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Smart consumption: *A Social Sciences and Humanities annotated bibliography*



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Executive summary

Background

- This annotated bibliography is one of four produced as part of the European Commission (EC) funded project *Energy Social sciences & Humanities Innovation Forum Targeting the SET-Plan* (Energy-SHIFTS).
- Energy-SHIFTS has worked over 2019–2021 to contribute to the European Energy Union by further developing Europe's leadership in using and applying energy-related Social Sciences and Humanities (energy-SSH).
- This bibliography offers accompanying context to a set of 100 priority SSH research questions on smart consumption (Robison et al., 2020)¹; these questions were developed through a Horizon Scan process which ran during 2020 alongside three other energy-related topic areas: renewables, energy efficiency and transport and mobility.

Aim

- The bibliography is intended to inform those working in policy and other non-SSH experts on the breadth and diversity of energy-SSH knowledge that characterises the field.
- An annotated bibliography is a list of references to books and articles followed by short descriptions of their content and arguments.
- This bibliography contains 200–300 word annotations to 25 key publications from SSH research on smart consumption, providing a backdrop to the 100 priority SSH research questions described in the separate Horizon Scanning report (Robison et al., 2020).

Approach

- The annotated bibliography presents a selection of social scientific and humanities based publications including journal papers, books and book chapters.
- Publications were selected to reflect the substantive and disciplinary diversity of the energy-SSH field relating to smart consumption, and include works from across e.g. Geography, Psychology, Political Science, Science and Technology Studies,

Sociology, Anthropology, as well as interdisciplinary collaborations.

- Ideas for publications to include were drawn from interviews with 10 energy-SSH experts and responses to the Horizon Scan survey from 74 energy-SSH scholars from across Europe; four Working Group steering committee members then produced the annotations.

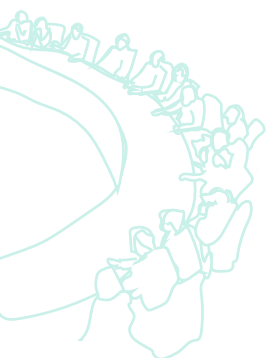
Findings

- Building on early contributions that situated energy consumption as part of broader socio-technical processes shaped by cultural and historical contexts, there has emerged a significant SSH literature on smart consumption.
- In its early incarnations, much of this literature was concerned with assessing how or if smart technologies, new price signals, or new types of information could stimulate behaviour change amongst energy consumers.
- The focus has expanded to probe ways that smart technologies and instruments can become parts of social practice, as well as to highlight the many ways that people can interact with smart technologies, one of them being as energy citizens.
- SSH has become increasingly concerned with how smart consumption is an element of broader institutional configurations, as well as critically discussing how smart consumption is organised and produced through technical and social arrangements.
- An important element of SSH debates about smart consumption relates to justice. Thus articles explore whether smart consumption is a good solution for all, and whose needs might be being overlooked in the pursuit of smart. Here the broader social and economic consequences of an energy transition underpinned by smarter energy consumption are made more visible.
- Policy assumptions about what smart consumption may achieve have been substantially critiqued from SSH, e.g. through accounts that see smart consumption as part of a broader governance strategy that obscures political aspects of energy transitions and new technologies.

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 1 Available at: https://energy-shifts.eu/wp-content/uploads/2020/12/D2.3_WG2_smart-consumption.pdf



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1. Introduction

1.1. Background: energy-SSH and Energy-SHIFTS

This annotated bibliography was developed as part of the *Energy Social sciences & Humanities Innovation Forum Targeting the SET-Plan* (Energy-SHIFTS) project². Energy-SHIFTS has worked to support the EU Energy Union by developing Europe's leadership in energy-related Social Sciences and Humanities (energy-SSH) research. The growing field of energy-SSH has remained marginal in terms of funding and policy impact, giving way to energy research interests dominated by the natural and technical sciences (Foulds and Christensen, 2016; Overland and Sovacool, 2020). However, the EC has expressed a commitment to mainstream SSH research and innovation activities, including supporting standalone energy-SSH projects. As part of this commitment, the Energy-SHIFTS project has therefore worked over 2019 – 2021 to strengthen energy-SSH for European research and innovation, as well as highlight its relevance to EU energy policy. Amongst other activities, Energy-SHIFTS has contributed cutting-edge research priorities from energy-SSH research communities, to help guide and anchor EU research and innovation funding for SSH research and bridge current research-policy gaps. To achieve this, a major part of the Energy-SHIFTS project has been a Horizon Scanning initiative, involving four Europe-wide Working Groups each culminating in the presentation of 100 priority SSH research questions on key topics within the EU Energy Union and EC research and innovation funding priorities, these topics being: (1) renewables (von Wirth et al., 2020), (2) smart consumption (Robison et al., 2020), (3) energy efficiency (Foulds et al., 2020), and (4) transport and mobility (Ryghaug et al., 2020). The four annotated bibliographies, of which this is one, are companion pieces to these four sets of Horizon Scan results.

² For more information about the project, visit the official website: <https://energy-shifts.eu/>

1.2. Aims of the Annotated Bibliographies

The four annotated bibliographies aim to provide a contextual backdrop and sense of the evolution of energy-SSH academic research over time, that can be read alongside the Horizon Scanning reports. An annotated bibliography is a list of references to books and articles followed by short descriptions of their content and arguments. This report provides annotations to 25 key publications in SSH research on smart consumption. The annotated bibliographies are intended to give policyworkers and other non-experts insight into the breadth of energy-SSH knowledge and approaches which characterise the field today. They portray key advances in energy-SSH fields and, as such, offer context for the forward-looking priority SSH research questions.

The annotated bibliographies offer a taste of the main SSH debates, milestones, and advances in the field through a summary of key scholarly contributions, but do not provide full coverage of the field. The ambition is to demonstrate the range and variation of energy-SSH research, incorporating different and sometimes contradictory disciplinary perspectives, research themes and approaches. The bibliographies can give policy workers and other non-experts or new researchers insights to help navigate the SSH field of smart consumption.

1.3. The topic of this bibliography: smart consumption

This annotated bibliography focuses on smart consumption. The Energy-SHIFTS Smart Consumption Working Group has taken 'smart' to refer to technologies which are digitally enabled and networked for (usually real-time) monitoring and/or control. The term 'consumption' shows an emphasis on these technologies in homes, workplaces, and communities, rather



than at industrial scale (Robison et al., 2019). Through a comprehensive, future-looking Horizon Scanning exercise (with methods detailed extensively in Foulds et al., 2019), the Working Group produced a list of 100 priority SSH research questions in the field. In doing this, the Smart Consumption Working Group aimed “To demonstrate how Social Sciences and Humanities (SSH) must play a leading role in smart energy transitions, in dialogue with technologists and policy makers, to accelerate a shift towards a sustainable energy future. To communicate that the social and technical aspects of smart cannot be separated, and the value of SSH in addressing challenging questions including those around values, justice, institutional change, democracy and participation. To reframe the smart consumption conversation, by highlighting how consumption is anchored in existing institutions and systems, which means that transitions challenge power structures and vested interests” (Robison et al., 2020, p.7).

The 100 SSH priority research questions for smart consumption were grouped into seven themes: (1) Power relations and smart energy transitions, (2) Engagement and trust in relation to smart technology roll-out, (3) Exclusion and unevenness in smart futures, (4) Building communities for smart consumption and presumption, (5) How smart can become part of or disrupt everyday life, (6) Beyond smart: evaluating assumptions and alternatives, and (7) Citizen, worker, parent: different roles involved in smart. While the questions highlight pressing topics and perspectives in SSH research on smart consumption, the field is broader, including topics that resist easy categorisation within these seven themes. In this annotated bibliography, we therefore aim to represent some of this broader view of SSH scholarship on smart consumption. Some of the publications presented here therefore do not explicitly deal with smart consumption or energy transitions, but are still important stepping stones and inspiration for stimulating new research topics, interests, perspectives, and debates.

1.4. Methodology for selecting key pieces of literature

As noted, this bibliography accompanies a Horizon Scanning exercise. As part of that work, we conducted 10 interviews with leading SSH scholars who were

tasked with outlining the historical development of the field, including a focus on key publications. This produced around 40 references, which were reviewed for this report alongside the final themes and questions resulting from the Horizon Scan. We wanted a list of publications that illustrated disciplinary diversity and representations, while also providing insights on the historical developments of the field. Most interviewees suggested at least one of the references included here. Following this initial selection, we probed material submitted by 74 scholars from around Europe as part of the Horizon Scan, which contained references to academic work, to fill out gaps. This method allowed for a combination of bottom-up identification of literature and top-down narrowing of scope. In sum, this should provide a useful entry into many key debates in and around SSH on smart consumption. Our selection, however, is by no means intended to be exhaustive, and readers who want a fuller picture should expect to need further reading. Nevertheless, reading this bibliography should give a rapid initial grounding in the breadth of key debates.

1.5. How to use the Annotated Bibliographies

These annotations are short summaries of the original source material and provide a taste of each contribution. We hope readers are inspired to seek out the full publications on their topics of interest. Given the limited selection of publications, readers may also use the list as a tool to discover broader and/or more specific literature in the field. The bibliography may, for instance, be read prior to viewing the 100 priority SSH research questions in the Horizon Scan report, or as an independent source of information.

Readers who wish to go further may choose to explore the four annotated bibliographies from the *Social sciences and Humanities for Advancing Policy in European Energy* (SHAPE ENERGY) project which was a predecessor to Energy-SHIFTS, and offer more extensive reviews of the given fields³. In particular Sumpf et al. 2017 provides 85 SSH references across the areas of ‘Energy system optimisation and smart technologies’. We have deliberately avoided too much overlap, with only 3 publications appearing in both bibliographies (Goulden et al., 2014; Strengers, 2014; Wolsink, 2012).

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3 The SHAPE ENERGY bibliographies are available open access via: <https://shapeenergy.eu/index.php/publications/annotated-bibliographies/>



2. Key SSH literature on smart consumption

2.1. Introduction

As the transition to a more carbon neutral energy system unfolds, there are strong incentives to change not only how energy is produced, but also how it is consumed. First, many scholars are now pointing to the opportunities for strongly reducing greenhouse gas emissions through changes at the demand-side of energy systems, i.e. through new modes of consumption (Grubler et al., 2018). Second, transitions in energy production mean that we will rely more on energy sources such as wind and solar power. The production of electricity from these technologies varies with weather, season, and time of day. This means that supply and demand require different management to match up, as compared to coal or nuclear power. Changing energy consumption patterns is a way of addressing this challenge. Third, a strong element of European decarbonization strategies is electrification e.g. of transport and heat (e.g. Rogge et al., 2020). This might increase the strain on existing, often old, electricity grids. With this as a backdrop, smarter consumption can be a way to avoid large scale investments in electricity grid capacity expansion. All of this has resulted in strong appraisals amongst policy makers, innovators and scholars for ideals such as ‘active consumption’, ‘flexible consumption’ and ‘smart consumption’.

Discussions about how to make consumption smarter are often highly technical, e.g. rooted in questions about how to combine technologies such as energy feedback monitors, home automation systems, batteries and solar PV. There is often a strong focus on the potential for sensors, software and other enabling ICT technologies to help energy systems calibrate the relationship between production and consumption in new, and smart ways.

In this annotated bibliography, our assumption is that smart consumption cannot, and should not, be reduced to a technical issue alone. Decades of SSH

research, as highlighted in this bibliography, support this claim as self-evident. Energy consumption is an activity undertaken (and overseen) by people who occupy spaces such as households, neighborhoods, and cities, within different historical, cultural and political contexts. Changing how, why, what and when we consume energy therefore entails changing how we live, what we do across scales, and how we relate to other people, broader systems, and institutions. Consumption is a fundamentally social and societally embedded activity, which both shapes and is shaped by our societies. The contributions from SSH presented here cover such issues from diverse perspectives, including critical ones, which ask us to consider alternative ways of framing both questions and solutions to contemporary challenges.

2.2. Setting the stage for an SSH-agenda on smart consumption: some historical roots

While the study of smart consumption as discussed in this annotated bibliography is a relatively new endeavour, it builds on past work within SSH which situates consumption as a broad societal phenomenon. The two references discussed in this subsection are of this type, and help us to situate what we today discuss as smart consumption within broader historical and cultural analyses and discussions.

Hughes, T.P., 1983. *Networks of power: electrification in Western society, 1880-1930*. Baltimore, MD: Johns Hopkins University Press.

Published in the early 1980s, this pioneering book on the history of technology contains a series of case studies which detail the invention, development, and



expansion of electricity systems within Western societies. Its relevance for this annotated bibliography lies in its systems-oriented focus; highlighting how the social and technical elements of such systems go hand-in-hand, to such an extent that they cannot meaningfully be separated. Thus, the book illustrates that consumption is not only an act performed by individuals, but rather as one element, or one process within a broader system. Translated into work for advancing smart consumption, this book asks us to zoom out from individual consumers to look at their roles in broader systems, and to understand how specific cultural and historical conditions shape such systems. This illustrates that a concept such as 'smart consumption' needs to be considered as embedded in broader systems (existing or new ones) and that such systems need to be fitted with pre-existing social and technological conditions in the places where they are expected to work.

Lutzenhiser, L., 1992. A cultural model of household energy consumption. *Energy*, 17(1), pp.47-60.

This article was part of an emerging SSH critique in the late 1980s and 1990s which pointed out the problems of assessing energy consumption and energy choices through narrow models of techno-economic rationality. To counter this, this article put forward a cultural model which emphasised the collective character of consumption and choice, noting how groups, not individuals, are the entities we need to understand if we seek to deploy new technologies, new practices and new meanings. This insight is highly valuable when thinking about smart consumption. A key for Lutzenhiser was to stress that different cultural forms, and ways of living across groups, might hold different potentials and constraints in terms of enabling consumption changes. As a hypothetical example, he illustrated the difference between “Retired working class couples – spending most of their time inside modest, well-kept homes in older neighborhoods, [with] limited food habits, [and] short trips in neighborhood” and “Young urban families – with a new baby, new car, smaller unit, newer appliances, fast food, frozen food, travel for commuting, shopping and visiting” (p.56). In terms of promoting smart consumption this suggests avoiding catch-all solutions, while thinking about change in broader terms than individual.

2.3. SSH to support, verify or reject proposed smart technologies and instruments to trigger behaviour change

Many early SSH contributions on smart consumption sought to gather evidence about the relationship between the provision of various forms of feedback on energy use, e.g. via 'smart' energy monitors, and whether this changed users' patterns of energy consumption. Another related strand of research sought to probe social barriers to adoption of such technologies. Hence, while the historical roots of SSH on smart consumption were relatively broad, early application of SSH insights to understand smart consumption were quite limited in scope and mainly served to verify or reject technological or economic solutions to energy system challenges proposed by non-SSH disciplines. In this annotated bibliography we have included two widely cited contributions that synthesised and reviewed insights from such studies.

Darby, S., 2006. *The effectiveness of feedback on energy consumption. A Review for DEFRA of the Literature on Metering, Billing and direct Displays*. Oxford: Environmental Change Institute.

Building on literature that dates from the 1970s onwards, this widely cited report discusses whether feedback technologies, which show users how much energy they use, are able to influence energy consumption. The report builds on the assumption that energy use is invisible to energy users, and that users therefore do not know what difference they could make by changing their behaviour. The report illustrates that feedback can be a useful tool in changing behaviours. A key point of the report, however, is that feedback works in many ways and that to be effective may require combining different forms of feedback, as well as combining feedback with other measures. While feedback is noted as a useful learning tool, its effects must therefore be interpreted in context. The report also notes that the effects of feedback are not uniform: it affects different social groups in different ways. The report is highly policy relevant. It notes that immediate and direct feedback provided over time can have important impacts on consumption behaviours, especially if combined with other measures such as informative billing and annual energy reports. However, it also cautions against



uniform embrace of feedback as a set of technologies assumed to affect behaviour in similar ways across contexts.

Balta-Ozkan, N., Davidson, R., Bicket, M. and Whitmarsh, L., 2013. Social barriers to the adoption of smart homes. *Energy Policy*, 63, pp.363–374.

The starting point for this article is the observation that smart home technologies might provide valuable assistance in realising energy demand management goals, e.g. associated with demand response programs, as well as a range of other cited benefits. The article proceeds to ask why smart home technologies are not more widely adopted and how one could develop new markets for such technologies. Building on past literature, the article identifies a range of social barriers to adoption: poor fit with existing and changing lifestyles, lack of interoperability (i.e. easy recognition and use of new components), perceived lack of reliability, privacy and security, as well as consumer perceptions and attitudes. These identified barriers are then discussed in interviews with technology developers and experts, as well as in workshops with members of the public. An outcome of these interviews and workshops is the addition of costs and trust to the list of potential barriers. Public lack of trust in industry, and authorities' abilities to regulate industry, are noted as important. The authors highlight that there must be a better match between technology development and public interests, e.g. through adopting user-centric design principles.

2.4. The social practice turn, and related approaches: beyond behaviour change

As a critique of the focus on individual responses and social barriers to change, work rooted in theories of social practice have become important in enabling new discussions about stability and change of energy consumption. These approaches note that energy use is never a goal in itself, but a derived demand of multiple interlocked practices, such as driving to work or cooking a meal, and associated with goals like keeping clean or being comfortable. This perspective does not focus on individual behaviour change but see individuals as carriers of practices that consists of ways of acting, forms of knowing, and material things. In this section we also include articles with a focus on technology use that goes beyond the idea of adoption, highlighting the active and generative potential of

technology users in processes of change, e.g. through what is sometimes called domestication.

Wilhite, H. and Lutzenhiser, L., 1999. Social loading and sustainable consumption. *ACR North American Advances*, 26, pp.281–287.

This was one of the first articles that discussed the social foundations of energy demand, and as such it is an important building block in a long-standing SSH debate about how energy consumption can be understood. The article uses the engineering terms of base and peak electricity load as a starting point to develop the concept of social loading. Social base load is an idea which highlights demand for energy that is produced by ordinary, routine, regular activities (e.g. cooking, cleaning, washing, commuting), while social peak loading refers to increases in consumption that arise around specific social events and activities. The authors argue that a focus on social loading helps us re-think energy loads as social accomplishments, noting that physical infrastructure must always be equipped to deal with social peak loads. By mobilising examples from different countries and cultures, the concepts of social base and peak load are used to discuss what constitutes what a society understands as necessary energy consumption (social base load), how this changes over time, as well as the social determinants of social loads. Four determinants are discussed: the role of status and display, the role of sociality and conventionality, the role of security and convenience, and the embeddedness in systems and structures. In terms of policy, the article urges us to think of consumption as a social and political phenomenon, which should be actively discussed and deliberated on. It notes that many of the things we take for granted are the results of framing (e.g. is a small car inferior or is it 'sporty'), and that there is political scope to debate what we as individuals and societies deem necessary.

Hargreaves, T., Nye, M. and Burgess, J., 2010. Making energy visible: A qualitative field study of how householders interact with feedback from smart energy monitors. *Energy Policy*, 38, pp.6111–6119.

This article represents one of the first qualitative field studies carried out with households using real-time displays to monitor their domestic energy consumption. Based on interviews with 15 UK householders trialling smart energy monitors of differing levels of sophistication, the authors focuses on householder motivations for acquiring the monitors, how the monitors have been used, how feedback has changed consumption behaviour, and the limitations to further behavioural change the householders experienced. Smart energy monitors,



it would appear, are only as good as the household, i.e. the social and political contexts in which they are used. Ensuring that these contexts are supportive of changes in domestic energy consumption patterns seems vital if smart energy monitors are to realise their potential. Several direct policy implications are apparent from the field study. Monitors need to look good to fit in with the wider household, the information they provide needs to be clear, transparent and flexible (i.e. presentable in a variety of formats and perhaps customisable) so that it can easily be related to everyday practices and contextualised. Further, monitors should address whole households rather than individual consumers. Finally, and keeping with other contributions in this bibliography, the wider policy and business context should be configured to support changes based on monitor information.

Goulden, M., Bedwell, B., Rennick-Egglestone, S., Rodden, T. and Spence, A., 2014. Smart grids, smart users? The role of the user in demand side management. *Energy Research and Social Sciences*, 2, pp.21–29.

This article focuses on the role of users in smart grids. It discusses how two different conceptions of the energy systems demand side ('energy consumers' and 'energy citizens') tend to stimulate and generate different forms of engagement. The notion of energy consumers tends to signal a passive consumer who hands limited control of some devices over to other actors to manage. Energy citizens signals an active citizen who 'manages' process of consumption and sometimes generation. The authors propose that smart grid design must transgress the technology itself and recognise that a smart user, who is actively engaged with energy, is critical to many demand side management proposals. More than just a technological project, however, a smart grid has the potential to fundamentally change the social dynamics of the energy system. Ultimately, the authors argue, the most effective smart grid will be one in which intelligence is sourced from users as well as devices.

Smale, R., Spaargaren G. and van Vliet, B., 2019. Householders co-managing energy systems: space for collaboration? *Building Research and Information*, 47(5), pp.585–597.

This is one of several SSH articles that expands on the role of households in smart energy systems through a social practice perspective. In doing so, it focuses on the role of households as co-managers in energy

systems, emphasising that smart energy systems tend to imply new responsibilities for households in terms of managing supply and demand in the energy system. The article uses a social practice approach to home energy management and distinguishes between consumption practices and home energy management practices. Home energy management practices are portrayed as those which involve oversight of energy use in the home (and thus may involve tasks to do with buying or monitoring electricity). They therefore sit between energy consuming practices (e.g. cooking) and production and distribution practices within the broader energy system. Analysing the use of a series of technologies, this article highlights the importance of information – not only as a way of communicating price, but as a way of elevating energy as an asset to be managed. Further, the article highlights that homes consist of domestic spaces and utility spaces. Home energy management systems are often confined to utility spaces (garages, attics, storages), but the authors argue the importance of using domestic space (kitchens, living rooms) actively in energy management.

Ryghaug, M., Skjølsvold, T. M. and Heidenreich, S., 2018. Creating energy citizenship through material participation. *Social studies of science*, 48(2), pp.283–303.

This article studies citizen participation in energy transitions, specifically how material devices can enable participation. On the one hand this entails an expansion of how to think about participation in transitions, and on the other hand it entails moving beyond a traditional understanding of social acceptance of new technology. The article probes participation through photovoltaic solar cells, electric vehicles and smart meters. The authors observe how the use of such technologies is not only influenced by attitudes held by users but how the use of these technologies becomes part of re-constituting the ways that citizens engage with energy and climate issues more broadly. The technologies in question become part of processes of producing new forms of awareness, new forms of knowledge and new actions and practices. This sometimes translates into broader forms of political and practical engagement also within other domains. In terms of smart consumption, the article provides a repertoire of opportunities for policy makers and designers, in thinking about how to design and deploy technologies that mobilise wider understandings of why humans act, other than those concerned with price.



2.5. Institutional and organisational dynamics of smart consumption

Publications in this section are concerned with smart consumption as an element embedded in and shaped by broader institutions and organisations. This means that analyses in this section go beyond treating consumption as individual acts conducted by consumers, instead focusing on how such acts are produced in relationships between actors and things. The publications explore themes including governance, innovation, and trust in infrastructures.

Luque-Ayala, A. and Marvin, S., 2016. The maintenance of urban circulation: An operational logic of infrastructural control. *Environment and Planning D: Society and Space*, 34(2), pp.191-208.

This article elaborates on new forms of governmental structures associated with smart technologies by using digital urbanism and urban resilience as a point of departure. This uncovers novel ways of seeing and engaging with the city. A detailed case study of Rio de Janeiro's Centro de Operações Rio (COR) is discussed. COR is a metropolitan control room aimed at integrating public and private organisations in charge of managing urban infrastructure. COR represents coupling between networked infrastructures and information technologies and is designed to function both as a daily operation centre and an emergency response centre. COR seeks to integrate two sectors: logistics (aviation, transportation, freight, distribution) and nodal points of commercial spaces (sporting facilities, shopping centres, office complexes). However, the priority is given not only to the material flow of resources (waste, traffic, water, power), but also to the configuration of information as a key urban resource. Constant information flow is the new nature of the city. The authors show how the citizens become operational components of the infrastructure through this control room. With this, the article describes how a new form of governance is established, where the city is managed as a logistical enterprise developing control mechanisms through information technologies.

Wolsink, M., 2012. The research agenda on social acceptance of distributed generation in smart grids: Renewable as common pool resources. *Renewable and Sustainable Energy Reviews*, 16(1), pp.822-835.

This article explores what the author calls the social foundations of smart grids. The article argues that current smart grid developments with substantially distributed energy generation suffer from an overtly technical focus. Most technical studies apply largely unfounded assumptions about the participation of actors. However, ongoing problems with deployment of renewable energy have shown that implementation is largely determined by a broad range of social acceptance issues, such as policy makers' rejection of new institutional configurations, or citizens unwillingness to change consumption patterns. The basic assumption of the article is that smart grids are socio-technical systems founded on organisational principles. They consist of decentralised networks that underpin the electricity consumption of groups of end-users who are increasingly becoming autonomous. These socio-technical networks form communities that exhibit high levels of interaction and integration between the actors. The author concludes that the governance of emerging smart grids may become a textbook example of a new kind of environmental governance. On the one hand, there are high expectations of smart grids, and on the other a complete lack of understanding of the need for institutional change required to establish them in real life. Research as well as policy agendas should therefore focus on how such new systems become institutionally embedded, and how they are socially constructed.

Pallesen, T. and Jenle, R.P., 2018. Organizing consumers for a decarbonized electricity system: calculative agencies and user scripts in a Danish demonstration project. *Energy Research & Social Science*, 38, pp.102-109.

Drawing on an empirical study from Denmark, and building on the sociology of markets, this article critiques much of existing social scientific literature which tends to claim that humans do not act as rational economic agents. Instead, the authors note that humans indeed sometimes do act as *homo economicus*, but are quick to note that this should not be considered an integral part of human nature. Instead, the authors urge us to consider economically rational behaviour – or what they call 'calculative agency' – as an outcome of work which e.g. includes the making of new markets, the training of users and the installation of technical equipment to assist in decision-making. The authors note that smart energy systems tend to be designed based on principles of control, which



means that embracing the messiness of everyday lives as a design principle is not straightforward. In light of this, the authors call for new types of interdisciplinarity, which would require both engineers and social scientists to work harder to understand the logics behind their respective work. This suggests that policy makers should stimulate research which re-thinks the relationship between social and technical research. By transgressing stereotypes anchored either in the social sciences or economics, such work could assist in creating new kinds of smart consumption.

Bulkeley, H., McGuirk, P. M. and Dowling, R., 2016. Making a smart city for the smart grid? The urban material politics of actualising smart electricity networks. *Environment and Planning A: Economy and Space*, 48(9), pp.1709-1726.

This article deals with the city as a site for governance of smart energy digitalisation and management of energy-related big data. The authors note that smart energy systems in cities lead to new forms of governmental interventions operating at the conjunction of the grid and the city. The article focuses on one case study of practical smart city governance, a major Australian, Federal government initiative called the Smart Grid Smart City initiative. The project was enacted in the Sydney and Newcastle Metropolitan region, Australia between 2010 and 2013, and at the time it was considered one of the widest-ranging technology assessments of smart grid products in the world, with the potential and goal of enabling no less than a new electricity economy. Based on this example, the authors argue that the urban context is not a mere background to the transition in electricity provision and use, but central to its politics, while electricity is also critical to the ways in which we should understand the politics of urbanism. It is argued that through seeing smart cities as both urban projects and grid projects, broader insights into the politics of governing energy in Australia's cities might be generated.

Grandclément, C. and Nadaï, A., 2018. Transitioning through markets. In: Labussiere, O. and Nadaï, A. (eds.), *Energy transitions: A socio-technical inquiry*. Cham: Palgrave Macmillan. pp.101-142.

This book chapter examines various aspects of the contribution of markets to the energy transition. Its relation to smart consumption lies in its examination of markets as instruments to incentivise private actors to engage in energy transition processes. It explores the practical consequences of the close association between energy transitions and markets by using analytical tools from economic sociology. Through four

case studies on energy transition processes in France, the authors critically examine the transition of energy markets. The case studies reveal a series of market-like devices, rather than substantive market forces. Building on the sociology of markets, the article highlights that markets do not exist in and of themselves, but that they are products of the work and processes conducted by a series of actors and organisations; complex processes define and shape who can participate in energy systems such as buyers, sellers, commodities and marketplaces, as well as what they can each do. To policy makers this signals that smart consumption is the outcome of complex processes of work, definition and role attribution through devices and actions – emphasising that such processes can also be affected through policy making.

Ritzer, G. and Jurgenson, N., 2010. Production, consumption, prosumption: The nature of capitalism in the age of the digital 'prosumer'. *Journal of consumer culture*, 10(1), pp.13-36.

This article provides a sociological exploration of prosumption in the context of contemporary capitalism; 'prosumers' are those who both generate and use energy, such as homeowners who install solar panels. It is part of an agenda to explore prosumption as a generic phenomenon and does not explicitly deal with energy. Its relevance here is that it explores how combining processes of production and consumption might affect social and economic relationships, which in the context of energy transitions have been made pertinent with the proliferation of solar panels and smart grids. The authors argue that in prosumer capitalism, control and exploitation take on a different form than in other types of capitalism. Four characteristics of prosumer capitalism are elaborated in the article: (1) capitalists have more difficulty controlling prosumers than producers or consumers and there is a greater likelihood of resistance by prosumers; (2) the exploitation of prosumers is less clear-cut; (3) a distinct economic system may be emerging where services are free and prosumers are not paid for their work (or in our case, energy); and (4) there is abundance rather than scarcity, a focus on effectiveness rather than efficiency in prosumer capitalism. The authors note that prosumption has always been important, but that in late capitalism, there is a tendency towards attempting to capitalise on the free labour sometimes provided by prosumers. In the context of this report, the article provides a critical reading of contemporary calls from energy policy makers for more prosumers and a more active demand side, suggesting that we should be wary of the potential exploitative relationships that we might be establishing and building future energy systems upon.



Sumpf, P., 2019. *System Trust: Researching the Architecture of Trust in Systems*. Berlin: Springer.

This book explores the importance of trust in systems – from legal systems and training systems to political systems – for the functioning of modern society. The author applies this thinking to the energy system, and in particular the decentralisation of energy and transition from fossil fuels to renewable sources in Germany. He poses the question: if trust is essential to the success of future (smart) energy systems, how will this be secured? The book contains sixteen hypotheses, including that systems need to build stable identities to become objects of trust, and that an ‘architecture of trust’ is built in order to make abstract systems like energy real for participants (or ‘trustors’). Amongst the book’s conclusions are a prediction that trust will come to play a greater role than currently in energy systems, as we move towards smart grids. The author observes that, unlike in the twentieth century, the increase in prosumer involvement in the energy grid means there may be systemic consequences if trust is lost.

Woodruff, A., Augustin, S. and Foucault, B., 2007. Sabbath Day Home Automation: “It’s Like Mixing Technology and Religion”. In *Proceedings, SIGCHI conference on human factors in computing systems*, pp.527-536.

This article presents a qualitative study of 20 American Orthodox Jewish families’ use of home automation technologies for religious purposes, primarily observing their role in Jewish religious rules on the Sabbath. It highlights American Orthodox Jews as a leading group in home automation practice, but a group which has been overlooked in home automation research. By focusing on the use of home automation to augment spiritual life the article highlights assumptions and biases often present in smart technology research, which has a tendency to over-emphasise values such as efficiency or mastery. In doing so, the article illuminates significant heterogeneity amongst households’ lifestyles, goals and value systems. The article translates learning from the study into three principles for consideration in future design of home automation systems: ‘surrender of control as a design resource’; ‘support for varied lifestyles and long-term goals’; and ‘respite as a mandate and as a community experience’. This article is useful for highlighting an alternative perspective on smart consumption, encouraging more heterogeneity in smart consumption research, and demonstrating the value of the above in relation to building a more holistic picture of how smart consumption interacts with different elements of social, family and spiritual life.

2.6. Unevenness and justice aspects of smart consumption

Promoting smart consumption might seem like a neutral endeavor. However, SSH scholars increasingly show how that is not the case. Different groups have different means and opportunities of participating in the activities that provide the benefits of smart consumption, which means that the benefits and burdens of smart energy systems will often be distributed unevenly across territories, between generations, and across social groups. The articles referenced in this section look at the background for and consequences of such inequalities, while asking how they can be avoided, thus providing key insights for policy makers on issues that are often overlooked.

Barnicoat, G. and Danson, M., 2015. The ageing population and smart metering: A field study of householders’ attitudes and behaviours towards energy use in Scotland. *Energy Research & Social Science*, 9, pp.107-115.

This article builds from the principle that smart technologies must be inclusive of diverse populations if they are to be adopted and used efficiently, and if they are going to bring the intended benefits. The article specifically focuses on older tenants in rural Scotland, examining their attitudes and behaviours towards energy use in the home after the installation of smart meters and in-home displays. Results from four research elements are given, encompassing: current and past engagement with energy use, strategies for managing energy use and alleviating fuel poverty, perceptions of using smart technologies, and external control of home energy. This article presents several implications for policy makers, outlining areas where the experience of research participants differed from assumptions in energy planning and practices. For example, habitual fuel-rationing practices were identified during non-peak times of the day, despite energy (gas) rates being cheaper. Low knowledge of energy pricing, energy efficiency and smart technologies were also identified as potential barriers to technology adoption and positive user experiences. The above points challenge assumptions that uptake of residential demand-response will automatically follow the introduction of variable pricing. More generally, this study serves as a reminder that assumptions built into energy planning and policy practices should be tested



on diverse user groups in order to check whether the approach is likely to yield intended results, and/or whether one size fits all approaches are appropriate.

Powells, G. and Fell, M.J., 2019. Flexibility capital and flexibility justice in smart energy systems. *Energy Research & Social Science*, 54, pp.56-59.

Written from a sociological perspective, this article engages with the notion of flexibility in energy consumption and the potential justice implications of instigating flexible consumption. The article discusses conceptually how one can think about a situation where flexibility is desired from an energy systems perspective and incentivised accordingly. This would entail penalising peak load energy consumption, while economically rewarding load shifting. The article discusses the possibility for citizens to contribute to such an endeavour in terms of flexibility capital. Flexibility capital illustrates how different households have different capacities in terms of economic capital, technology ownership, home ownership, size of home etc., and that these differences in capacity influence the possibility of reaping the economic rewards from selling flexibility. For example, people who own a house, have an electric vehicle and many other loads (e.g. induction oven, large water boiler, floor heating) to play around with have more flexibility to sell than those who rent a small apartment and who mainly use a few essential loads. This means that people with high shares of flexibility capital can actually afford to opt out of providing flexibility, while those who have few means to provide flexibility may be forced to do so, or incur economic penalty. The policy implications of these dynamics are that policies meant to stimulate flexibility should also develop and implement tools that seek to avoid injustices inflicted by flexibility schemes.

Strengers, Y., 2014. Smart energy in everyday life: are you designing for resource man? *Interactions*, 21(4), pp.24-31.

This article describes the archetype of a rational, individual, masculine energy consumer – ‘Resource Man’ – around which many smart technologies are built. The article then challenges this dominant image, arguing that very few households or individuals actually reflect the archetype in practice. It points to several risks of ‘designing for Resource Man’, including: consumer apathy or disengagement, ignorance of the daily activities and social practices that actually implicate energy consumption, and a tendency to encourage new forms of consumerism in the consumption of smart energy devices and services. The article closes with five recommendations for designing future smart technologies

such as: embracing messiness, designing for others (different social groups, family structures, dwelling types etc.), and questioning common assumptions in design processes. The article provides a practical challenge to current dominant design paradigms and highlights how they may fail to deliver desired results if deployed unquestioningly at scale. New principles for smart technology design may help to overcome these hurdles ensuring that technology serves a broader diversity of people, practices, lifestyles and living situations. This can ultimately contribute to greater reductions in overall energy demand, demand peaks and greenhouse gas emissions whilst serving a wider range of social needs.

2.7. Beyond smart: questioning assumptions and evaluating alternatives

The critique of current ways of promoting smart consumption has also prompted calls for radically different thinking about smart technology and how it might change our societies. Studies that do this often end up calling for alternative ways of mobilising ICT technologies to instigate change, or more creative ways of understanding human rationality.

Boucher, A., Gaver, W., Kerridge, T., Michael, M., Ovalle, L., Plummer-Fernandez, M. and Wilkie, A., 2018. *Energy Babble*. London: Mattering Press.

This book presents the outputs from a collaborative study between Design and Science and Technology Studies researchers. During the project, researchers created computational devices called ‘Energy Babbles’, described as ‘automated talk radios for energy’ consisting of synthesised voices reading out energy-related content from a variety of sources (e.g. policy announcements, social media, National Grid etc.). The devices were given to eight participating community groups in the UK who focused on community energy demand-reduction, and reactions they provoked were observed. The book presents research findings in textual and visual formats. A key aim of this book is to present differing views alongside each other in the same space, rather than attempting to synthesise this ‘babble’ into a single narrative. This research is useful for policy makers as it explores the complexities of public engagement with and understanding of energy-related issues. Importantly, it highlights the heterogeneity of views and reactions within even fairly small, engaged communities. It also highlights the



agency and expertise held within energy communities, inviting researchers to reconsider how participants are characterised, and engaged with, for future research studies.

Sadowski, J. and Levenda, A.M., 2020. The anti-politics of smart energy regimes. *Political Geography*, 81, 102202.

The main argument of this article is that energy systems, including smart energy systems, are political. This is explained using the concept of technopolitics, which outlines how technological systems and infrastructures embed and enact politics – even where they are superficially presented as a-political. The USA and Australia are presented as two national case studies providing empirical evidence of politics within smart energy system development. The article demonstrates how smart energy systems are not only the subject of de-politicisation on a technocratic basis, but also through neoliberal processes of deregulation and marketisation. Anti-politics, conceptualised as a way of doing politics by destroying the political, is highlighted as a particular form of technopolitics that is emergent in the smart energy space. In particular, anti-politics is characterised by the extension of real-time energy markets and the shaping of ‘good’ market subjects through automation, removing human messiness and inefficiency from market function. This article is useful in highlighting the political implications of decisions and philosophies that may otherwise be assumed not to hold political consequence. This can provide a valuable prompt for policy makers to re-assess where and what political assumptions are built into their work, whether these are intentional, and whether they will support policy outcomes to align with desired goals.

Morozov, E., 2013. *To Save Everything Click Here: Technology, solutionism and the urge to fix problems that don't exist*. London: Penguin.

This book has popularised and brought to a large readership the types of critical analyses that scholars from SSH have often provided on what Morozov calls ‘technological solutionism’. The book does not specifically concern smart energy consumption, but rather engages broadly with how contemporary culture tends to uncritically praise new technologies based on the collection and exploitation of data, e.g. by making algorithms that assist in consumption choices, systems that gamify choices, or markets that sell new types of products that are based on the collection and analysis of data in near real time. The book is concerned with the dark side of such developments, noting that while rhetorically promoting free individual choice, such

technologies tends to concentrate economic power and other elements of control in a few hands, while catering for capitalism based on surveillance and triggering behaviour change through cynical manipulation. The policy relevance here is clear, as the book calls for developing new institutions that regulate the action of big technology companies to benefit the public good, governance procedures that work to anticipate and mitigate dark side consequences, as well as acknowledging the political aspects of new technologies.

Kitchin, R., 2015. Making sense of smart cities: addressing present shortcomings. *Cambridge journal of regions, economy and society*, 8(1), pp.131-136.

This article describes and critiques research on smart cities. The article points to the seemingly common sense and non-ideological character of the smart agenda rhetoric, which has obscured the political assumptions, ideologies, processes and consequences built into smart cities. The article then outlines the development of a smaller body of critical smart city research aiming to fill this gap. However, the author also points to shortcomings in this literature. The article argues for the need to expand on the historical understanding of smart cities, by analysing the term's differential origins and interpretations, developmental paths, influential actors, and inbuilt economic/political assumptions. Further, the article critiques the tendency to use overly general (‘one size fits all’) analytical approaches when seeking to understand smart cities. The article also criticises the use of canonical examples, i.e. a small number of smart, typically newly built cities (e.g. Masdar in the United Arab Emirates) – and a lack of comparative research. Finally, the article highlights weak collaboration with technically-oriented stakeholders as a gap in critical smart city research. The article is a useful tool for highlighting gaps in knowledge that policy makers should be aware of when developing smart city policies, which are arguably also key contexts for the promotion of smart consumption. It may also be useful for funding bodies looking to advance research that targets these gaps.

Bina, O., Inch, A. and Pereira, L., 2020. Beyond techno-utopia and its discontents: on the role of utopianism and speculative fiction in shaping alternatives to the smart city imaginary, *Futures*, 115, 102475.

This article builds on a body of work regarding ‘smart city imaginaries’ (SCIs); visions of technologically-enhanced urban futures used actively in policy and planning. It takes a critical stance on many mainstream SCIs as presenting a ‘techno-utopian’ vision of the future that risks glossing over potential negative side



effects for citizens and the environment, for example erosion of political agency or reduction of access to green space. However, the article does not take an anti-utopian view. Rather, it argues that engaging with different forms of utopianism can become a useful analytical tool. To do this, the article analyses 57 ‘culturally significant’ speculative fictional representations of technologically-driven futures. The authors argue that engaging with this kind of literature can be valuable for two main reasons. Firstly, utopian depictions can help to explain, bring to life, and expand existing

social scientific critiques of SCIs. Secondly, they can help people to creatively engage with the construction of new and different SCIs. This article provides a useful reminder of the importance of engaging with artistic and literary disciplines, alongside other forms of social and scientific study, in creating visions for the future. It is also valuable in highlighting how practising this form of interdisciplinarity can broaden the collective imagination of what it is possible to build in the future, potentially promoting more inclusive and environmentally friendly approaches.



3. Concluding remarks

This annotated bibliography has surveyed the breadth of scholarship characterising SSH research on smart consumption. It has illustrated how the field emerged in broader SSH debates focussing on the cultural and historical contexts of consumption. As smart consumption became a more distinct theme, much early literature was concerned with assessing how or if smart technologies, new price signals or new types of information could stimulate behaviour change amongst energy consumers. The focus has later expanded to probe ways that smart technologies and instruments can become parts of social practice, as well as to highlight the many ways that people can interact with smart technologies, one of them being as energy citizens. Further, SSH has become concerned with how smart consumption is an element of broader institutional configurations, as well as critically discussing how smart consumption is organised and produced through technical and social arrangements. Finally, an important element of SSH debates

about smart consumption relates to justice. For whom is smart consumption a good solution, and for whom is it not? What are the social and economic consequences of an energy transition underpinned by smarter energy consumption?

Thus SSH research offers both critical and productive perspectives for how policy and (smart) technology development can better be facilitated, to achieve more sustainable futures. We believe these debates and insights need to be much better reflected in policy, which today over-emphasises targets related to technically and economically 'optimal' solutions whilst turning a blind eye to the discussions raised in this report.

We by no means intend the list of articles in this report to be exhaustive. Yet, we think this bibliography characterises some of different avenues of scholarship and debates within the field and we hope readers are inspired to seek out in-depth knowledge on smart consumption.



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