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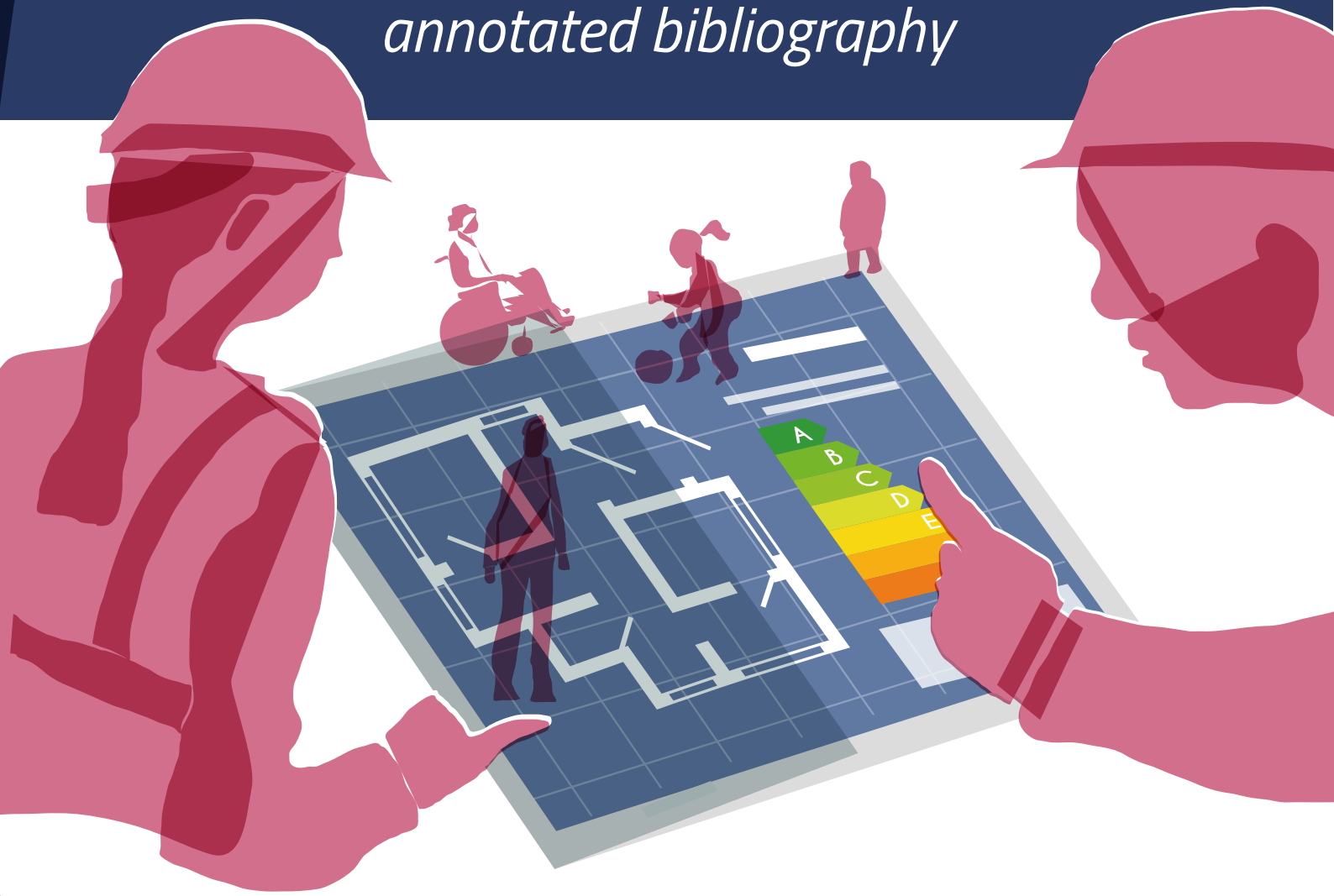
Energy efficiency:
A Social Sciences and Humanities annotated bibliography



Energy-SHIFTS
ENERGY SOCIAL SCIENCES & HUMANITIES INNOVATION FORUM TARGETING THE SET-PLAN

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June 2021

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Executive summary

Background

- This bibliography was developed as part of the European Commission (EC) funded project Energy Social Science Humanities Innovation Forum Targeting the SET-Plan (Energy-SHIFTS), which contributes to the European Energy Union by further developing Europe's leadership in using and applying energy-related Social Sciences and Humanities (energy-SSH).
- The annotated bibliography offers context to the Horizon Scan results developed through the project.

The aim

- This report provides annotations to 24 key publications in SSH research on energy efficiency and should serve as a companion piece to the 100 priority SSH research questions in the Horizon Scanning report.
- This report is intended to inform policymakers and other non-experts on the breadth of energy-SSH knowledge that characterises the field today.

The approach

- The annotated bibliography presents a selection of peer-reviewed scientific publications that contextualise the research priority questions identified in the Horizon Scan.
- Publications were selected to reflect the substantive and disciplinary diversity of the energy-SSH field.

The findings

- We structured past SSH contributions to the energy efficiency literature around six themes: SSH overviews and syntheses of energy efficiency (subsection 2.1); innovations in and of energy efficiency (2.2); policies and politics of energy efficiency (2.3); challenging behavioural assumptions of energy efficiency roll-out (2.4); lived experiences of energy efficiency (2.5); and, moving to issues of energy demand (2.6).
- It is clear that SSH has much to offer the normative pursuit of widespread energy efficiency. SSH can therefore offer more in-depth understanding of and new pathways for such pursuits, than a traditional reliance on, for example, the rational choice assumptions of mainstream Economics approaches to energy efficiency. Examples include policy mixes, transition pathways, modelling assumptions, innovation processes, experimentation, lived experiences, expectation management, and the consideration of various (e.g. professional) actors beyond that of the usual 'end-user'.
- This said, it is also clear that much of the SSH literature remains firmly ambivalent with energy efficiency as an end-goal. Indeed, there are many papers dedicated to its critique (e.g. assumptions within its underlying paradigm) and many relatively new papers that argue for research/policy communities to fundamentally shift their attentions to instead focus on bigger questions of energy demand (i.e. energy conservation and sufficiency, over efficiency).

Contents

Executive summary **3**
Contents **4**
1. Introduction **5**
1.1. Background: energy-SSH and Energy-SHIFTS 5
1.2. Aims of the Annotated Bibliographies 5
1.3. The topic of this Bibliography: Energy efficiency 5
1.4. Methodology for selecting key pieces of literature 6
1.5. How to use the Annotated Bibliographies . 6
2. Key pieces of Social Sciences and Humanities (SSH) literature on energy efficiency **7**
2.1. Social Sciences and Humanities (SSH) overviews and syntheses of energy efficiency 7
2.2. Innovations in and of energy efficiency 9
2.3. Policies and politics of energy efficiency . 10
2.4. Challenging behavioural assumptions of energy efficiency roll-out 11
2.5. Lived experiences of energy efficiency 12
2.6. Moving to issues of energy demand..... 14
3. Concluding remarks **17**
4. Acknowledgements **18**
5. References **19**

1. Introduction

1.1. Background: energy-SSH and Energy-SHIFTS

This annotated bibliography was developed as part of the Energy Social Sciences and Humanities Innovation Forum Targeting the SET-Plan (Energy-SHIFTS) project. Energy-SHIFTS supports the EU Energy Union to develop Europe's leadership in energy-related Social Sciences and Humanities (energy-SSH) research. The field of energy-SSH has remained marginal, giving way to energy research interests dominated by the natural and technical sciences (Foulds and Christensen, 2016; Overland and Sovacool, 2020; Robison and Foulds, 2019; Royston and Foulds, 2021). However, the EC has expressed a commitment to mainstream SSH research and innovation activities, including supporting standalone energy-SSH projects.

The Energy-SHIFTS project aims to strengthen energy-SSH for European research and innovation, as well as strengthen its relevance to EU energy policy. Energy-SHIFTS contributes cutting-edge research priorities from energy-SSH research communities, which can guide and anchor EU research and innovation funding for SSH research and thereby bridge the current policy gap. Through its Horizon Scanning initiative, four Europe-wide working groups presented 100 priority SSH research questions on key topics within the EU Energy Union and EC research and innovation funding priorities: (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 annotated bibliographies are companion resources to these Horizon Scan outputs.

1.2. Aims of the Annotated Bibliographies

The annotated bibliographies aim to provide a contextual backdrop and sense of the evolution of academic research, which is intended to be read alongside the 100 priority SSH research questions in the Horizon Scanning reports. An annotated bibliography is a list of references to academic books and articles, accompanied by short descriptions of their content and arguments. Specifically, this report provides annotations to 24 key publications in SSH research on energy efficiency. It is one of four annotated bibliographies, alongside renewables, smart consumption, and transport and mobility. These annotated bibliographies are intended to give policyworkers and other non-experts insight into the breadth of energy-SSH knowledge and approaches that currently characterise the field. They portray the main relevant advances in energy-SSH and, as such, offer context for the forward-looking priority SSH research questions.

The annotated bibliographies therefore offer a taste of the main SSH debates, milestones, and advances in the field through a summary of key scholarly contributions, without providing 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 policyworkers and other non-experts (or new researchers) insights to help navigate the SSH research relating to energy efficiency.

1.3. The topic of this Bibliography: Energy efficiency

This annotated bibliography focuses on energy efficiency, as a clear priority of EU energy, climate, and now Green Deal policies. The Energy-SHIFTS Working Group on energy efficiency took the EU's 2012 Energy Efficiency Directive as a starting point for defining the group's scope, which refers to "*the ratio of output of performance, service, goods or energy, to input of energy*" (European Parliament and Council, 2012: article 2, point 4; p.10). Critically, the Working Group did not regard energy efficiency as being equivalent to energy-saving behaviours, but was open to critical perspectives that more deeply considered energy efficiency in light of wider energy demand (and energy sufficient) considerations (Foulds et al., 2019; Foulds et al., 2020).

Through a comprehensive, future-looking Horizon Scanning exercise (Foulds et al., 2019a), the Working Group produced a list of 100 priority SSH research questions, primarily relating to EU funded research and innovation on energy efficiency. These 100 questions together aimed to "*promote SSH research that better situates energy efficiency in relation to social systems of energy demand and supply; and to constructively challenge notions of energy efficiency by opening up questions of its meanings, applications and implications across diverse contexts, actors and scales*" (Foulds et al., 2020, p.7).

The 100 SSH priority research questions for energy efficiency were clustered across seven themes: (1) Citizenship, engagement and knowledge exchange in relation to energy efficiency; (2) Energy efficiency in relation to equity, justice, poverty and vulnerability; (3) Energy efficiency in relation to everyday life and practices of energy consumption and production; (4) Framing, defining and measuring energy efficiency; (5) Governance, policy and political issues around energy efficiency; (6) Roles of economic systems, supply chains and financial mechanisms in improving energy efficiency; and (7) The interactions, unintended consequences and rebound effects of energy efficiency interventions. While these questions highlight pressing topics and perspectives in SSH research on energy efficiency, the field is broader, encompassing topics that resist easy categorisation within these seven themes. In this annotated bibliography, we, therefore, aim to present a broader view of what constitutes SSH scholarship on energy efficiency, which does not always relate to the normative pursuit of ever greater (energy) efficiency. Nevertheless, these key pieces are important stepping stones and inspiration for stimulating new research topics, interests, perspectives, and debates.

1.4. Methodology for selecting key pieces of literature

Our 24 publications were selected based on their relevance to the research priority questions in the Horizon Scan and policyworkers. This selection includes peer-reviewed scientific publications, review articles, monographs and anthologies.

The selection criteria were diversity and disciplinary representation to highlight the breadth of the energy-SSH field. Publications were selected following 10 expert interviews with SSH leaders with significant experience working in the broad areas of energy efficiency research. These 10 interview participants were also part of the energy efficiency Working Group, and thus did also formally contribute to the Horizon Scanning exercise. The interviews were conducted between January and February 2020, in the initial stages of the Horizon Scanning. Interview participants included energy-SSH experts working on a range of topics and within different disciplinary traditions, and geographical and gender diversity (Foulds et al., 2019a, p.17-18, p.25). Each participant submitted approximately five publications they considered seminal for the development of the field. From these, a selection of publications was included in the annotated bibliography based on number of citations, perceived impact within the field, and contribution to new research avenues and themes within the field. Some publications suggested in the interviews were excluded because they lacked a focus on SSH, were less relevant to the Working Group theme, or were marginal in terms of their impact and relevance to the topic and our definition of energy efficiency. The authors then identified gaps based on the participants' descriptions of the development of their fields and key research themes that emerged during the Horizon Scanning exercise. Additional complementary publications were sourced from the Horizon Scanning survey responses (evidence and rationale for proposed research questions) and the authors' expertise within the field.

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 seek out 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 may also be interested in reading annotated bibliographies from the Social Sciences and Humanities for Advancing Policy in European Energy (SHAPE ENERGY) project[1], which was the predecessor to Energy-SHIFTS and offers more systematic reviews of the given fields.

1 https://shapeenergy.eu/index.php/publications/annotated-bibliographies/

2. Key pieces of Social Sciences and Humanities (SSH) literature on energy efficiency

Research on energy consumption, conservation and security began in earnest in the 1970s, partly in response to the oil crisis at the time; this increasingly involved calls for greater energy efficiency at both micro- and macro-levels. In the decades that followed, more and more SSH research (although mainly Economics-led) was undertaken in the pursuit of improving energy efficiency levels, albeit against the backdrop of energy supply issues usually being prioritised over energy demand issues. But it was not, however, until the 1990s that this SSH research went beyond these techno-economic positions; the likes of Lutzenhiser, Shove, Wilhite and others were central to this evolution of the literature. Since then, there was a ballooning of SSH research on energy efficiency, especially during 2000-2015 approximately, mirroring policy interest in energy efficiency as a route to addressing energy poverty and carbon reduction goals. In more recent years, we would argue that many SSH researchers who had published widely on energy efficiency began to evolve their work to e.g. critique and explore the implications of the next generation of energy-related techno-fixes (including smart technologies), and/or moved beyond energy efficiency in exploring wider systemic issues of how energy demand is socially and culturally organised (including calling for energy sufficiency).

In the following six sub-sections, we present six themes representing clusterings of similar SSH literature. These themes primarily relate to current debates within the critical-SSH literatures, and we do thereby push back against the traditionally-dominant (instrumental) utilisation of SSH as a dissemination tool for technology transfer of energy efficiency. We therefore intentionally exclude much of the SSH literature that still enable the continuation of such arguments - and policy positionings - as including these would directly contradict a core ambition of this bibliography: to demonstrate the diversity, richness and overlooked potential of much of the energy-SSH literature.

2.1. Social Sciences and Humanities (SSH) overviews and syntheses of energy efficiency

Given the array of studies around energy efficiency over recent decades, there have been a small number of review articles that set themselves the task to offer overviews of past works and critically distill cross-cutting lessons. These review papers have reiterated the point that energy efficiency research has been dominated by technical research interests, and hence Engineering research dominates the evidence base. But within the relatively small subset of SSH-focused papers on energy efficiency, these overviews and synthesis papers also emphasise that the research that is meant to be more societal in its remit is still really rather techno-economic in its positioning. As such, the illustrative papers that we cover below step back in identifying the research gaps and policy dangers of this mainstream, technical energy efficiency agenda. Within this, questions are also raised of the normative assumptions of energy efficiency, i.e. that energy efficiency is good for societies and that it should be a priority in energy and climate change strategies. All the papers complicate such interpretations and suggest avenues through which SSH can contribute to a more nuanced view on energy efficency.

Patterson, M.G., 1996. What is energy efficiency? Concepts, indicators and methodological issues. *Energy Policy*, 24(5), pp.377–390.

Written at a time when energy efficiency was only starting to take hold in mainstream energy policy agendas, this paper unpicks what energy efficiency indicators are and usefully problematises the concepts and methodologies that underpin their development

and implementation. Whilst much of this paper is Engineering in nature, the interdisciplinary stance leads to a number of SSH-related findings. Firstly, Patterson argues that the assumption that thermodynamic measurements are fundamentally objective is wrong; value judgements exist and thus the way that energy efficiency performance is calculated is not "free of human values and perceptions" (p.383). Secondly, energy efficiency can be assessed at multiple scales and, as such, systems-level considerations only add to the complexity of any methodology being applied. Thirdly, assessing energy efficiency requires one to draw boundaries (e.g. regarding energy input definitions), which are often not transparently presented, properly justified, nor thoroughly thought out. The paper argues that these issues need due consideration, if energy efficiency policies are to be appropriately monitored.

McAndrew, R., Mulcahy, R., Gordon, R. and Russell-Bennett, R., 2021. Household energy efficiency interventions: A systematic literature review. *Energy Policy*, 150, pp.112136.

In focusing on household-level energy efficiency interventions, McAndrew et al. undertook a systematic review of 160 publications (over 1990 to November 2019) and 153 relevant interventions. They specifically explored how effective energy efficiency interventions were in advanced economies, in the context of of households. Their reviewed energy efficiency interventions were shown to improve: health and well-being; thermal comfort; air quality; productivity; energy security; and social capital. These benefits were said to justify the place of energy efficiency within dominant energy policy agendas, although they cautioned that the evidence was mixed and that there were actually significant inconsistencies and gaps in e.g. intervention types, approaches, population groups, etc. More work was therefore needed to inform evidence-based policymaking, including more comparisons for instance. They finish by recommending that energy policy move beyond a "one-size-fits-all approach" (p.9) by grounding its interventions in specific theories, clear purposes, local contexts, and targets on co-benefits.

Dunlop, T., 2019. Mind the gap: A social sciences review of energy efficiency. *Energy Research & Social Science*, 56, pp.101216.

This review demonstrates that a mere 2.6% of energy efficiency research literature over 1909-2018 (totaling 155,156 publications) is from the Social Sciences, and thus Dunlop argues that this underrepresentation needs to be urgently addressed - not least because of energy efficiency's prominent positioning in energy policies globally. In propelling the Social Science literature on energy efficiency, she cautions that deeper discussion is needed on what exactly 'energy efficiency' means from a Social Scientific perspective, in both conceptual terms and in how interventions are designed. Such frank debate is essential given the value judgements that are embedded within different approaches to energy efficiency. In particular, the review argues that more attention is needed on: the historical aspects of energy efficiency relating to its origins and evolutions, including its connections to societal notions of efficiency more broadly away from energy; how our socially-shaped value judgements are shaping how we measure energy efficiency; a deeper interrogation of the (contested) benefits of energy efficiency and the default assumption that its roll-out will always represent a social good; and, finally, a greater utilisation of Sociological approaches in unpicking the consequences of energy efficiency solutions (e.g. in relation to energy justice issues).

Lutzenhiser, L., 2014. Through the energy efficiency looking glass. *Energy Research & Social Science*, 1, pp.141–151.

The focus of this paper is on what is said to be an overused 'model' that dominated both research and policy discourse on energy efficiency. The paper argues that even if this model is not explicitly discussed, it is implicitly present in the fundamental arguments put forward for (and about) energy efficiency. The model in question assumes a rational, linear, predictable, and ordered roll-out of energy efficiency technologies, which is only made possible because of the assumed predictability and stability of society. A key message from this paper is that this model inherently conflicts with the problem definitions posed by Social Scientists, and thus the mainstream rationales and approaches that sit behind energy efficiency are argued as being at odds with what the Social Sciences bring to the energy efficiency (policy) discussion. In this vein, the paper strongly argues for greater research and policy consideration of the political and institutional contexts that produce and maintain societal visions and approaches to energy efficiency.

2.2. Innovations in and of energy efficiency

Energy efficiency policy and research has largely focused on innovations as means for transitions. SSH mainly contribute to this theme by studying innovation processes historically and empirically. The papers included in this theme reject the idea that innovations are driven by technology or markets alone. They explore how other factors – such as policy and politics, societal structures, technology framings, and collectively held norms and values, together with technology and markets – spur innovations. Innovation, here, is conceived as the outcome of negotiations between a broad variety of directly or indirectly involved actors and actor groups. This implies that innovations rarely are progressing in a linear way and that there is no single factor or actor that is able to move a new technology from its inception to widespread adoption. Instead, what this literature captures are tensions, abrupt changes and composite motivations that characterise innovation trajectories

Geels, F.W., Schwanen, T., Sorrell, S., Jenkins, K. and Sovacool, B.K., 2018. Reducing energy demand through low carbon innovation: A sociotechnical transitions perspective and thirteen research debates. *Energy Research & Social Science*, 40, pp.23-35.

This paper gives an overview of issues related to the emergence, diffusion and impacts of radical innovations aiming at reduced energy demand. Arguing against the simplifications of Neo-classical Economics and Social Psychology, the authors first introduce a socio-technical transition perspective and then discuss 13 related key research debates. Topics touched upon include: the power struggles between challengers and incumbent actors; the question of scalability; the role of space and place; how economics and financing should be organised; the nature of diffusion and how it can be accelerated; how user practices affect and are implicated in innovations; the existence, strength and causes of rebound effects; the availability and appropriateness of quantitative impact modelling tools; the co-construction of impacts; and, the role of policy and politics. The paper concludes with a summary of the central characteristics of a low-carbon transition; involving systemic, cultural and political change, and characterised by pervasive uncertainty. The paper can serve as a starting point for those who are looking for useful entries to a specific aspect of low-carbon demand-side innovation, and also for those who are interested in looking at a comprehensive picture of a broad set of issues that are at stake when demand-side energy reduction is conceived as an important part of climate change mitigation.

Lovell, H., 2008. Discourse and innovation journeys: the case of low energy housing in the UK. *Technology Analysis & Strategic Management*, 20, pp.613-632.

Lovell tells the story of the innovation journey of low energy housing in the UK, from its beginnings in the 1970s to the (paper's) present. Based on interviews and documentary analysis, she analyses the discourses that have framed, promoted and impeded the development and diffusion of sustainable housing and the coalitions of actors sharing these discourses. While in the 1970s, a broader movement for radical social change experimented with buildings that conserve energy and was mainly motivated by a desire for autonomy, the 1990s saw a reframing of language and problems. Here, the lack of innovation in construction, poor construction quality, fuel poverty, and traffic congestion were added to concerns about energy and climate change. Leading to the present (i.e. 2008), Lovell describes how a low-carbon discourse coalition had become dominant in UK policy. According to Lovell, central in this process were early pilots, above all the BedZED and Hockerton housing developments, which provided the public, professionals and policymakers with physical evidence of the feasibility of low-carbon construction. This evidence, however, was not without problems, as it favoured a particular framing, which neglected negative consequences of a one-sided reliance on technological solutions. Two lessons drawn from this brief history are particularly relevant beyond the UK. First, based on the presented observations, Lovell warns against the tendency of projecting current discourses into the past, which produces stories of innovation journeys that in reality were much less friction-free and linear leading. Second, the UK story resonates with developments in many other countries, where the same shift occurred from sustainable housing being part of a broader vision for social change to becoming framed as a technological fix, which is embedded in the promise that climate change mitigation, comfort and cost-efficiency can be achieved at the same time.

Morrissey, J.E., Dunphy, N.P. and MacSweeney, R.D., 2014. Energy Efficiency in Commercial Buildings: Capturing Added-Value of Retrofit. *Journal of Property Investment and Finance*, 32, pp.396–414.

Energy retrofitting of commercial buildings is a prime example of the so-called energy efficiency paradox,

based on the observation that cost-efficient energy saving measures are only hesitantly implemented. This paper provides an analysis of the whole value-creating process involved in energy efficiency retrofits. After a thorough discussion of tangible (i.e. monetary) and intangible value created by retrofit activities, the authors set out to empirically study the different stakeholders' viewpoints and relations. To make sure that the whole life cycle of energy efficiency retrofits is covered, they identify six life cycle stages (which they call activity hubs) on which value is created: upstream; initiation and viability; design and planning; construction/implementation; operation and maintenance; and, end of life. Based on 57 interviews with professionals involved in these stages across Europe, they then propose a model of informational, monetary, and value flows in office construction and retrofit projects. They found that perceptions of value vary considerably between and within the involved stakeholder groups, which in turn influences the focus of value creation activities. Moreover, temporal perspectives – which matter greatly in questions of *when* a value is expected to materialise – were found to be different among stakeholders. Because of this complexity, a key message of the paper is that only a careful analysis of the various perceptions of value (both tangible and intangible) is able to yield the knowledge required to increase market uptake of energy efficiency innovations.

2.3. Policies and politics of energy efficiency

This theme of SSH work addresses a series of interrelated and complementary sets of issues surrounding energy efficiency policy and politics, by posing different sets of questions. The historically informed empirical analyses, which draw from Science and Technology Studies (STS) and Innovation Studies, trace some of the most important shortcomings of energy efficiency policy and the corresponding goals, while offering fruitful insights on some of the possible ways towards overcoming them. While some work focuses on how the authority of (EU) energy efficiency policymaking is contested, attained and managed, other work offers insights on how to mobilise key actors and address key issues (e.g. energy poverty) that can expand the policy links and have a positive impact on policy goals. The papers pay attention to the need for consistent and coherent policies and calls for a shift on how energy efficiency policy is defined, understood and implemented.

Bergman, N. and Foxon, T.J., 2020. Reframing policy for the energy efficiency challenge: Insights from housing retrofits in the United Kingdom. *Energy Research & Social Science*, 63, pp.1-12.

Directly aimed at policymakers and industry stakeholders, the paper provides policy recommendations for overcoming the shortcomings of stimulating (large-scale) investments for residential energy efficiency. Even though the study is UK-focused, Bergman and Foxon provide insights that transcend the country-specific case study. The authors argue that the dominant policy framing for addressing market failures is insufficient in resolving the lack of investments, especially for overcoming concerns by investors. By shifting the focus away from market failures, which limit the scope of the problem and the avenues for taking action, the authors show how a different pathway can – at least, partly – resolve some of the shortcomings of achieving the policy goals. Namely, Bergman and Foxon argue that the lack of coherent and long-term policies can halt the mobilisation of various actors, which could otherwise be involved and play an incremental role towards the achievement of the policy targets. Drawing from interviews with key stakeholders and an extensive literature review, they suggest three aspects of a more systematic policy framing, namely: energy efficiency as infrastructure; new business and financing models for energy efficiency provision; and decentralised financing institutions for energy efficiency investment (p.3). Each of these framings can provide (new) policy links that can enable further investments and engage the correspondingly relevant actors in the process.

Kern, F., Kivimaa, P. and Martiskainen, M., 2017. Policy packaging or policy patching? The development of complex energy efficiency policy mixes. *Energy Research & Social Science*, 23, pp.11-25.

Investigating policy mixes involves the combined study of policy instruments and policy goals, and how they change or evolve overtime. Through a comparison between the UK and Finland, the authors trace differences and similarities in the energy efficiency policy mixes for buildings, from 2000 to 2014. They specifically examine how changes in such policy mixes can affect policy outcomes over time, in the hope that their ex-ante evaluation can offer guidance on how best to achieve energy efficiency policy goals. They discuss how their policy mixes included four processes – layering; drift; conversion; and, replacement – which influence the coherency of policy goals, and thus ultimately the effectiveness of the policy. Kern et al. also adopt concepts of policy packaging (i.e. where previous policies are discarded) and policy patching (i.e. where

additions and/or substitutions are made to existing policies), in discussing two different policy design processes, which can help to provide coherence and consistency between policy goals and instruments. Based on the differences found between the two case studies, the authors provide good suggestions for how the conceptual framework can be applied, while providing insights on how policy coherence can be achieved regardless of the policy mixes that have been adopted.

Dupont, C., 2020. Defusing contested authority: EU energy efficiency policymaking. *Journal of European Integration*, 42, pp.95-110.

Covering a period of nearly fifty years (1970s-2020), Dupont traces changes in the dominant types of contestations surrounding the EU's energy efficiency policymaking. With contestations on policymaking being a constant, the author suggests strategies for how to manage them. Such strategies mainly build on a discussion of previous EU efforts for establishing authority. Essentially, the author poses the following questions: "How has the EU attained the authority(-ies) of doing energy efficiency policy?" and within the context of attaining this authority "What have been the dominant types of contestations that the EU responded to, and how were they resolved?". By shifting the attention to the links between contestations and authority, the author provides useful insight on understanding the policymaking process(es). This enables her to suggest different strategies for managing policymaking contestations.

Urge-Vorsatz D. and Herrero S.H., 2012. Building synergies between climate change mitigation and energy poverty alleviation. *Energy Policy*, 49, pp.83-90.

Urge-Vorsatz and Herrero aim to provide policy links between energy poverty alleviation and climate change mitigation. As they argue, the two have, insofar, remained relatively distinct and disassociated policy spheres, despite their mutual interactions and common policy merits. The authors provide a bridge between energy poverty and climate change by placing the two at the heart of energy efficiency policy for buildings. Through an overview of the limited corresponding literature addressing energy efficiency in building, the authors offer a critique of the narrow definitions, which restrict further connections with energy efficiency policy goals. They argue that these definitions are narrow because they primarily focus on a single aspect of energy poverty (e.g. household heating) while completely ignoring other key-areas of energy poverty (e.g. cooling, lighting etc.). In order to remedy this conceptual gap, they provide a broader definition of energy poverty as: "encompassing the various sorts of affordability-related challenges of the provision of adequate energy services to the domestic space" (p.84). By doing so, they pave the way for further links between energy poverty and climate change, specifically targeted at energy efficiency policy for buildings.

2.4. Challenging behavioural assumptions of energy efficiency roll-out

The papers included in this theme collectively challenge the expectations attached to the roll-out of energy efficiency improvements. Fundamentally, they emphasise how inserting new energy efficiency technologies into people's lives is not a clear-cut, simple, or linear process. For instance, on one side, embedding energy efficiency technologies is dependent on people being prepared to make them part of their everyday lives, and on the other side, that integration may also affect people's lives. The papers argue that energy efficiency roll-outs cannot be understood as technological innovations that will one-directionally shape people's lives and lead to energy efficiency, but that there is a mutual shaping and a dynamic relationship between energy efficiency and people's practices and behaviors. Deeper reflection on assumptions regarding energy efficiency roll-out can therefore help improve management of societal expectations of energy efficiency improvements, and then possibly also their roll-out effect.

Gram-Hanssen, K., 2013. Efficient technologies or user behaviour, which is the more important when reducing households' energy consumption? *Energy Efficiency*, 6, pp.447-457.

This paper questions whether it is the introduction of energy efficient appliances and houses or user behaviour, which is more important in shaping efficient energy consumption. Using a range of qualitative and quantitative datasets (mainly from Denmark), Gram-Hanssen argues that user behaviour is consistently at least as important as new energy efficiency technologies. Moreover, in the case of heating-related domestic consumption, the study showed that 40-50% of its variation can be explained by building characteristics (e.g. house size, year of construction), with householder characteristics only marginally influencing consumption. Nevertheless, the paper also showed that completely identical houses varied (by a factor of 2-3) with regard to heating consumption, mainly due to

user behaviour. All in all, this paper essentially argues that it is not helpful look at energy efficiency technologies/houses and behaviour as a binary. Rather, they both matter and are interrelated. Policymaking should therefore target both when designing policies towards energy consumption reductions.

Shove, E., 1998. Gaps, barriers and conceptual chasms: theories of technology transfer and energy in buildings. *Energy Policy*, 26, pp.1105-1112.

Shove argues that mainstream policy agendas assume that the reason for why energy savings are not achieved is due to 'non-technical barriers'; that is, people's behavior and its associated determinants. Moreover, the mainstream assumes that these non-technical barriers are identifiable and linear in terms of their cause-effects relationships with energy efficiency uptake, and, critically, that new technologies represent the solution and thus must be pursued. The main (perceived) challenge, then, is to convince users to buy new energy efficiency solutions and/or use them correctly. By using insights from the STS, Shove argues against this techno-economic position. Similar to the previous paper, she argues that social and technical dimensions are being inappropriately separated (often implicitly) by those working in building energy management. In response to this, she discusses how technical innovations are socially structured, and thereby argues for a fundamental critique of interventions that seek a simple solution through technology transfer.

Lutzenhiser, L., Cesafsky, L., Chappells, H., Gossard, M., Moezzi, M., Moran, D., Peters, J., Spahic, M., Stern, P., Simmons, E. and Wilhite, H., 2009. *Behavioral assumptions underlying California residential sector energy efficiency programs*. White Paper prepared for California Institute for Energy and Environment (CIEE) Behavior and Energy Program, Oakland: CIEE.

This white paper examines California's utility-managed energy efficiency programmes, and their behavioural assumptions of residential consumers embedded within those programmes. Specifically, it examines the assumptions present in the physical-technical-economic model (PTEM), which has shaped California's energy efficiency programmes since the mid-1970s. The PTEM was shown to be wrong, given that its underlying assumptions did not represent anything close to real-world dynamics and its associated energy-consuming behaviours. Uncertainties that the PTEM poorly dealt with included: interactions between consumption determinants (e.g. values, behaviours, building characteristics); actual programme experiences as opposed to policy expectations (e.g. in terms of actual energy savings and market uptake); and viabilities of alternative approaches (e.g. driving energy efficiency improvements). The paper also discusses various Social Scientific reviews of energy efficiency programmes and paradigms, on route to generating recommendations for both research and policy. For policymakers and programme managers, the paper recommended that: policy conversations need to be reframed to better reflect Social Scientific evidence; they need to embed experimental and pilot-focused approaches to innovation; and, that craft knowledge needs to be better accounted for.

Sorrell, S., 2009. Jevons' Paradox revisited: The evidence for backfire from improved energy efficiency. *Energy Policy*, 34(4), pp.1456-1469.

Jevons' Paradox - as per William Stanley Jevons' original argument in 1865 - asserts that economically-justified energy efficiency interventions will increase energy consumption. If true, then the implications for low-carbon energy transitions and associated policy programmes will be significant, given that the default expectation is that energy efficiency will reduce energy consumption. Sorrell argues that most of the literature that has engaged with Jevons' Paradox has been overly theoretical and ultimately inconclusive. In this paper, he therefore attempts to test out the Paradox by connecting it to the literature on 'rebound effects'. This paper argues that whilst it is very unlikely that all energy efficiency improvement will lead to increases in energy consumption (or as the rebound effect literature would refer to it as, 'backfire'), it is possible. Hence there is much to still be learned from the factors that make said backfire in energy consumption more or less likely to happen. Evidence also suggested that Jevons' Paradox was more likely to hold for different types of improvements, e.g. electric motors in the early 1900s as opposed to modern thermal insulation improvements. From this, the policy message was that rebound effects (i.e. economic-led reductions in the potential energy savings achievable through energy efficiency upgrades) matter, are inevitable, and warrant further consideration by research and policy communities alike.

2.5. Lived experiences of energy efficiency

In this theme, the papers put more emphasis on the direct experiences individuals and collectives have with energy efficiency measures, how these are adopted in their everyday lives, and whether they lead to the

intended outcomes. SSH research addresses experiences predominantly as activities that are performed together with others and that interact with material settings and technologies. The papers below open several new ways in which lived experiences are discussed: as a concern about whether users' well-being is reduced by energy efficiency measures; as difficulties experienced in the practical implementation of energy efficiency; and, as embodied experience connected to practices that imply energy consumption. Together, they all refocus energy efficiency debates back onto the users and call attention to the complexity of their experiences and the multiple dynamics of their everyday lives.

Ornetzeder, M., Wicher, M. and Suschek-Berger, J., 2016. User satisfaction and well-being in energy efficient office buildings: Evidence from cutting-edge projects in Austria. *Energy and Buildings*, 118, pp.18-26.

This paper looks more closely at the various connections between the lived experience and well-being of occupants and the energy efficiency in office buildings. Ornetzeder et al. use mixed methods to study two highly energy efficient buildings and a larger sample of office buildings. Using a socio-material perspective, the authors assume that energy use and well-being are influenced by both the building and non-technical factors, such as work satisfaction and relations between occupants. The main finding of the study is that there is no systematic correlation between well-being and energy use. They identify three main factors that explain this finding: occupants compared experiences with the building with previous experiences in other buildings; building management and operation had an important influence on occupant well-being; and, the available area per occupant, for example in the form of break-out rooms, was in one case positively correlated with occupant well-being. Of these three factors, only the last one is more directly related to energy efficiency, but its effect can be neutralised by the other factors.

Gram-Hanssen, K., Christensen, T.H. and Petersen, P. E., 2012. Air-to-air heat pumps in real-life use: Are potential savings achieved or are they transformed into increased comfort?. *Energy and Buildings*, 53(10), pp.64-73.

In techno-economic analyses, the term 'rebound effect' describes situations in which energy saving directly or indirectly causes increases in energy consumption, for instance through reduced energy demand, which in turn lowers energy prices. In this paper, the relevance of this term is tested for a specific form of rebound which is connected to changes in what users do and experience after they have acquired and installed energy saving devices. The case studied was air-to-air heat pumps installed in Danish buildings. Based on a survey, which was analysed using a regression analysis, qualitative interviews, and technical inspections, the authors found solid evidence for actual energy savings falling behind the technical potential. For Danish summer houses, this effect was calculated to be 100% (i.e. no energy saving); for regular homes, this effect was less pronounced, 26%, but still significant. The main factor responsible for this rebound effect was identified as the changes in heating practices to achieve higher norms for comfort. Gram-Hanssen et al. conclude the paper with a call for the acknowledgement of such socio-economic phenomena in policymaking, for example through adding progressive energy tariffs to the promotion of energy efficient technologies.

Hansen, A.R. 2018. 'Sticky' Energy Practices: The Impact of Childhood and Early Adulthood Experience on Later Energy Consumption Practices. *Energy Research & Social Science*, 46, pp.125–39.

Norms about what level of energy consumption is 'normal' differ greatly between individuals, households, and cultures. In this paper, the role of early childhood and early adulthood experiences is analysed for their influence on adult energy consumption. Hansen compared energy use, sociodemographic factors, and attributes of the inhabited building and its installations in three cohorts of individuals at different points in time: during their childhood, in early adulthood, and as adults. Household characteristics from childhood and early adulthood contributed significantly to variations in energy consumption, including when the study controlled factors such as income and characteristics of the current building. This finding corroborates the hypothesis that individual energy consumption levels are related to embodied experiences, which are acquired in the formative years of childhood and early adulthood, and which at least partly persist during the rest of the life. The paper demonstrates that just as taste and cultural preferences are a part of a 'habitus' (as shown in the classic study by Bourdieu), preferences for heating and hot water consumption are deeply rooted in personal history and are an integral part of the user's individuality. The most important practical implications of this research is that material and social surroundings do form expectations about what is seen as 'normal' energy consumption, but they do so in the most pronounced way only early in an individual's life. This both sheds light on what can be expected from future energy consumers, whose formative experiences

are made now, and it should moderate exaggerated expectations regarding the effectiveness of technical, economic, or informational interventions around energy efficiency.

Murto, P., Jalas, M., Juntunen, J. and Hyysalo, S., 2019. The difficult process of adopting a comprehensive energy retrofit in housing companies: Barriers posed by nascent markets and complicated calculability. *Energy Policy*, 132, pp.955-964.

In this paper, a user perspective on energy retrofit markets is presented, which sheds light on reasons for the slow adaptation of comprehensive energy retrofits. The study is based on field notes of researchers who conduct a potential comprehensive energy retrofit and interviews with housing company representatives that had undergone such a retrofit. Particularly one assumption that is taken for granted when talking about markets turned out to be wrong: the object purchased on the market – comprehensive energy retrofit – is far from clearly defined as it depends on a large number of input variables that are needed to identify suitable solutions for a particular site and building. The process of acquiring this information was additionally made more difficult by market actors providing contradictory information, and by varying availability of data about the building. This led to high degrees of uncertainty and complexity despite considerable efforts to succeed. The interviews with housing company representatives confirmed these findings. Despite having more technical expertise than regular end-users, they often had hired help from energy consultants. These intermediaries, however, were hard to find and were recruited through pre-existing networks and happenstance. The article concludes with recommending more widespread public support for energy counseling services and other intermediaries that close the gap between solutions that are available on the market and the potential users of these solutions.

2.6. Moving to issues of energy demand

An influential body of recent literature aims to move beyond techno-economic framings of energy efficiency, towards more holistic understandings of energy demand and how it can be reduced. This work draws largely on Sociology and on Science and Technology Studies (STS), and is informed by historical and philosophical perspectives, as well as responding directly to the limitations of energy efficiency approaches (such as rebound effects) that have been identified within more technical literatures. These critiques have crystallised particularly clearly in the last five years, but build on decades of energy-SSH research, as well as on the concept of 'sufficiency', which originated in sustainability and justice literatures, drawing on philosophical debates about needs. Work within this field pays attention to 'what energy is for' (the services that energy provides), opening up questions about how these services could be provided differently. For example, how shifted timings or altered standards and expectations can reduce energy demand. The papers in this section therefore call for systemic approaches to energy, within both research and policy, that recognise the diverse ways that policies shape and steer energy demand.

Alexander, J.K., 2008. *The Mantra of Efficiency: From Waterwheel to Social Control*. Baltimore: The Johns Hopkins University Press.

In this book, Alexander explores how the concept of efficiency has evolved in modern history, from a simple measure of the thermal economy of a machine, to much wider applications across different spheres of technology, economy and society. She uses six historical case studies (from Britain, France, Germany, and the United States) to illustrate the concept's development, including the 'efficiency craze' of the twentieth century, which was said involve a societal-wide pursuit of efficiency across sectors. Alexander suggests that efficiency fundamentally entails the pursuit of mastery through techniques of surveillance, discipline, and control. In particular, she argues that since the mid-nineteenth century, efficiency has been seen as a way of overcoming natural limits to facilitate progress and growth; this goal, and recent ecological challenges to it, directly inform current debates on sufficiency. While the book is not directly on energy efficiency, it therefore provides valuable context to issues currently high on energy policy and research agendas.

Shove, E., 2017. What is wrong with energy efficiency? *Building Research & Information*, 46(7), pp.1-11.

This influential recent paper distills criticisms of energy efficiency that have developed over several decades within sociological energy research. Shove argues that established criticisms of energy efficiency, including those which focus on rebound problems, rarely challenge the basic idea of 'efficiency'. This paper offers a more fundamental critique, arguing that, far from being a solution, the current notion of efficiency can undermine reductions in actual energy use. This is because policies that promote energy efficiency often reinforce

energy-intensive ways of life, and lock in expectations about the levels of service that energy provides; for example, expectations about services of comfort, lighting and mobility. While not presenting concrete policy prescriptions, the paper raises the possibility of crafting buildings and equipment that do not meet present needs, and that do not deliver equivalent levels of service, but that do enable and sustain much lower-carbon ways of living. Shove suggests fostering forms of design, manufacture and planning that actively unpick carbon dependency, giving the example of providing householders and office workers with opportunities to adapt to their thermal conditions (e.g. through building design), and so enabling different interpretations of comfort. The paper is also significant in having sparked debate, including a response from authors defending energy efficiency (Fawcett and Rosenow's 2017 Commentary[2]), with a further response by Shove in 2018[3].

Labanca, L. and Bertoldi, P., 2018. Beyond energy efficiency and individual behaviours: policy insights from social practice theories. *Energy Policy*, 115, pp.494-502.

This paper presents a critical analysis of the idea of energy efficiency, building on SSH concepts similar to those of Shove (2017) above, but offering a more explicit focus on current policy and the provision of recommendations. The paper argues that policies based on energy efficiency have limited impacts because they are based on quantitative estimates of reductions in energy inputs and neglect how qualitative changes in the energy outputs can offset these reductions. For example, more energy efficient engines can enable the production of larger cars, which consume more energy overall. It suggests that radically alternative policies should target qualitative changes and re-organisations in energy outputs, aiming at 'doing better' with less energy, rather than 'doing more'. To achieve this, the authors call for 'governance on the inside', which refers to (among other things): greater democratic participation of citizens in energy transitions; use of qualitative approaches that recognise diverse types of expertise, perspectives and interests; and support for upscaling grassroots innovations.

Rinkinen, J., Shove, E. and Marsden, G., 2020. *Conceptualising Demand: Distinctive approaches to consumption and practice*. London: Routledge.

This recent book brings together many of the arguments about efficiency and demand that have been mentioned so far in this theme, with a particular focus on identifying and challenging assumptions about energy 'needs' that are embedded across policies, investments, energy models and other aspects of governance. The foundational idea of the book is that resources such as energy are consumed in accomplishing social practices: activities in everyday life such as heating, cooling, commuting and laundering. Energy demand is an outcome of these practices, and the social, institutional and material arrangements that structure them; not simply an outcome of individual choices and technical efficiency. Furthermore, the amount of energy (and the timing of energy provision) that these practices require is not fixed, but changes over time. Building on this, the authors argue that energy demand is *made* and not simply met; and that it is influenced, deliberately or not, by many forms of policy and governance. They also highlight differences in how demand is understood in different fields, which the energy field could learn from. For example, in the transport sector, demand is often seen as derived from what people do (for more on this, see the Annotated Bibliography by Suboticki et al., 2021) – a useful interpretation of demand that has rarely been applied to energy use in buildings. They also suggest that energy policy could benefit from considering the concept of an obesogenic environment (an environment that favours habits that contribute to obesity) which has informed more holistic approaches to interventions within public health. Such innovative thinking could inform approaches that recognise and work with the multiple ways that policies can shape practices and their energy demands.

Darby, S. and Fawcett, T., 2018. *Energy sufficiency: an introduction*. Concept Paper. European Council for an Energy Efficient Economy: Stockholm.

From 2017 to 2020, the European Council for an Energy Efficient Economy (eceee) ran the Energy Sufficiency Project, aiming to explore and operationalise this emerging concept within energy research. Among a number of events and publications, the project produced this Concept Paper that offers a helpful introduction to the idea of energy sufficiency, building on the authors' own work dating back to 2007, as well as on notions of sufficiency and needs within wider literatures on sustainability and ethics. The paper reviews research literature on sufficiency, incorporating ideas from recent work on 'doughnut economics' (which is

2 https://bricommunity.net/2017/11/02/what-is-right-with-energy-efficiency/
3 https://bricommunity.net/2018/01/04/commentary-writing-the-wrongs-of-energy-efficiency/

based on the idea that there is a safe and just space for humanity that lies between a minimum foundation of meeting basic human needs, and the upper ceiling set by planetary limits). The paper defines energy sufficiency as "*a state in which people's basic needs for energy services are met equitably and ecological limits are respected*". In highlighting policy implications, the authors note that energy sufficiency requires consideration of equity; for example, an energy sufficiency approach might prioritise investing in the building stock so that *all* housing would be of sufficient quality to allow those on low incomes to experience adequate thermal comfort. Developing 'sufficient energy services' could also include prioritising the use of ambient, untraded energy services (e.g. passive house design, natural cooling and ventilation); valuing and enabling adaptive and non-expert ways of achieving comfort in buildings; and developing people's skills and practical know-how to facilitate this.

3. Concluding remarks

This annotated bibliography set out to capture the breadth and diversity of SSH scholarship on energy efficiency. As mentioned, this is not an extensive review, but aims to give a taste of what energy efficiency SSH has to offer to broaden research agendas and strengthen policy-responses aimed at energy efficiency improvements. Whilst there has been a traditional deployment of SSH to focus on 'users' of new technologies and systems, the literature presented here shows a wide back-catalogue of examples that clearly demonstrate the broader application of SSH ideas on furthering and critiquing the energy efficiency agenda.

SSH ultimately problematises the notion that energy efficiency in a number of ways. It unpacks and consequently challenges the normative assumptions and framings which guide energy efficiency policies and programs. Most notably, it challenges expectations which posit energy efficiency efforts as neutral and simple. The annotations give insight into how energy efficiency can be distributed and affect people differently, how different people and users may experience and adapt to them in diverse ways, and consequently, how its roll-out is intimately linked to the everyday lives of its users. With a broader understanding of both what energy efficiency entails and how it may transform energy use and users, the literature collectively points to the need to diversify understandings of energy efficiency transition pathways. Some scholars also question if it is indeed the most appropriate, default path for (demand-focused) energy policy initiatives. It is clear that many SSH researchers feel inherently uncomfortable in pursuing the normative agenda of energy efficiency; although many SSH researchers would seem to nevertheless agree that energy efficiency improvements should happen, but with more realistic expectations (relating to e.g. unintended consequences) and as part of a wider set of intervention priorities that also considers changes to everyday life (in line with e.g. energy sufficiency arguments).

All in all, this literature is an important contribution to both review previous energy efficiency outcomes and programmes, and to critically engage with the future energy efficiency agenda.

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5. References

European Parliament and Council, 2012. Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC. Available: https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX:32012L0027 [Accessed 10 February 2021].

Foulds, C. and Christensen, T.H., 2016. Funding Pathways to a Low-carbon Transition. *Nature Energy*, 1(7), pp.1–4.

Foulds, C., Bharucha, Z.P., Krupnik, S., de Geus, T., Suboticki, I., Royston, S. and Ryghaug, M., 2019a. *An approach to identifying future Social Sciences & Humanities energy research priorities for Horizon Europe: Working Group guidelines for systematic Horizon Scanning*. Cambridge: Energy-SHIFTS.

Foulds, C., Genard, Q., Berker, T. and Bharucha, Z.P., 2019b. *Terms of Reference: Energy-SHIFTS Working Group 3 – Energy Efficiency*. Cambridge: Energy-SHIFTS.

Foulds, C., Royston, S., Berker, T., Nakopoulou, E., Abram, S., Ančić, B., Arapostathis, E., Badescu, G., Bull, R., Cohen, J., Dunlop, T., Dunphy, N., Dupont, C., Fischer, C., Gram-Hanssen, K., Grandclément, C., Heiskanen, E., Labanca, N., Jeliazkova, M., Jörgens, H., Keller, M., Kern, F., Lombardi, P., Mourik, R., Ornetzeder, M., Pearson, P., Rohracher, H., Sahakian, M., Sari, R., Standal, K. and Živčič, L., 2020. *100 Social Sciences and Humanities priority research questions for energy efficiency in Horizon Europe*. Cambridge: Energy-SHIFTS.

Overland, I. and Sovacool, B.K., 2020. The misallocation of climate research funding. *Energy Research & Social Science*, 62, pp.101349.

Robison, R. and Foulds, C., 2019. *7 principles for energy-SSH in Horizon Europe: SHAPE ENERGY Research & Innovation Agenda 2020-2030*. Cambridge: SHAPE ENERGY.

Robison, R., Skjølsvold, T.M., Lehne, J., Judson, E., Pechancová, V., Foulds, C., Bilous, L., Büscher, C., Carrus, G., Darby, S., Demirbağ-Kaplan, M., Douzou, S., Drevenšek, M., Frantál, B., Guimarães Pereira, A., Hargreaves, T., Karvonen, A., Katzeff, C., Kola-Bezka, M., Laakso, S., Lettmayer, G., March, H., Parag, Y., Renstroem, S., Sáfián, F., Swora, M., Tjørring, L., van der Werff, E., van Vliet, B., Wallenborn, G., Wolsink, M. and Wyckmans, A. 2020. *100 Social Sciences and Humanities priority research questions for smart consumption in Horizon Europe*. Cambridge: Energy-SHIFTS.

Royston, S. and Foulds, C., 2021. The making of energy evidence: How exclusions of Social Sciences and Humanities are reproduced (and what researchers can do about it), *Energy Research & Social Science*, 77, pp.102084.

Ryghaug, M., Suboticki, I., de Geus, T., Loorbach, D., Foulds, C. and Bharucha, Z.P., 2019. *Terms of Reference: Energy-SHIFTS Working Group 4 – Transport and Mobility*. Cambridge: Energy-SHIFTS.

Ryghaug, M., Suboticki, I., von Wirth, T., Smeds, E., Scherrer, A., Foulds, C., Bertolini, L., Beyazit, E., Brand, R., Cohen-Blankshtain, G. Dijk, M., Freudendal-Pedersen, M., Gössling, S., Guzik, R., Kivimaa, P., Klöckner, C., Nikolova, C.L., Lis, A., Marquet, O., Milakis, D., Mladenović, M.N., Mom, G., Mullen, C., Ortar, N., Paola, P., Oliveira, C.S., Schwanen, T., Seidenglanz, D., Tuvikene, T. and Wentland, A., 2020. *100 Social Sciences and Humanities priority research questions for transport and mobility in Horizon Europe*. Cambridge: Energy- SHIFTS.

Suboticki, I., Ryghaug, M., Smeds, E., Valler, T.M., Scherrer, A., Haugeland, B.T., von Wirth, T., 2021. *Transport and Mobility – a Social Sciences and Humanities annotated bibliography*. Cambridge: Energy-SHIFTS.

von Wirth, T., Loorbach, D., Wagner, A., Koretskaya, O., Wade, R., Krupnik, S., Rudek, T., Foulds, C., Adem, C., Akerboom, S., Batel, S., Caspar Rabitz, F., Certoma C., Cherp, A., Chodkowska-Miszczuk, J., Denac, M., Dokupilová, D., Dotterud Leiren, M., Frolova Ignatieva, M., Gabaldón-Estevan, D., Horta, A., Karnøe, P., Lilliestam, J., Markard, J., Mišik, M., Mühlemeier, S., Nemoz, S., Nilsson, M., Osička, J., Papamikrouli, L., Pellizioni, L., Sareen, S., Sarrica, M., Seyfang, G., Smith Stegen, K., Sovacool, B., Telesiene, A., and Zapletalova, V., 2020. *100 Social Sciences and Humanities priority research questions for renewable energy in Horizon* Europe. Cambridge: Energy-SHIFTS.

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