Boltanski & Thévenot, 1999, 2006), as efforts to critique, make sense of, justify, and reconfigure smart urban policies and developments. We observe and describe how different forms of agency are at work in performing domestic energy practices, describing the pragmatic shifts participants made between levels of argumentation and justification (Thévenot, 2001). In conclusion, we reflect on the implications of this analysis for processes of urban policy development and decision-making.

Negotiating the limits of the 'comfort zone': the complexity of energy management in a real-life smart urban context

Throughout the living lab intervention, we found that factors such as urban infrastructures, established energy cultures and practices, time-consuming familiarization with- and adaptation to smart technologies, as well as household compositions and dynamics (see also Hargreaves et al., 2017; Shove & Walker, 2014), complicated a 'Resource Man' approach (Strengers, 2013) of achieving change in energy practices and consumption through providing information and feed-back. Although the smart sub-metering devices being introduced through the urban living lab was supposedly a 'plug-and-play' solution, installing and operating these smart energy monitors entailed major technical challenges.[11] This made energy management a time-consuming learning process for participants, which would be a barrier for domestication of such devices (see also Hargreaves et al., 2010). Discussions around technical issues also illustrated low levels of trust towards local energy companies and institutions. Reflecting on what appeared to be wrongful readings of energy consumption by the sensing devices, for instance, brought about questions about the validity of official readings for the electricity bill.

Beyond technical challenges, participants also discussed the ways in which such devices became integrated, negotiated, and how they to some extent interfered with household dynamics and pre-existing urban practice repertoires. A frequently mentioned challenge was to get other household members engaged in energy management, whether that be fellow students living in a shared flat, or children or spouses in family households. This shows that collective social learning processes (Darby, 2006) are significant for the level of engagement with such devices. Discussions about creating engagement among other household members for increasing energy efficiency included pragmatic shifts from a regime of familiarity to a regime of justification, drawing on for instance

'market world' arguments and to some extent mirroring 'Resource Man' configurations (Strengers, 2013). For instance, some participants discussed the idea of introducing financial penalties for certain behaviors for other household members, in particular children. This included engaging with the smart energy devices as backing for such justifications, as a way of obtaining 'proof' of certain arguments:

> … my kids put the floor heating up to full steam, and then leave the bathroom door open. I was hoping to find out [how much this costs], so I would be able to say: 'Listen up, from now on this will be charged from your piggy bank'.

This exemplifies how the introduction of smart energy monitors with 'resource management' logics (Strengers, 2008), can be socially disruptive; reducing the sense of comfort and convenience (Shove, 2003) which characterizes the regime of familiarity. It also shows that such devices can contribute to changes in internal household dynamics by providing data that gives increased weight to certain justifications belonging to 'green', 'market' or 'industrial' worlds (Boltanski & Thévenot, 1999, 2006). While this might contribute to reducing the overall electricity consumption on an urban scale through demand side management, some participants described potential downsides and fears related to introducing such logics within domestic dwellings: "The downside here is huge. You have controlling parents around who will lock their kids up for a week, because they showered for too long". This objection points towards 'civic' world arguments, and exemplifies that 'smart' homes can also intensify what has been termed "*the dark side of home*" (Cancellieri, 2017, p. 58); that homes can be places where the social density of domestic practices can favor forms of social control or domestic abuse (see e.g. Mayhew & Jahankhani, 2020).

Furthermore, a lack of engagement from other household members was also partly explained by references to a broader urban 'energy culture' (see also Wallenborn et al., 2011), especially in households with members from different cultural backgrounds. As one participant put it: "There is no culture here for turning off the light". With situated practices of relatively high electricity consumption, typically against a backdrop of long, cold and dark winters, many described energy-intensive consumption practices as a conscious choice of increasing comfort and wellbeing at home. This included reflections on how certain technologies, such as heat pumps, sustained or enhanced *comfort*, as a 'concept of service' (Shove, 2003). A key concept within such descriptions, related to a regime of familiarity (Thévenot, 2001), was the notion of 'the comfort zone', which arguably needed to be sustained or increased: "We mounted a heat pump (…) and the house changed its character because of the constant heat in the building stock. So it is possible to increase the comfort zone. (…) it's not static". Some stated that the limit of engaging in energy saving practices was reached if the comfort zone got compromised: "We are doing really well (…), until it reaches the comfort zone. If it threatens the comfort zone, it's over". Despite this, however, most participants described an increasing interest in, and engagement for, energy-saving practices (see also Karlstrøm & Ryghaug, 2012), mainly anchored in 'green' world justifications, such as the importance of urban sustainability and stewardship of environmental resources. This included arguments about 'limits to growth', and critical reflections about the historical development and what should be the potential limits of the 'comfort zone':

> We probably had a different comfort zone in the 1950s than we have today. It increases as we move to the next step, and then we set a new standard (…). If the energy consumption increases (…), then this relatively increased comfort is not necessarily positive.

This resonates with the city's Green Strategy's descriptions of people from Bergen as an engaged urban public, and of the local grassroots movements questioning predominant models of economic growth (Bergen municipality, 2016). Ecological or 'green world' arguments were typically given a higher 'order of worth' than market world arguments: "My value choice here is about: 'Can we reduce the total energy consumption?' Not 'Can I save money?' If we can reduce the energy consumption, that is a goal in itself". The same green argument was also emphasized when participants discussed investments in energy-saving technologies, which can be quite expensive compared to the economic savings achieved through reductions in electricity consumption. Notably though, electricity prices were still relatively low at the time of these discussions (Eurostat, 2019), and many participants mentioned that the future prospects of new price tariffs (The Norwegian Water Resources and Energy Directorate, 2015b) or higher electricity prices, could have an effect on their energy practices and possibilities for investing in energy-saving technologies. There was also several critical discussions about the credibility of and trust in local urban energy institutions, especially in terms of the prospect of new network tariffs, with participants questioning the purpose of and motivation behind such developments. These discussions illustrate the relations with the broader urban energy context and conditions, and shows how this urban intervention served as an open space for articulating public issues, concerns, and critique.

As participants reasoned about their experiences with smart and sensing technologies as part of the urban living lab activities, they also linked domestic smart energy practices to broader imaginations of urban energy transformations and futures: " … we are all are part of this project. It's a household project, as part of a larger urban project, which is again part of a national and global transformation of our daily lives". This included critical evaluations of what they considered to be appropriate responses at the domestic and urban scale to the global ecological crisis. As such, participants took on an active role, clearly departing from constructions of publics as passive recipients (e.g. Bulkeley et al., 2016). To some extent, alternative future imaginations entailed a scalar reconfiguration of topics such as nature conservation and potential increases in electricity prices, which had been a source of controversies at both the urban and national level for several decades. A key concept within such deliberations, drawing on both 'green' and 'civic world' justifications, was the idea of *energy solidarity*', and the issue of climate change as a shared global problem: " … we have just one world and one climate. It doesn't help if we go all green, if coal power is fired up right next door". Despite the long history of conflicts related to nature conservation, some argued for expanding the regions' hydropower production, drawing on 'green world' justifications, arguing that such an expansion would enable a reduction of less environmentally friendly energy production in other (European) countries or regions. This included imaginations of Norway as a potential 'green battery' for Europe (see e.g. Gullberg, 2013), as well as 'market world' arguments favoring a further integration with the European electricity market to achieve a reduction in overall electricity consumption, even though this might potentially entail an increase in the regional electricity prices. Such argumentative registers are in sharp contrast to the

emphasis on market measures and economic incentives in national energy policy contexts (see e.g. Boasson, 2013) and of imaginations of energy users mainly as economic actors. This scalar shift related to the idea of global energy solidarity also challenges the situated urban energy culture characterized by energy-intensive domestic practices and the established local nature conservationist practices and views; reconfiguring what has been considered to be 'good' urban and domestic energy practices and values.

The system is like a 'black-box': staying 'in control' of automated smart homes increasingly integrated with the smart urban energy grid

At an early stage, many of the participants in the living lab articulated expectations of the smart energy monitors increasing or creating a feeling of being 'in control' of domestic spaces, through enabling access to data about energy consumption, particularly of specific appliances. There was a particular interest in the impact of visual elements in the app and online platform for encouraging changes in energy practices by "*making energy visible*" (cf. Wallenborn et al., 2011). With the increased feeling of being 'in control', the introduction of such devices seemed to contribute to a regime of 'familiarity', but also to a regime of 'planning', in the sense of optimizing energy efficiency of domestic spaces. For some of the most tech-savvy participants, the 'predict-and-provide' logic (Marvin et al., 1999) of sensing technological devices had been an integral part of their homes and domestic energy practices for years. However, as outlined, most participants ran into both social and technical challenges, which to various degrees made energy management a disruption to their usual comfort at home. Consequently, some argued for the prospect of a smart urban future of *automation*, in line with the increased focus on automation within imaginaries of smart urban energy transformationspreviously described, to avoid such disruption within the regime of familiarity: "For this to work for ordinary people, at a large scale, it has to be automated. (…) It has to be so easy that you can go about your daily life without this causing stress". Imaginations of increasingly automated future smart homes becoming a more integrated part of the energy infrastructure of the smart city were especially apparent, with argumentative registers pertaining to a 'planning' regime, such as discussions of potential investments in new smart appliances or in domestic energy production technologies. However, some participants were also highly critical of imagined energy futures of automation, based on 'green' regime justifications. They expressed concerns that increased automation would make energy consumption *less visible* in people's everyday life, as opposed to smart devices with visualisations of energy consumption, and thus possibly also result in decreased engagement for energy-saving practices.

To a large extent, however, automation was perceived as a desired smart home future, and most participants envisioned some degree of third-party steering of household appliances and thermal loads. Importantly though, being able to stay 'in control' and having the possibility to override automated domestic processes or technologies was continuously emphasized: "If things can be automated, they should be automated. But of course, you must be able to override it". Drawing on arguments related to a regime of 'familiarity', this included being able to decide what to delegate to third parties: "I can make a deal with the DSO that they can steer for instance my hot water boiler, (…) but I have to control the details in the house myself". This emphasis on people being

'in control' themselves departs from imaginations and conceptualizations of publics as passive recipients (see e.g. Bulkeley et al., 2016). These arguments also included critical reflections and sceptisicm about the prospect of an increased integration of the smart home with the larger urban energy grid, related to the low levels of trust in local energy institutions, and the complexity and lack of transparency of the energy system (see also Ballo, 2015; Inderberg, 2015). As one prosumer participant described: "I don't trust the system, it's like a 'black box'". Many expressed general scepticism towards an increased collection of data as part of smart urban developments (see also e.g. Barns, 2016; Shelton et al., 2015), drawing on arguments related to a regime of 'familiarity', with concerns about whether such data might reveal personal information about domestic activities and practices. In such discussions, participants also made shifts towards a regime of justification, linking their concerns to 'civic' justifications of privacy implications and the potential for misuse of data: "The only way to avoid the misuse of data is to not collect the data". Some also emphasized the need to be able to say no to the introduction of smart domestic energy technologies overall: "I am most concerned about being able to say no to this, to keep control of the data. (…) The private sphere is small enough as it is". This was intertwined with reflections about the broader urban energy context and the on-going introduction of smart meters, which was mandatory, with very few options to opt out (see e.g. Oftebro, 2019; The Norwegian Water Resources and Energy Directorate, 2011). This process was perceived as providing few options for individual choice, for instance to safeguard against privacy infringements. In this context, participants drew on 'market world' arguments, arguing that a third-party market of products and services would be preferable, since this would entail at least some freedom of choice.

Some also described fears of *losing control* over increased domestic automation, drawing on 'civic' world justifications, such as concerns about whether this would come at the expense of possibilities for acting as an autonomous citizen: "I am thinking about the long-term perspective, as a citizen (…) If we are not paying attention now, (…) I feel like we lose the autonomy to have an opinion". This included 'planning' regime responses in preparation of potentially dystopian urban futures, for instance considering the engagement and experiences with smart technologies within the urban living lab as a way of improving their knowledge and 'keeping up' with 'smart' technological developments: "The app (…) helps increase awareness, to be ready for the wave of technology that will wash over us". This can be considered as enacting forms of 'energy citizenship' (Ryghaug et al., 2018). Although, this kind of citizenship is arguably limited in terms of actually working institutionalized regimes of engagement (Rommetveit et al., 2021; see also Wahlund & Palm, 2022).

Thus, while the desire to 'stay in control' of smart homes to some extent pertains to a regime of familiarity, or a '*sense of home*' (Cancellieri, 2017), participants also make pragmatic shifts that point towards civic justifications; expressing a desire to be involved in and make their own decisions about what is deemed socially acceptable in terms of delegation of domestic energy management to third parties, and also about other social implications of smart domestic technologies, such as issues related to privacy or data collection. This emphasis on people being actively involved, staying *in control* of home automation and making their own decisions in terms of the application, protection, and storage of energy consumption data is in sharp contrast to emerging imaginaries of

automation and sensor technology (Throndsen, 2017), which to a large extent bypasses civic perspectives and involvement, including in protections of privacy (Rommetveit & Van Dijk, 2022). The way that such expert-driven imaginaries of automation entail a shift from 'deficit model' or 'resource manager' constructions of *imagined publics*, to eliminating or bypassing urban publics altogether (Rommetveit & Wynne, 2017), does indeed substantiate participants' articulated fears related to dystopian imaginaries of 'losing control'.

Conclusion

This paper has discussed some aspects of what happens as *smart* sensing devices enter complex household dynamics, and the ways in which citizens in a specific urban context make sense of, reason about, and justify such smart technological changes as part of broader urban energy developments. Our analysis mobilizes pragmatic sociology as a valuable extension to practice-oriented approaches, showing how different forms of agency are at work in performing domestic energy practices. The paper shows that making sense of smart sensing devices does not just entail negotiations of potential changes within the domestic domain, but also involves reasoning, justifications and critique of such smart technologies as part of broader urban and societal developments.

We have exemplified how participants in an urban living lab constantly change the scope of their engagement, flexibly shifting along a scale of different pragmatic orientations of greater or lesser generality, depending on arrangements specific to the situation; manoeuvring (simultaneously) their status as energy users, citizens, and members of an urban public. Drawing on Boltanski & Thévenot's (1999, 2006) framework of 'regimes of engagement', we argue for moving towards conceptualizations of 'imagined publics' in smart urban contexts that recognize people's critical capacities and the pragmatic shifts between levels of argumentation and justification that people make, with different modes of intervention and agency (Thévenot, 2001), in efforts to critique, make sense of, justify, and reconfigure smart urban political and institutional agendas, goals, and values, and the means through which these become actualized. Such account could potentially contribute towards 'opening up' for broader public engagement related to smart urban developments; expanding available mechanisms and regimes for public engagement. Arguably, urban interventions and experimentation such as the Bergen living lab described in this paper can be utilized as a way of 'opening up' spaces for critical reflections about on-going smart developments and the articulation of alternative imaginaries and geographies of 'smart' urban futures.

Although participants taking part in this urban living lab intervention were to some extent engaged in changing their domestic energy practices in line with the 'resource management' logics of smart sensing devices, such efforts reached a limit when compromising high-consumption energy practices that sustained a '*comfort zone*' or a regime of 'familiarity'. What might contribute to changes of such energy-intensive practices is not just financial measures, but also citizens' critical reflections and situated urban responses related to the global challenge of climate change, mobilizing both 'green' and 'civic' regimes. The concept of '*energy solidarity*' emerged in such discussions, potentially reconfiguring a local history of conflicts related to nature conservation, as well as the status of the well-established 'comfort zone' within the local urban energy culture.

The need to sustain a regime of familiarity was also evident when participants reasoned about how 'market', 'green' and 'industrial' world logics would enter domestic spaces in new ways in future 'smart homes'. Importantly, participants articulated an alternative 'imagined public' as part of future imaginaries of the automated smart home, by strongly emphasizing the need for users to be *in control* of domestic smart technologies and automation processes. As part of these reflections, people made pragmatic shifts that pointed towards 'civic' justifications, supporting forms of 'energy citizenship' (Ryghaug et al., 2018), although this is a limited kind of citizenship in terms of 'actually working' institutionalized regimes of engagement (Rommetveit et al., 2021).

Following this, we argue for the need to take citizens' critical evaluations of smart agendas and policies into account in processes of energy- or urban policy development and decision-making. We suggest that being open to the many ways that people deliberate about- and critically assess future imaginaries and on-going material developments related to 'smart' energy grids or 'smart' cities, would be an important step for moving towards more inclusive and socially robust imagined futures. Such an approach provides a more profound and empirically grounded understanding of the *actual* potential for change of domestic energy practices in specific urban contexts, going beyond implicit desired behaviors that are portrayed in loosely structured smart urban imaginaries. This could give insights into multiple valid public issues, concerns and pitfalls related to smart developments and social acceptability, it could open up for alternative imaginations of smart urban futures, and give insights about whether or to what extent 'smart' imaginaries are actually perceived as desirable urban futures for those who live in smart cities.

This also suggests challenging narrow 'smart' framings of urban governments as entrepreneurial facilitators of new markets or of 'big data' urbanism (Swyngedouw, 2007). Based on the findings and analysis in this paper, we argue for moving towards more inclusive and open-ended processes of urban governance of emerging technological developments, emphasizing inclusive processes and open urban spaces, making room for place-specific interests, and different forms of local and urban knowledge and expertise (see also Hodson et al., 2018). This could also contribute to transcending the project logic of urban experimentation (Torrens & von Wirth, 2021), through the involvement of multiple established communities already operating across existing institutional and material boundaries and (infra-)structures. This entails taking into account the complex processes in which heterogeneous socio-material urban elements and actors constitute themselves, with multiple forms of power and sources of authority to produce governance capacity (McGuirk et al., 2021), as well as people's capacity to respond to governance; with processes of cohering happening through emerging shared sociotechnical imaginaries and other efforts towards alignment. Importantly, one needs to remain attentive to the various ways in which de-centered networked efforts to produce urban governance capacity are embedded in both strategic intent and power relations (McGuirk et al., 2021). However, acknowledging a situated plurality of interests, agendas and future imaginations might "*enhance recognition of the potential of urban governance as a heterogenous space of political possibility, less easily tethered to dominant agendas, interests or aspirations than has previously been imagined*" (McGuirk et al., 2021, p. 775), and thus possibly bring us a step closer to a more inclusive and participatory smart city.

Notes

1. The Centre for the Study of the Sciences and the Humanities at UoB was a partner in the PARENT project (see also www.parent-project.eu).
2. Participants received a sub-meter energy monitor called a 'Smappee', see www.smappee.com. This device also had an accompanying app for domestic energy management. The app showed visualisations of household electricity consumption data disaggregated by individual devices and offered the choice of seeing graphs of consumption over time, for instance, or current consumption in real-time.
3. National regulation set the deadline for completing the rollout of smart meters by January 1, 2019. At this date, 97 percent of the electricity meters had been switched out with 'smart' meters. The remaining 3 percent was delayed due to e.g. technical issues, and that some households rejected the installation of a smart meter or had opted out based on medical certificates (The Norwegian Water Resources and Energy Directorate, 2019).
4. The Norwegian energy system is divided in five different price areas, with prices varying between these areas, depending on the transmission capacity of the electricity grid and where the weather conditions are most favourable for energy production (Statnett, 2022).
5. One example is the grassroots movement called Sustainable Life, with branches in different areas of the city (more information can be found at: www.bærekraftigeliv.no).
6. The only option for opting out was to get a medical certificate for el-sensitivity or other health-related issues. However, households who have opted outstill have to pay for a legally mandated yearly control of their electricity meter (see The Norwegian Water Resources and Energy Directorate, 2019), which has become a topic for Parliamentary debates (The Norwegian Parliament, 2018).
7. Tensions has been high between local DSOs, who constitute a regulated monopoly with the operational responsibility for the smart meter rollout, and people opposing this technology. There have been examples of local DSOs threatening to turn off the electricity in households that have refused to install a smart meter (see e.g. Viseth, 2019). There has also been several instances of households refusing to get a smart meter who has thus received large fees or had to meet in court (Oftebro, 2019), as well as counter-examples of people filing police reports against local DSOs (Ulrichsen, 2019).
8. The concept of a techno-epistemic network (Ballo, 2015; Rommetveit et al., 2015; 2020) which we apply, can be seen as an extension of the concept of networked regimes (see also Rommetveit et al., 2021), in the sense that it refers to organized and networked efforts by institutional actors with forms of technical and regulatory expertise.
9. Participants received a sub-meter energy monitor called a 'Smappee', see www.smappee.com. This device also had an accompanying app for domestic energy management.
10. The app showed visualizations of household electricity consumption data disaggregated by individual devices. It offered the choice of seeing graphs of consumption over time or current consumption in real-time. The participants also received two smart plugs that could be used for steering specific devices or appliances. The online energy management platform was developed by the PARENT project and included specific challenges encouraging environmentally friendly practices with associated points and rankings, and comparisons of total energy consumption with similar households (sorted based on criteria such as number of inhabitants or size of apartment/house).
11. Most participants needed the assistance of an electrician. Additional explanatory guidelines, installation protocols and videos were also created to facilitate the installation process.

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References

Ballo, I. F. (2015). Imagining energy futures: Sociotechnical imaginaries of the future Smart Grid in Norway. *Energy Research & Social Science*, *9*, 9–20. https://doi.org/10.1016/j.erss.2015.08.015

Barnett, J., Burningham, K., Walker, G., & Cass, N. (2012). Imagined publics and engagement around renewable energy technologies in the UK. *Public Understanding of Science*, *21*(1), 36–50. https://doi.org/10.1177/0963662510365663

Barns, S. (2016). Mine your data: Open data, digital strategies and entrepreneurial governance by code. *Urban Geography*, *37*(4), 554–571. https://doi.org/10.1080/02723638.2016.1139876

Bergen municipality. (2015, August 7). Bergen 2030: Kommuneplanens samfunnsdel. https://www.bergen.kommune.no/omkommunen/planer-i-kommunen.

Bergen municipality. (2016, September 21). Grønn strategi, Klima- og energihandlingsplan for Bergen. https://www.bergen.kommune.no/api/rest/filer/V304556.

Blunt, A., & Dowling, R. (2006). *Home*. Routledge.

Boasson, E. (2013). *National climate policy ambitiousness: A comparative study of Denmark, France, Germany, Norway, Sweden and the UK*. Center for International Climate and Environmental Research. (CICERO Report, 2013-02). http://hdl.handle.net/11250/191980.

Bøeng, A. C., Halvorsen, B., & Larsen, B. M. (2012). *Kartlegging av oppvarmingsutstyr i husholdningene*. Statistics Norway. (Document 2014/45). https://www.ssb.no/energi-og-industri/artikler-og-publikasjoner/_attachment/211307?_ts=14a38e530c0.

Boltanski, L., & Chiapello, E. (2005). *The new spirit of capitalism*. Verso.

Boltanski, L., & Thévenot, L. (1999). The sociology of critical capacity. *European Journal of Social Theory*, *2*(3), 359–377. https://doi.org/10.1177/136843199002003010

Boltanski, L., & Thévenot, L. (2006). *On justification, economies of worth*. Princeton University Press.

Bowker, G., & Star, S. L. (1999). *Sorting things out: Classification and its consequences*. MIT Press.

Bradshaw, M., & Stratford, E. (2010). Qualitative research design and rigour. In I. Hay (Ed.), *Qualitative research methods in human geography* (pp. 69–80). University Press.

Braun, B. P. (2014). A new urban dispositif? Governing life in an age of climate change. *Environment and Planning D: Society and Space*, *32*(1), 49–64. https://doi.org/10.1068/d4313

Bulkeley, H., Castan Broto, V., & Edwards, G. (2015). *An urban politics of climate change: Experimentation and the governing of socio-technical transitions*. Routledge.

Bulkeley, H., McGuirk, P. M., & Dowling, R. (2016). Making a smart city for the smart grid? The urban material politics of actualising smart electricity networks. *Environment and Planning A*, *48*(9), 1709–1726. https://doi.org/10.1177/0308518X16648152

Cancellieri, A. (2017). Towards a progressive home-making: The ambivalence of migrant's experience in a multicultural condominium. *Journal of Housing and the Built Environment*, *32*(1), 49–61. https://doi.org/10.1007/s10901-015-9489-7

Cotton, M., & Devine-Wright, P. (2010). Making electricity networks "visible": Industry actor representations of "publics" and public engagement in infrastructure planning. *Public Understanding of Science*, *21*(1), 17–35. https://doi.org/10.1177/0963662510362658

Darby, S. (2006). Social learning and public policy: Lessons from an energy-conscious village. *Energy Policy*, *34*(17), 2929–2940. https://doi.org/10.1016/j.enpol.2005.04.013

Dell'Era, C., & Landoni, P. (2014). Living lab: A methodology between user-centred design and participatory design. *Creativity and Innovation Management*, *23*(2), 137–54. https://doi.org/10.1111/caim.12061

Eurostat. (2019, May 21). *Energy prices in 2018, Household energy prices in the EU increased compared with 2017*, [News release]. https://ec.europa.eu/eurostat/documents/2995521/9802432/8-21052019-AP-EN.pdf/7f42181d-d795-4ce1-9dde-ba93fe247166.

Evans, J., & Karvonen, A. (2011). Living laboratories for sustainability: Exploring the politics and epistemology of urban transition. In H. Bulkeley, V. Castan Broto, M. Hodson, & S. Marvin (Eds.), *Cities and low carbon transitions* (pp. 126–141). Routledge.

Gabrys, J. (2014). Programming environments: Environmentality and citizen sensing in the smart city. *Environment and Planning D: Society and Space*, *32*(1), 30–48. https://doi.org/10.1068/d16812

Gohari, S., Ahlers, D., Nielsen, B. F., & Junker, E. (2020). The governance approach of smart city initiatives. Evidence from Trondheim, Bergen, and Bodø. *Infrastructures*, *5*(4), https://doi.org/10.3390/infrastructures5040031

Gullberg, A. T. (2013). The political feasibility of Norway as the 'green battery' of Europe. *Energy Policy*, *57*, 615–623. https://doi.org/10.1016/j.enpol.2013.02.037

Haas, P. M. (1992). Epistemic communities and international policy coordination. *International Organization*, *46*(1), 1–35. https://doi.org/10.1017/S0020818300001442. http://www.jstor.org/stable/2706951

Hansen, M., & Borup, M. (2018). Smart grids and households: How are household consumers represented in experimental projects? *Technology Analysis & Strategic Management*, *30*(3), 255–267. https://doi.org/10.1080/09537325.2017.1307955

Hargreaves, T., Nye, M., & Burgess, J. (2010). Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors. *Energy Policy*, *38*(10), 6111–6119. https://doi.org/10.1016/j.enpol.2010.05.068

Hargreaves, T., Wilson, C., & Hauxwell-Baldwin, R. (2017). Learning to live in a smart home. *Building Research and Information*, *46*(1), 1–13. https://doi.org/10.1080/09613218.2017.1286882

Harris, A., & Moore, S. (2013). Planning histories and practices of circulating urban knowledge. *International Journal of Urban and Regional Research*, *37*(5), 1499–509. https://doi.org/10.1111/1468-2427.12043

Hodson, M., Evans, J., & Schliwa, G. (2018). Conditioning experimentation: The struggle for place-based discretion in shaping urban infrastructures. *Environment and Planning C: Politics and Space*, *36*(8), 1480–1498. https://doi.org/10.1177/2399654418765480

Hodson, M., & Marvin, S. (2009). Cities mediating technological transitions: Understanding visions, intermediation and consequences. *Technology Analysis & Strategic Management*, *21*(4), 515–534. https://doi.org/10.1080/09537320902819213

Hollands, R. G. (2008). Will the real smart city please stand up? Intelligent, progressive or entrepreneurial? *City*, *12*(3), 303–320. https://doi.org/10.1080/13604810802479126

Huber, M. (2015). Theorizing energy geographies. *Geography Compass*, *9*(6), 327–338. https://doi.org/10.1111/gec3.12214

Hui, A., & Walker, G. (2018). Concepts and methodologies for a new relational geography of energy demand: Social practices, doing-places and settings. *Energy Research & Social Science*, *36*, 21–29. https://doi.org/10.1016/j.erss.2017.09.032

Inderberg, T. H. (2015). Advanced metering policy development and influence structures: The case of Norway. *Energy Policy*, *81*, 98–105. https://doi.org/10.1016/j.enpol.2015.02.027

Introna, L. (2016). Algorithms, governance, and governmentality: On governing academic writing. *Science, Technology, and Human Values*, *41*(1), 17–49. https://doi.org/10.1177/0162243915587360

Irwin, A., & Wynne, B. (1996). *Misunderstanding science? The public reconstruction of science and technology*. Cambridge University Press.

Jasanoff, S. (2005). *Designs on nature: Science and democracy in Europe and the United States*. Princeton University Press.
Jasanoff, S., & Kim, S.-H. (2009). Containing the atom: Sociotechnical imaginaries and nuclear power in the United States and South Korea. *Minerva*, *47*(2), 119–146. https://doi.org/10.1007/s11024-009-9124-4
Jasanoff, S., & Kim, S.-H. (2013). Sociotechnical imaginaries and national energy policies. *Science as Culture*, *22*(2)), https://doi.org/10.1080/09505431.2013.786990
JPI Urban Europe. (2019, January). *Strategic research and innovation agenda 2.0*. The Joint Programming Initiative Urban Europe. https://www.horizon-europe.gouv.fr/sites/default/files/2022-08/t-l-charger-le-sria-de-la-jpi-urban-europe-6895.pdf.
Karlstrøm, H., & Ryghaug, M. (2012). From user to consumer? How households' use of electricity is affected by market deregulation and environmental concern. In Karlstrøm, H. (2012) *Empowering Markets? The Construction and Maintenance of a Deregulated Market for Electricity in Norway*. [Doctoral dissertation, NTNU]. NTNU-trykk.
Karlstrøm, H., Sørensen, K. H., & Godbolt, L. (2012). Consumers as professional and political constructions. On the performativity of energy economics. In Karlstrøm, H. (2012) *Empowering Markets? The Construction and Maintenance of a Deregulated Market for Electricity in Norway*. [Doctoral dissertation, NTNU]. NTNU-trykk.
Kitchin, R. (2014). The real-time city? Big data and smart urbanism. *GeoJournal*, *79*(1), 1–14. https://doi.org/10.1007/s10708-013-9516-8
Kjellevold, K. (2022a, April 5). Forteller om montører som møter trusler om at kniv og skytevåpen skal hentes. – Det er en trist utvikling. Bergens Tidende. https://www.bt.no/nyheter/okonomi/i/7dAyav/forteller-om-montoerer-som-moeter-trusler-om-at-kniv-og-skytevaapen-skal-hentes-det-er-en-trist-utvikling.
Kjellevold, K. (2022b, October 13). BKK Nett mangler kontakt med 7000 målere – ber folk lese av strømmen selv, Bergens Tidende, https://www.bt.no/nyheter/lokalt/i/pQQ6oG/bkk-nett-mangler-kontakt-med-7000-maalere-ber-folk-lese-av-stroemmen-selv.
Klauser, F., Paasche, T., & Söderström, O. (2014). Michel Foucault and the smart city: Power dynamics inherent in contemporary governing through code. *Environment and Planning D: Society and Space*, *32*(5), 869–885. https://doi.org/10.1068/d13041p
Latour, B. (1998). To modernize or to ecologize? That's the question. In N. Castree, & B. Willems-Braun (Eds.), *Remaking reality: Nature at the millenium* (pp. 221–242). Routledge.
Latour, B. (2005). *Reassembling the social – An introduction to actor-network theory*. Oxford University Press.
Luque-Ayala, A., & Marvin, M. (2015). Developing a critical understanding of smart urbanism? *Urban Studies*, *52*(12), 2105–2116. https://doi.org/10.1177/0042098015577319
Luque-Ayala, A., McFarlane, C., & Marvin, S. (2014). Smart urbanism: Cities, grids and alternatives? In M. Hodson, & S. Marvin (Eds.), *After sustainable cities?* (pp. 74–90). Routledge.
Marvin, S., Chappells, H., & Guy, S. (1999). Pathways of smart metering development: Shaping environmental innovation. *Computers, Environment and Urban Systems*, *23*(2), 109–26. https://doi.org/10.1016/S0198-9715(99)00011-3
Mayhew, J., & Jahankhani, H. (2020). Combating domestic abuse inflicted in smart societies. In H. Jahankhani, S. Kendzierskyj, N. Chelvachandran, & J. Ibarra (Eds.), *Cyber defence in the age of AI, smart societies and augmented humanity. Advanced sciences and technologies for security applications*. Springer. https://doi.org/10.1007/978-3-030-35746-7_16
McGuirk, P., Bulkeley, H., & Dowling, R. (2016). Configuring urban carbon governance: Insights from Sydney, Australia. *Annals of the American Association of Geographers*, *106*(1), 145–166. https://doi.org/10.1080/00045608.2015.1084670
McGuirk, P., Bulkeley, H., & Dowling, R. (2021). Urban governance dispositifs: Cohering diverse ecologies of urban energy governance. *Politics and Space C*, *39*(4), 759–780. https://doi.org/10.1177/2399654420957329
Mouffe, C. (2005). *On the political*. Verso.
Nordic Smart City Network. (2019). Nordic Smart City Network, Smart City Bergen. https://nscn.eu/Bergen.

Nowicka, M. (2006). Mobile locations: Construction of home in a group of mobile transnational professionals. *Global Networks*, *7*(1), 69–86. https://doi.org/10.1111/j.1471-0374.2006.00157.x

Oftebro, I. (2019, June 7). Nettselskap går til sak: Nekter å bytte strømmåler – må møte i retten. Teknisk Ukeblad. https://www.tu.no/artikler/nettselskap-gar-til-sak-nekter-a-bytte-strommaler-ma-mote-i-retten/466894.

Oseland, S. E., & Haarstad, H. (2022). Displacing conflicting goals in planning for sustainability? Insights from three Norwegian cities. *Planning Theory & Practice*, *23*(2), 233–247. https://doi.org/10.1080/14649357.2022.2034924

Peck, J. (2011). Geographies of policy: From transfer-diffusion to mobility-mutation. *Progress in Human Geography*, *35*(6), 773–797. https://doi.org/10.1177/0309132510394010

Peck, J., & Theodore, N. (2012). Follow the policy: A distended case approach. *Environment and Planning A*, *44*(1), 21–30. https://doi.org/10.1068/a44179

Prince, R. (2012). Policy transfer, consultants and the geographies of governance. *Progress in Human Geography*, *36*(2), 188–203. https://doi.org/10.1177/0309132511417659

Rommetveit, K., Ballo, I. F., & Sareen, S. (2021). Extracting users: Regimes of engagement in Norwegian smart energy transition. *Science, Technology & Human Values*, https://doi.org/10.1177/01622439211052867

Rommetveit, K., & Van Dijk, N. (2022). Privacy engineering and the techno-regulatory imaginary. *Social Studies of Science*, *52*(6), 853–877. https://doi.org/10.1177/03063127221119424

Rommetveit, K., van Djik, N., & Gunnarsdòttir, K. (2015). *EPINET conceptual analysis: Integrated assessments in technoepistemic networks*. [Discussion Paper], EPINET–Integrated Assessment of Societal Impacts of Emerging Science and Technology from within Epistemic Networks, FP7-SCIENCE-IN-SOCIETY-2011. https://www.researchgate.net/publication/339955772.

Rommetveit, K., van Djik, N., & Gunnarsdòttir, K. (2020). Make way for the robots! Human- and machine-centricity in constituting a European public-private partnership. *Minerva*, *58* (1), 47–69. https://doi.org/10.1007/s11024-019-09386-1

Rommetveit, K., & Wynne, B. (2017). Technoscience, imagined publics and public imaginations. *Public Understanding of Science*, *26*(2), 133–147. https://doi.org/10.1177/0963662516663057

Rutherford, J., & Coutard, O. (2014). Urban energy transitions: Places, processes and politics of sociotechnical change. *Urban Studies*, *51*(7), 1353–1377. https://doi.org/10.1177/0042098013500090

Ryghaug, M., Skjølsvold, T. M., & Heidenreich, S. (2018). Creating energy citizenship through material participation. *Social Studies of Science*, *48*(2), 283–303. https://doi.org/10.1177/0306312718770286

Sadowski, J., & Bendor, R. (2018). Selling smartness: Corporate narratives on the smart city as a sociotechnical imaginary. *Science, Technology & Human Values*, *44*(3), 540–563. https://doi.org/10.1177/0162243918806061

Shelton, T., Zook, M., & Wiig, A. (2015). The 'actually existing smart city'. *Cambridge Jourbal of Regions, Economy and Society*, *8*(1), 13–25. https://doi.org/10.1093/cjres/rsu026

Shove, E. (2003). Users, technologies and expectations of comfort, cleanliness and convenience. *Innovation*, *16*(2), 193–206. https://doi.org/10.1080/13511610304521

Shove, E., & Walker, G. (2014). What is energy for? Social practice and energy demand. *Theory, Culture and Society*, *31*(5), 41–58. https://doi.org/10.1177/0263276414536746

Silvast, A., Williams, R., Hyysalo, S., Rommetveit, K., & Raab, C. (2018). Who 'uses' smart grids? The evolving nature of user representations in layered infrastructures. *Sustainability*, *10*(10), 3738. https://doi.org/10.3390/su10103738

Simonsen, K. (2007). Practice, spatiality and embodied emotions: An outline of a geography of practice. *Human Affairs*, *17*(2), 168–182. https://doi.org/10.2478/v10023-007-0015-8

Skjølsvold, T. M., Jørgensen, S., & Ryghaug, M. (2017). Users, design and the role of feedback technologies in the Norwegian energy transition: An empirical study and some radical challenges. *Energy Research & Social Science*, *25*, 1–8. https://doi.org/10.1016/j.erss.2016.11.005

Skjølsvold, T. M., & Ryghaug, M. (2015). Embedding smart energy technology in built environments: A comparative study of four smart grid demonstration projects. *Indoor and Built Environment*, *24*(7), 878–890. https://doi.org/10.1177/1420326X15596210

Söderström, O., Paasche, T., & Klauser, F. (2014). Smart cities as corporate storytelling. *City*, *18*(3), 307–320. https://doi.org/10.1080/13604813.2014.906716

Statnett. (2022, October 3). Fakta om prisområder. https://www.statnett.no/om-statnett/bli-bedre-kjent-med-statnett/om-strompriser/fakta-om-prisomrader/.

Strengers, Y. (2008). Smart meter demand management programs: challenging the comfort and cleanliness habitus of households, *Proceedings of the 20th Australiasian Conference on Computer-Human Interaction: Designing for Habitus and Habitat (OZCHI '08), USA* (pp. 9–16). https://doi.org/10.1145/1517744.1517747.

Strengers, Y. (2013). *Smart energy technologies in everyday life: Smart utopia?* Palgrave Macmillan.

Swyngedouw, E. (2007). The post-political city. In G. Boie, & M. Paywels (Eds.), *Urban politics now*. NAI.

The Norwegian Ministry of Petroleum and Energy. (2012). Energiutredningen – verdiskaping, forsyningssikkerhet og miljø [White Paper]. (Norges offentlige utredninger 2012: 9). https://www.regjeringen.no/no/dokumenter/nou-2012-9/id674092/.

The Norwegian Parliament. (2018, October). Skriftlig spørsmål fra Åshild Bruun-Gundersen (FrP) til olje- og energiministeren, (Dok.nr. 15:169 (2018-2019)) https://www.stortinget.no/no/Saker-og-publikasjoner/Sporsmal/Skriftlige-sporsmal-og-svar/Skriftlig-sporsmal/?qid=73780.

The Norwegian Water Resources and Energy Directorate. (2008, October). Avanserte måle- og styringssystem (AMS), Forslag til endringer i forskrift 11.mars 1999 nr. 301, Høringsdokument oktober 2008http://publikasjoner.nve.no/dokument/2008/dokument2008_12.pdf.

The Norwegian Water Resources and Energy Directorate. (2011, June). Avanserte måle- og styringssystemer, Oppsummering av høringsuttalelser og endelig forskrift, Dokument 7-2011. http://publikasjoner.nve.no/dokument/2011/dokument2011_07.pdf.

The Norwegian Water Resources and Energy Directorate. (2015a, October). AMS. https://www.nve.no/reguleringsmyndigheten/kunde/nett/ams/.

The Norwegian Water Resources and Energy Directorate. (2015b, May). Høring om tariffer for uttak i distribusjonsnettet. http://publikasjoner.nve.no/hoeringsdokument/2015/hoeringsdokument2015_03.pdf.

The Norwegian Water Resources and Energy Directorate. (2019, April). Smarte målarar (AMS), Status for installasjon per 1.kvartal 2019. Sluttrapport. https://publikasjoner.nve.no/rapport/2019/rapport2019_24.pdf.

The Norwegian Water Resources and Energy Directorate. (2022, July). Ny nettleie fra 1.juli 2022. https://www.nve.no/reguleringsmyndigheten/kunde/nett/ny-nettleie-fra-1-juli-2022/.

Thévenot, L. (2001). Pragmatic regimes governing the engagement with the world. In K. Knorr-Cetina, T. Schatzki, & E. von Savigny (Eds.), *The practice turn in contemporary theory* (pp. 64–82). Routledge.

Thévenot, L., Moody, M., & Lafaye, C. (2000). Forms of valuing nature: Arguments and modes of justification in French and American environmental disputes. In M. Lamont, & L. Thévenot (Eds.), *Rethinking comparative cultural sociology*. Cambridge University Press.

Thrift, N. (2014). The 'sentient' city and what it may portend. *Big Data & Society*, *1*(1), 1–21. https://doi.org/10.1177/2053951714532241

Throndsen, W. (2017). What do experts talk about when they talk about users? Expectations and imagined users in the smart grid. *Energy Efficiency*, *10 (2)*(2), 283–297. https://doi.org/10.1007/s12053-016-9456-5

Torrens, J., & von Wirth, T. (2021). Experimentation or projectification of urban change? A critical appraisal and three steps forward. *Urban Transformations*, *3*(1), 1–17. https://doi.org/10.1186/s42854-021-00025-1

Townsend, A. (2013). *Smart cities: Big data, civic hackers and the quest for a New Utopia*.

Ulrichsen, H. (2019, November 23). Her er strømmåler motstanderne hos politiet: Anmelder Skagerak Nett for trusler. Tønsberg Blad. https://www.tb.no/skagerak-nett/strommalere/nyheter/her-er-strommaler-motstanderne-hos-politiet-anmelder-skagerak-nett-for-trusler/s/5-76-1181416.

Vigsnæs, M. K. (2018, March 9). Nye smartmålere skaper debatt: - Vi vil ikke bli overvåket. https://www.nrk.no/norge/nye-smartmalere-skaper-debatt_-_-vi-vil-ikke-bli-overvaket-1.13951968.

Viitanen, J., & Kingston, R. (2014). Smart cities and green growth: Outsourcing democratic and environmental resilience to the global technology sector. *Environment and Planning A*, *46*(4), 803–819. https://doi.org/10.1068/a46242

Viseth, E. S. (2019). Stenger strømmen hos AMS-nekterne. https://www.tu.no/artikler/stenger-strommen-hos-ams-nekterne/465701.

Voytenko, Y., Mccormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of Cleaner Production*, *123*, 45–54. https://doi.org/10.1016/j.jclepro.2015.08.053

Wahlund, M., & Palm, J. (2022). The role of energy democracy and energy citizenship for participatory energy transitions: A comprehensive review. *Energy Research & Social Science*, *87*, 102482. https://doi.org/10.1016/j.erss.2021.102482

Walker, G., Cass, N., Burningham, K., & Barnett, J. (2010). Renewable energy and sociotechnical change: Imagined subjectivities of 'the public' and their implications. *Environment & Planning A*, *42*(4), 931–947. https://doi.org/10.1068/a41400

Wallenborn, G., Orsini, M., & Vanhavebeke, J. (2011). Household appropriation of electricity monitors. *International Journal of Consumer Studies*, *35*(2), 142–152. https://doi.org/10.1111/j.1470-6431.2010.00985.x

Wiig, Alan. (2015). IBM's smart city as techno-utopian policy mobility. *City*, *19*(2–3), 258–273. https://doi.org/10.1080/13604813.2015.1016275