



HAL
open science

1 Imagining energy futures: an introduction

Sarah Pink, Nathalie Ortar, Karen Walторp, Simone Abram

► **To cite this version:**

Sarah Pink, Nathalie Ortar, Karen Walторp, Simone Abram. 1 Imagining energy futures: an introduction. Simone Abram; Karen Walторp; Nathalie Ortar; Sarah Pink. Energy Futures: Anthropocene Challenges, Emerging Technologies and Everyday Life, De Gruyter, pp.1-24, 2022, 9783110745627. <10.1515/9783110745641-002>. <halshs-03918529>

HAL Id: halshs-03918529

<https://shs.hal.science/halshs-03918529v1>

Submitted on 25 Nov 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

Chapter 1

IMAGINING ENERGY FUTURES: AN INTRODUCTION

Sarah Pink, Nathalie Ortar, Karen Walторp and Simone Abram

Abram, Simone, Karen Walторp, Nathalie Ortar, and Sarah Pink, eds. 2022. *Energy Futures: Anthropocene Challenges, Emerging Technologies and Everyday Life*. Berlin: De Gruyter.

Energy and Futures are inextricably entangled in the narratives, hopes and concerns of the second decade of the twenty first century: hope for climate health is invested in an energy transition to renewable sources; the need to forecast energy demand better occupies electricity networks; engineers develop new technologies with the techno-solutionist promise of solving energy problems; governments, industry stakeholders and academic reviewers make choices about which energy focused research agendas and projects to fund on the basis of their projected or expected future impact; electric car batteries are charged so that they will be ready for anticipated journeys; and everyday energy demand at home is often constituted through the mundane routines through which people in diverse circumstances accomplish what they need to do in order to be able to move forward in life. In short, energy is bound up with the different stakeholders, scales and temporalities through which futures are imagined, desired, feared, planned or prepared for and anticipated, across diverse continents, countries, regions, neighbourhoods, communities and lives. During the period of writing this book we have also seen how demand for and access to energy has shifted during a global pandemic, climate events and war.

This means that to understand how and where energy is significant and meaningful to the lives of people, non-human species, and environments, we need to go beyond the conventional anthropological focus on the present immediately related to the past. Instead we thus need to engage with the question of how energy is entangled with futures. To do so is not only a step into a new temporality for energy anthropologies, it is also an inescapably critical step. It calls for us to ask how energy futures are being predicted, projected, and ostensibly shaped, by diverse stakeholders, and to consider our own role as anthropologists in proposing and ultimately seeking to direct, different ways forward to answer challenges that have in recent scholarship often been associated with the concept of the anthropocene.

Energy Futures addresses these circumstances. Born of a collaboration between energy anthropologists and futures anthropologists it brings anthropological expertise to insist on a rigorously analytical anthropology of energy, which is attentive to both the uncertainty and contingency of futures, and the creative capacity of people to improvise as they move forward into circumstances about which their knowledge will always be incomplete.

In what follows we first critically review dominant visions for and of energy futures. We reveal how they are complicit with colonisation, capitalism, narratives of technological solutionism and how they generally fail to understand, acknowledge or attend to people as participants in energy futures. We then examine the conceptual foundations of a futures anthropology and energy anthropology approach to outline how they open up alternative ways of conceptualising energy futures. We discuss the methodological implications of this move towards future-focused energy anthropologies and analyses. We emphasise the need for change in the kinds and orientations of energy research funding. Finally we outline the book and its contributions.

Dominant visions of energy futures: forecasting and transition

Energy futures are not new - there has long been a need and intent to consider the future of energy production, demand and supply and the future of the planet and human lives, as well as government and corporate concerns which all of these impact. Formal energy futures have typically been quantified, existing in realms dominated by engineering, economics and capital. Climate futures likewise have conventionally been quantified, by scientists, activists and anyone who is trying to make a powerful point about environmental impacts, climate change or otherwise, given the power of numbers to carry weight in political debate. The 3D's —Decarbonization, De-centralization and Digitalization (Silvestre et al. 2018) or - 4Ds Decarbonization, Deregulation, Digitalization and Democratization (DEEP 2018) are expected, respectively, to be drivers in creating the green energy economy of the future and to transform the energy market. Yet, energy and climate futures are also experiential domains, they can be understood and imagined through non-representational ways of knowing, including through deep indigenous knowledges of environment and country, in mundane moments of everyday life anywhere or during extreme weather and other climate events. We turn to these later; first we outline the dominant visions with which they are frequently in tension.

Global visions

Given the devastating impacts that global energy production is having on the earth's climate, changing energy systems is an urgent global concern. There are many and diverse interests at stake, and a correspondingly wide range of future imaginaries at play in thinking about energy futures. However, global political and investment strategies are normally based on quantified and technological assessments of potential solutions. Strategies for change, from those of United Nations (UN) Conference of the Parties' (COPs) to national and local agendas, most commonly call on a fairly narrow range of future projections supplied by agencies such as the World Energy Council (WEC) or International Energy Agency (IEA), or by commercial organisations such as BP. As Mudttun and Baumgartner pointed out some decades ago, although this kind of forecasting and modelling has been treated as technocratic and "neutral", they have "often been used for partisan purposes to push through, or oppose, certain energy developments" (1986: 219), leading to clashes between industry-related and ecological forecasts that are so familiar today. The WEC¹ produces World Energy Scenarios, which they emphasise "are designed to be used as a set to explore and navigate what might happen, not what should happen or what we want to happen"². They offer three possible quantified scenarios, validated by consultation with their expert members based on surveys with leaders, which they recommend are used to "provide a useful, pre-decision thinking framework to help energy leaders engage with deep uncertainties and anticipate possible energy transition pathways"³. To achieve low carbon scenarios the report identifies, "consumer behaviour needs changing"⁴. The IEA is an Organisation for Economic Co-operation and Development (OECD) agency governed by energy ministers or senior representatives from member countries, and meets every two years to determine its scope of work and budget. It is, in other words, explicitly a political organisation and although it professes to be fuel and technology ambivalent, it was founded in 1974 in response to the oil crisis⁵. Despite the consensus that models are by nature flawed, and despite the glaring possibility that industry projections could be self-serving, global predictions for continued and increasing demand for energy consumption were

often rehearsed in project meetings, and invoked as introductory stage-setting to inject urgency into problem-solving activities. The World Economic Forum (WEF) also has a Global Future Council on Energy Transition⁶ which, it says, "will provide a vision for the transition to a more sustainable, inclusive and affordable post-COVID world". Its work is based on the assumption that technology solutions to our energy futures exist and should be deployed. Its report suggests that "Like all technology-led transitions, the energy transition will unleash significant creative destruction, create large new opportunities for wealth formation, and will ultimately lead to greater prosperity and major societal benefits. Nevertheless, there will also be transition costs that need to be minimized and taken into account"⁷. No anthropologists appear in its list of 26 members.

If these views of energy futures continue to dominate, the world will be in much trouble. The evidence from anthropology is that the strategies of treating people as "consumers" whose "behaviour needs changing" (as the WEC does), or assuming that "technology-led transitions" will lead to "societal benefits" (as the WEF does), are based on unrealistic understandings of people and our relations with technology, and are therefore at great risk of failure. Rather, to work towards realistic, sustainable, ethical and equitable futures, we need to acknowledge people in their diversity, for their ways of knowing and for their creativity. We believe these dominant approaches are misguided and problematic, but we do not wish to stop at critique. We want to open up a productive dialogue, and we seek to shift a situation where dominant narratives are unable to account for the very issues that anthropological analysis demonstrates also need to be addressed? Anthropology complicates the narratives of global visions of energy futures, it generates new layers of uncertainty and proposes radical new ways forward. But, we argue, it needs to participate. The essential task is to generate a constructive anthropological voice in this global domain. This book is a step in this direction.

National Forecasting and modelling

Modelling and forecasting is part of the way global visions are developed, but in the energy industry quantitative forecasting also plays a key role at the national level in seeking to determine how energy demand will take shape in the future and what infrastructure and other investments and policies are needed to respond to and influence this. The examples of two countries we discuss in this book demonstrate how this quantitative process involves multiple stakeholders from government and industry. In the UK, National Grid produces annual Future Scenarios based on a two-by-two grid with axes such as "speed of decarbonisation" versus "level of decentralisation" (National Grid 2019). These use technical models such as UKTimes to project possible outcomes based on different rates of change. A closer look at National Grid scenarios shows these axes changing over time, with 2017 axes being "prosperity" versus "green ambition", while in 2020 and 2021, they adopted the axes: "level of societal change / speed of decarbonisation", with a clear acknowledgement of the complexity of the challenge, "not least because there are many ways to reach net zero, each with their own trade-offs."⁸ The scenarios claim to offer "four different, credible pathways for the future of energy over the next 30 years"; whereas earlier scenarios included an option of "business as usual", all of the so-called pathways in the more recent scenarios move significantly towards decarbonisation, at different degrees of urgency. The possible options have changed not primarily due to changing technology but due to the growing acceptance across the energy industries that responsibility to address climate change lies with them. Alongside this change comes an acknowledgement that such responsibility does not lie entirely within the scope of technological change or infrastructural improvement, but encompasses changes with either

social impact or a social basis. Yet, as argued above, there is a distinct lack of acknowledgement of a broad set of social science arguments, and a tendency to fall back on environmental psychology through which to create "social acceptance".

Yolande Strengers, Sarah Pink and Larissa Nicholls (2019) have analysed existing approaches to energy forecasting, noting how similar logics inform these quantitative exercises across the UK, Australia and Europe: the UK National Grid Future Energy Scenarios claim that "by providing a range of credible futures, we can be confident that the reality will be captured somewhere within that range" (National Grid 2016, cited in Strengers et al 2021: 2); while the Australian Government's national science agency's (CSIRO)⁹ major visioning project - the Future Grid Forum - proposed "to inform and inspire a national conversation and provide a way forward for the sector, its stakeholders and, most importantly, all Australians" (CSIRO 2013, cited in Strengers et al 2021: 14). The Australian Energy Market Operator (AEMO), manages Australia's electricity and gas systems and markets¹⁰. AEMO "has produced electricity demand forecasts for the National Electricity Market (NEM) since 2012"¹¹ and does so drawing on diverse data sources relevant to the task, including data relating to consumer trends, climate change and EV uptake¹². However existing forecasting methods have not always predicted shifts in demand. For instance in the case of Australia the emergence of peak demand relating to air conditioning on extreme heat days, led to electricity grid failures. These instances have demonstrated the need for deeper understandings of how human futures are likely to impact on the futures that forecasting modelling and scenario building seeks to predict (Strengers et al. 2019).¹³

Transition and decarbonisation

Other energy future projections are developed in the Transition Management field, with the aim to get to Net Zero emissions by particular end dates. Transition Management approaches seek to bring about step changes in energy systems and how people use energy. Yet they lack attention to the everyday worlds and the contingent circumstances that shape what people do with energy (Sharpe et al 2022).

The current energy transition to renewables involves a structural shift from fossil fuels such as oil, gas and coal to renewable energy sources such as solar, wind, biogas and changing everyday life practices. It is debated in the arenas of academia, business, government and industry, but often in ways that either disregard everyday worlds, or see them and the people who inhabit them as posing a behavioural challenge or barrier to energy efficient and sustainable futures and the technological solutions that are supposed to bring them about. The very choice of the term "transition" downplays the turmoil and conflict caused by energetic uncertainty as transitionist imaginaries suggest a gentle, gradual, consensual change and tend to depoliticize its real implications (Loloum et al. 2021). As anthropologists have shown, renewable energies are also part of the long succession of abuses and exploitation of human and natural resources carried out by foreign actors with the complicity of local actors (Howe 2015), as discussed in Chapter 5. To convert solar energy into electricity depends on the same extractive industries, globalised production networks, and electronic waste streams that characterised the industrial exploitation of resources, land, and labour (Cross 2019). Wind or solar parks have social effects on the regions that host them and are part of unequal power relations, both north-south or north-north (Knight and Argenti 2015).

Transition management, when envisioned as individual responsibilities to deliver visions of desired futures, moreover assumes that it is possible to be granted "social licence" from people

(classified as consumers, users, publics or citizens) to implement change, which they will subsequently adapt their everyday lives to. There have recently been attempts to meaningfully engage the concept of social licence - a term most commonly used in the context of the extractive industries - into discussions about energy transition, supply and demand side management. The term was engaged by the Australian Council of Learned Academies 2020 *Australian Energy Transition Research Plan*¹⁴, and in a 2021 international Technology Collaboration Programme (TCP) report, *Social License to Automate*¹⁵. For Sophie Adams and colleagues, SLA [Social License to Automate] "provides a framework to understand the (mis)alignments between the expectations of actors within the energy system on the one hand, and household practices, sense of control and stake in the energy system, on the other" and reveals the negotiations that occur in each domain (Adams et al 2021: 2). It is debatable whether engaging terminologies and concepts which originate in the extractive industries is the right position for anthropologists. However, as presented by Adams and colleagues, it takes a step forward informed by the social sciences to offer a more nuanced and realistic approach, in terms of creating dialogue and engagement in ways recognisable to industry and government stakeholders. Yet such alignments simultaneously risks both diluting arguments for a more radical paradigm shift in how everyday worlds and automated energy systems might be co-constituted and exacerbating existing power relations.

Both energy forecasting and Transition Management approaches project into the future, the former working forward towards particular years, and the latter working backwards from a desired outcome. However, the reality is that precisely how everyday energy futures will come about is impossible to know, and without acknowledging and seeking to work with the messiness and contingency of the everyday such approaches are difficult to apply.

Automation, digital capitalism and digital colonialism

As climate change and the consequences of global heating intensify, transnational and local public institutions and industries continue to place their bets on digitalisation as a technical solution to the problem of carbon emissions (Szeman & Boyer 2017). Industries proclaim a "fourth industrial revolution" based on AI and cloud computing (Schwab 2016) and likewise industry and consultancy reports assume that emerging digital and automated technologies will be solutions to problems of energy demand and supply and will assist in the transition to net zero emissions (Dahlgren et al 2020), discussed in chapter 2. Energy companies turn to the technology industries to find "smart" solutions to the intermittency of renewable energy and to the increased pressures put on local and national grids by the ongoing electrification and digitalisation of transport and industrial production, regarding digital technologies as sources of grid stability (Blondeel *et al.* 2021: 11).

Emerging automated systems and devices offer technological possibilities, on the basis of which it is possible for organisations to build other technologically driven future imaginaries, thus making them not only infrastructures that support the delivery of energy management systems and change processes, but they can be interpreted as "anticipatory infrastructures" upon which other future imaginaries are built (Pink et al 2022, and chapters 4 and 5 this volume). In the case of energy futures these technologies enable imaginaries of automated technologies that will manage energy demand, such as automated wireless charging systems, energy demand management systems that take control of energy supply to household devices out of the hands of householders.

The context of the growing and possible further automation of the energy industry is envisioned to bring many benefits. Yet in doing so, like the ambitions towards energy transition discussed earlier, its limitation is that stakeholders in this field have tended to engage with people as consumers, whose behaviour may be changed through the application of technological solutions, once they trust and accept them. These logics are typical across industry and government approaches to emerging technologies (Pink 2022a), and are entrenched in the dominant technologically solutionist narratives of contemporary society. Moreover, this world where technologies are increasingly automated and connected, itself requires vast amounts of ambient energy, which in turn requires new digital infrastructure (Bresnihan & Brodie 2020). This includes the immense energy demand of data storage facilities, discussed in chapter 4, as well as the further energy costs associated with the resource extraction required for, the production of, transportation, installation and maintenance of these technologies. The lack of attention to both people and to the "invisible" costs of automated and connected technologies in energy futures, relates to the wider issue of how imagined, envisioned and planned energy futures are both embedded in and could exacerbate existing inequalities and colonial continuations as chapter 5 elaborates on: both within countries and in terms of how their costs are unequally distributed across the world.

One aspect of this is the growth of what has been called *digital capitalism*, whereby "the accumulation of capital, decision-power and reputation are mediated by and organised with the help of digital technologies and where economic, political and cultural processes result in digital goods and digital structures" (Fuchs 2022: 28). Digital capitalism is often discussed in dystopian narratives, warning of what could happen if its logics were to play out, often through existing examples which highlight how inequalities have come about through unethical uses of automated and connected technologies. For example, building on approaches that study platforms as infrastructural intermediaries in everyday life and positioning digital platforms within the political economy/ecology literature on rent(ierism), Jathan Sadowski (2020: 13) critically defines platforms as a dominant form of rentier in contemporary capitalism through data extraction, digital enclosure, and capital convergence (Van Dijck & Poell 2015). Sadowski argues that platforms have latched onto and inserted themselves into the production, circulation, or consumption process. By doing so platforms capture rents from all economic activity it mediates and as such should be considered as an evolution and expansion of rentier capitalism. The *digital inequalities* associated with digital capitalism are manifold. The production of big data as a commodity involves processes best understood as accumulation through dispossession (Harvey 2004): as technology users enter into tacit data licence agreements with the firms that create and control the technology, they are dispossessed of the right to control those data. This could provide the preconditions for a new stage of capitalism that can barely be imagined, but for which the appropriation of human life through data would be central (Thatcher et al. 2016). Government data have also imposed a new regime of surveillance, profiling, punishment, containment and exclusion worsening inequality (Eubanks 2018). Inequalities are also woven throughout "the digital inequality stack in many ways from differentiated access, use, and consumption, literacies and skills, and production" (Robinson et al. 2020).

These possible generic effects of digital technologies are coupled with the exclusionary nature of digital networks which are built and imagined in such ways to exclude or include certain people and places, as discussed in chapter 4 and 5. Copper and fibre optic cables constitute Internet, and show how the invisible "cloud" connecting devices and data is rather a material set of cables, servers, and antennas, with implications for both politics, histories and imaginaries (Hu 2015,

Furlong 2021, Maguire et al. 2021, Starosielski 2015, Thylstrup 2019). Nicole Starosielski (2015) highlights that cable connections are often built through - rather than to - coastal and other rural communities that host secure cable landing and access points making them outposts for tech and telecoms companies operating and delivering services elsewhere. Moreover, through its very infrastructures, the resources needed and its access, the cloud is at the origin of what has been called *data colonialism* which combines the predatory extractive practises of historical colonialism with the abstract quantification methods of computing (Couldry & Mejias 2019) creating new forms of inequalities between the global North and South. To store data and have it ready to hand, data centres have repurposed the industrial and military infrastructures of the 20th century, connecting "our digital present to our industrial past" (Pickren 2018: 22; Furlong 2021, see also chapter 4). It is not only the "natural" cooling of northern climates which are making northern countries aspiring hubs of the new digital economy (Brodie 2020; Johnson, 2019; Vonderau 2018; Velkova 2021) but also their connections to major cable networks, which were laid across colonial routes of oceanic trade and communication (Furlong 2021). As argued by Nick Couldry and Ulises Mejias (2019), digital colonialism's future incidence is still unknown "as the scale of this transformation means that it is premature to map the forms of capitalism that will emerge from it on a global scale".

These possible digital and technological energy futures are frightening, and it is urgent for us to attend to them. The existing literature reveals their possibilities and their logics, often focusing on a likely progression to dystopian ends. They warn us of what could happen. However these do not need to represent the realities of our energy futures. In fact the dystopian narratives of critical social theorists frequently fail to account for the capacity of people to disengage, to not participate in the automated futures they portray. The ethnographic evidence is that people do not necessarily sign up for the journey towards dystopian digital futures (Pink et al 2022), and specifically that they often do not envisage themselves relinquishing control of their data, energy systems and access to energy companies or other organisations (Pink 2022b).

The evolving relationship between emerging digital and automated technologies and our local and global energy futures needs considerably more work. There is an important role for anthropologists who can be sensitive to how change happens, how power relations are enacted, how inequalities are experienced, and what these questions mean for intervention. It is to the role of anthropology in our energy futures that we turn our attention in the next section.

Thinking energy futures anthropologically

The need to attend to energy futures anthropologically, in attending how technical approaches tend to close the field of possibilities has long since been part of anthropologies of energy. In the 1980s, Laura Nader (1981) pointed out the inconsistencies of a system "founded on the deleterious fear of change in lifestyles 'despite' the very wide range of lifestyle choices available in any plausible energy future" (Nader 2010: 241). So how can energy futures be envisaged? How can current systems and infrastructures be turned around? How can whole countries across the globe move from carbon states to decarbonised states? Who will imagine the road from C to D? And what knowledge will they rely on to start that journey?

Science studies tell us how crucial the imagination is in generating particular futures, and the actions and policies that flow from it. Janet Stewart shows how the visual language of fossil technologies colonises the everyday imagination from which futures are conjured (Stewart 2016), making extraordinary global claims appear to be little more than common sense through a teleological narrative. Theorists such as John Law have shown how models and metaphors have been implicated in the shaping of modern states (1986), with data emerging early on as an essential governmental technology for 'acting at a distance', to govern distant territories and trades. A number of sociologists and historians have shown how numbers, statistics, calculability and probabilities have supported the science of the state - political science - in shaping political agendas. Miller and Rose showed how double entry book keeping came to define the budgetary systems of modern states, defining which elements could be quantified and therefore recognised by the state (1990), while Hacking (1986) showed how these enumerations led to the "making up of people" who would reflect the categories defined by calculable quantities - observations developed in Ruppert and Scheel's study of how central data practices are to the making of a people at the European level (2021).

These socio-technical principles apply equally to energy futures, shaped as they are by the technological imaginaries of their designers, the engineers and mathematicians who model current and postulated energy systems, defining as they go along the limits to possibility, and embedding cultural expectations and judgements into the evaluation of technological designs. Hence, it is important to look at how new technologies are brought into practice, and how infrastructures are shaped and controlled. This task speaks directly to current concerns in social anthropology of addressing hybrid-social worlds, that is, socio-material, socio-technical, and beyond-human articulations. Examining how technologies are imagined, crafted and adopted becomes an anthropological lens through which to unpack the terminologies and concepts that support and are supported by technological imaginaries. What are the actions at a distance performed by electrical grids, for example? What are the limits to possibility of the notion of "energy" itself? (see Abram et al 2019, Daggett 2019, Anand et al 2018).

Research into energy transitions has shown how the technical systems in place lead to inertia and limit not only possible action in the future (Nader 1981, Araújo 2014) but frame a specific thinking that prevents the ability to "shift gears" (Nader 2004). For Mette High and Jessica Smith, the alleged inevitability of the energy transition "hamper[s] our ability to engage and respond to it" (2019: 11) by narrowing the universe of possibilities. The existing methods of scenario planning and forecasting used in the energy sector often tend to prioritise and limit the possible futures (Strengers et al. 2019). High and Smith (2019: 11) argue that "the overall framework of energy transitions has narrowed the scope of how anthropologists understand and engage in ethical dilemmas posed by energy". Understanding these dilemmas therefore presents new challenges for anthropology to include the questions, desires and concerns of diverse but interdependent groups of people.

Such thinking, which accounts for the future, is now present in the majority of anthropological energy research, whether it relates to the exploitation of oil (Weszkalnys 2016; Witte 2018), new fossil resources (Szolucha 2018) or renewable energies (Boyer & Howe 2019; Knight 2012, 2018), or to the imagined futures of smart grids and the automation of residential energy supply (Pink 2022b). Energy resources and infrastructure - existing or planned - generate "citizen hopes, desires and aspirations" (Weszkalnys 2016: 161) that "saturate the conceptions of time and the future"

(Ferry 2016: 185). This growing emphasis on futures in energy anthropology has coincided with a significant expansion of interest in the anthropology of the future, and futures anthropologies (Collins 2020). This creates new opportunities to engage with energy futures through anthropology, and to indeed understand all anthropological futures research as inevitably having something to say about possible energy futures, given the inevitability of energy across the sites of all anthropological investigation.

However, the turn to futures in anthropology is not one unified move, rather it comes from and stands for divergent theoretical threads and conceptual categories. This means that the approach to futures in anthropology which is followed has analytical consequences, and subsequently informs both the nature of the stories that we are able to tell from our ethnographies and the interventions we are able to make. That is not to say necessarily that one approach is better than the other, but that we should carefully consider which we take in any given set of circumstances, because theory has effects. In academia the theoretical approach we take will mean that our work is accepted, or dialogued with, by certain camps within the discipline. In interdisciplinary collaborations the concepts we engage may open or close particular shared interdisciplinary categories, debates and ways of knowing. Moreover, in engaged research, theory can limit or enable the kinds of interventions we make.

Chapter 2 suggests how such differences might play out. There we compare two anthropological approaches to futures: Rebecca Bryant and Daniel Knight's (2020) anthropology of the future on the one hand, and on the other Sarah Pink and Juan F. Salazar's (2017) futures anthropology. These are two very different ways of looking at futures in anthropology, to the extent that they do not dialogue with each other in these two works. Bryant and Knight's work is a study of anticipation in everyday life in the present, based on the social practice theory (SPT) of Theodore Schatzki. Pink and Salazar in contrast argue for a radical departure from the anthropology of the present, towards a futures anthropology that roots itself in the contingent nature of present and futures. The relevance of this approach for everyday life, is that coming together with design anthropology, it builds on the growing emphasis in anthropology on indeterminacy, uncertainty (Pink, Akama et al 2015) the imagination (Sneath et al 2009), emergence (Smith and Otto 2016) and a more generally processual (rather than culturalist) underpinning to anthropological thought (Ingold 2000). In chapter 2 Sarah Pink and co-authors engage both design anthropological and SPT approaches, demonstrating how approaches informed by SPT produce opportunities to trace futures in the present, while futures anthropology approaches with their leaning towards design anthropology enable more interventional approaches that seek to engage with futures as modes of generative uncertainty (Akama et al 2018) as much as to study them.

Chapter 3 engages directly with the governance of energy futures through the technological imaginaries and the hopes and fears they generate or confront. Thinking *with* the generation of energy and the resources and commitments that go into changing energy systems and regimes, the chapter addresses a shift in anthropological focus from studies of anticipation to the contradictory horizons that different futures appear to offer (cf Guyer 2007). The chapter considers how different kinds of energy futures are both envisaged and contested in relation to different moments that shape so-called energy transitions, showing how divergent understandings can become positioned as "resistance" or "conflict", while some are considered apolitical. It shows how closely energy futures are entangled into technologies of government, bringing the STS critique of governance into dialogue with discussions about energy infrastructures and recent research on extractivism.

Chapter 4 engages with futures through digitalisation and the planning of data infrastructures and consumption. It examines how their futures are planned and to which effect, and attends to the everyday implications of these infrastructures on the future of neighbouring communities as well as the future ecologies they are producing. Data centres, it reveals, are paradoxical infrastructure as they are “both solid and durable and evaporative and itinerant; it is built and grown, rigid and fluid, meant to last but doomed to be outmoded, ruined, and exceeded.” (Howe et al 2015). As such, data centres enabled and accelerated many of the effects associated with the anthropocene, and yet might be the best way to ameliorate the contemporary predicament. To engage with their future theoretically the authors engage with the anticipatory temporalities that drive the data centre industry (Hu 2015; Taylor 2021; 2022) and the implication of “preparedness” a notion loosely defined by Frédéric Keck (2016) as “a state of vigilance cultivated through the imagination of disaster”. Through preparedness anthropologists grasp dystopian future scenarios produced by practitioners and which threatening events - which can range from pandemic outbreaks to cyberattacks to extreme weather events – are constructed as inevitable and unpreventable, but potentially manageable (Taylor 2021).

Data centres thus participate in an “economy of anticipation” (Cross 2015) in which socio-technical imaginaries are used to divert attention from the present (Abram & Weszkalnys 2013) and build local and national accounts of a data driven desirable future. These socio-technical imaginaries participate in a “solutionist” (Morozov 2013) innovation paradigm, whereby the futures they imagine often pronounce technological solutions to human and environmental problems, assuming that neither people nor the environment have agency in such processes. Velkova (2021: 665) defines this as a thermopolitics of data, to grasp these dynamics, and the economic and social relations that they install, as they support conservative agendas, which - even when presented as disruptive - are likely to be appropriated by powerful stakeholders in strategies that maintain the status quo and develop digital capitalism. In chapter 4 Nathalie Ortar and co-authors (dis)entangle these narratives through ethnography as a gesture to shed light on how the various stakeholders build their legitimacies through an economy of anticipation and by doing so try to close down alternatives futures.

In chapter 5, the future anthropologies agenda (Salazar et al 2017) as detailed and discussed in chapter 2 is extended further in a move to unsettle a solutionist paradigm and pay attention to other ways of relating to landscapes, resources and energies than the “standing reserve” (Heidegger 1977, Waltpop et al. forthcoming) logic of extraction for growth without limit. Waltpop has engaged with how various flows of images across physical, digital, and imaginal realms figure in people’s lives, relations, and futures, in ways that means having your phone charged of utmost importance (Waltpop 2017, 2020, 2021). Chapter 5 looks at what it takes to enable such a flow of images in a digitalised world; and shows that water is primary across field sites in Chile and Botswana with varying effects. Water is needed to produce energy, it is needed to cool down the cables that connect, and as we see in chapter 4; the data centres that store our data. At the same time digital infrastructures are also enabling alliances of circulating images in mainstream and social media with indigenous people fighting for their approach to land and resources as in northern Norway; and in Southern Africa there is no wish to not have this infrastructure and access, yet the Tech giants entering the region are energy hungry. The consequences for the electricity system is increased pressure in a situation of recurrent scheduled blackouts. Chapter 5 engages with research on extractivism that chapter 3 introduces and further engages with the regional colonial histories, asking what continuations exist in terms of whose techno-social imaginaries and futures come to count and carry more weight in terms of what is deemed preferable, probable and even possible.

Chapter 5 argues for engaging with decolonial scholarship, activism and alliances to open up more possible energy futures that have people and environment at the centre, and challenge the sedimented logic of treating the earth and other beings as standing reserves in a way that makes ourselves standing reserves in the end.

What's next?

Funding energy futures research

In energy-related research and innovation the vast majority of funding has gone to the natural and technical sciences (Overland and Sovacool, 2020) and efforts towards interdisciplinarity have had limited effect (Baum and Bartkowski, 2020). As Horizon Europe (FP9) was about to release its first funding calls for 2021-2022, the European Commission maintained its commitment both to mainstreaming Social Sciences and Humanities (SSH) across all of its funded research and to creating opportunities for dedicated SSH-led research where needed. Much of this research, and for instance the French research programme or the energy research programme of the CNRS, is likely to be predominantly technical and natural science-led. It is these contexts – of strategic change in European research and innovation, and renewed commitments to SSH without exact clarity on what forms this may take – that provide the foundations of four reports on the 100 priority SSH research questions for four key topics associated with the EU Energy Union. These four SSH key questions are renewables (von With et al. 2020), smart consumption (Robison et al. 2020), energy efficiency (Foulds et al. 2020) and transport and mobility (Ryghaug et al. 2020). These topics were set to align with existing EC research and innovation funding priorities, as part of contributing to EU energy policy commitments. The hope is to provide the EC with resources to support reflection on alternative possibilities of energy-SSH.

Within the propositions of what should be funded, three topics relate to energy futures as framed in this book: The need to explore various cultural aspects of the role of socio-technical imaginaries in transitions towards a renewables-based energy system as socio-technical imaginaries impacts transition dynamics and anthropologists are trained in addressing this according to geographical differences, and specific interconnections with dominant energy regimes (von Wirth et al. 2020). Transport is one of the major Co2 emitters. The roles of different trends, solutions and technologies need to be explored as narratives and imaginaries of fossil free and low-carbon mobility cultures emerge (Ryghaug et al. 2020). Energy transitions require institutional change as current energy consumption patterns are embedded in institutional power dynamics (Flipo et al. 2021). How citizens and communities can become empowered through smart technologies and how energy justice can be achieved should thus be questioned (Foulds et al. 2020). Underlying those questions and intrinsically linked to the argument of this volume is the need to explore alternative futures to go beyond the actual corporation and capitalism regime.

There is clear evidence of social science and humanities narratives excluded from energy funding calls and government consultations in Europe (Royston and Foulds 2021), and we hope to spark a broader conversation around how these excluded disciplines, including anthropology, can contribute to energy policy and research. Chapter 2 illustrates how well-designed stories, like comic strips depicting industry imaginaries about e-cars and everyday life, create an atmosphere to explore knowledge in a situated, context-dependent way (Mourik et al. 2021). We argue that

storytelling can form the foundation for inclusive and participatory future thinking and visioning and echo the Future Anthropologies Manifesto (in Salazar et al 2017: 1-2) calling for “a politics of listening attuned to a diversity of voices and (we) tell stories that are imaginative, illustrative and informative.” Chapter 4 highlights that ethnography used as a method to “follow the network” helps unravel the entanglement between infrastructures and stakeholders' narratives of the futures and the everyday and futures effects of an economy of anticipation. Chapter 5 shows the friction in differently conceived energy futures, and the unequal colonial structures continued in who gets to articulate and define the energy future and resource extraction. The chapter points to the potential in different localised struggles, imaginaries, and ways of relating to land locally toward a more sustainable future - these need to be made more visible in mainstream energy transition policies and politics. This book demonstrates the important steps that can be taken when anthropological research into energy futures is funded. These opportunities have not only enabled us to contribute knowledge and practice but also to develop and propose the vision for energy anthropology futures outlined in this introduction. However, we argue that approaches to funding need to change, anthropology needs to be recognised as a leader in energy research, as a discipline able to understand and move forward with other disciplines and stakeholders. Anthropological perspectives can design approaches that lead to the just, fair, equitable and sustainable solutions that are so often proposed to be the underpinning aims of funding calls, in ways that science and engineering approaches simply do not have the capacity to.

Methodologies for energy futures

An interventional anthropology for energy futures needs new methodologies, and a new methodological openness to the approaches of other disciplines and stakeholders. If we are to have a chance to influence the course of energy futures we need to be able to collaborate with disciplines and organisations in this field, both through our own research strengths and by applying our anthropological sensitivity to understand other ways of being and seeing to our own in the contexts of collaboration and the other actors involved.

As implied throughout this introduction, both immersive long term ethnography and a range of increasingly experimental applications of ethnography - represented across the chapters of this book - form an important basis of response to the dominant narratives, practices, and assumptions which we wish to complicate and intervene in. Ethnographic practice foregrounds new narratives, other possible futures, and stories that are frequently invisible in the agendas towards transition to net zero and the assumptions that emerging automated and connected technologies will solve societal and global energy problems. It involves sharing aspects of peoples' lives with them in the present, and as they experience possible futures in order to comprehend the sensory, affective and expressive modes through which energy futures coalesce, how these configure with the global, local and everyday circumstances of life, and how these circumstances configure and reconfigure over time.

Anthropological ethnography must also take seriously the everyday ethics (Mattingly & Throop 2018) of both the people and situations in which we do fieldwork and of ethnographic practice. As anthropologists working in the energy futures field we have an ethical responsibility to our participants, in the conventional sense of fieldwork ethics. But don't we also have a responsibility to go beyond accounting for how energy is implicated in the circumstances of their lives and

futures, and to also engage what we learn *with* them towards energy futures that are just and fair? Anthropological ethnography can show how energy futures are situated in relation to the multiplicity of things, other species, processes and possibilities that people and energy are co-implicated with. It thus enables us to surface these modes of connectedness and relationality. Energy futures emerge not in a vacuum but in worlds already full of politics, power and taken-for-granted notions of what works and how. Ethnography makes these relations visible and their implications obvious. Both as a general principle, and in a move that pulls into view the very differentiated cultural taken-for-granted ways that these relations, their implications and the ways they are experienced play out in different places and across different scales. These relations, visible through ethnography play out different connections and logics to the causal chains of top-down transition focused and technological solutions that dominate in the narratives outlined earlier in this introduction. However to ensure that we can make these differences, and their implications clear, we need methodologies for engagement.

Therefore, to confront energy futures we need to be methodologically bold as outlined in the future anthropologies network's (FAN) collectively developed manifesto (in Salazar et al 2017: 1-2). The first three points identify futures anthropologists as: critical and "engaged with confronting and intervening in the challenges of contested and controversial futures"; collaboration without fear of contamination or incapacity from exposure to other disciplines; and de-centring the human to embrace "larger ecologies and technological entanglements". Each of these points resonates strongly with the methodologies we need to engage for an energy futures anthropology, and is played out in the following chapters as we show how our work contests the dominant narratives outlined above, engages with other disciplines and stakeholders to go forward together, and accounts for environments, other species and technologies as participants with humans, in emerging energy futures.

The futures anthropology manifesto is also strongly interventional. Futures anthropologists "get our hands dirty" and "we are ethical, political and interventionist and take responsibility for interventions" (in Salazar 2017 et al: 2). Methods for making energy anthropologies public and interventional are emerging across both examples discussed in this book and more broadly amongst anthropologists of energy. They include: new modes of reporting ethnographic energy futures in ways that dialogue with industry reporting (eg Dahlgren et al 2020, Strengers et al 2021, Nicholls et al 2021); new techniques of visualising possible futures and therefore making the issues themselves visible to diverse groups of stakeholders (Dahlgren et al 2021, and chapter 2); new models of writing and co-authorship across projects and places, such as that developed in this book, and by James Maguire and colleagues in 2021; creating new modes of storytelling about energy futures accessible across academic and other sectors, including documentary filmmaking, such as *Digital Energy Futures* (Pink 2022b); making interactive websites tracing encounters between logics and feral ecologies growing out of- but beyond the control of- human built infrastructures as in the "Feral Atlas" of the More-than-Human Anthropocene (Tsing, Deger, Saxena and Zhou 2021) creating new materials for intervention, such as design cards (see Pink et al 2017); hackathons (Flipo et al 2022); future speculative design scenarios of colour packaging for waste reduction, theatre with janitors and inhabitants in social housing areas, and creating waste robots in collaborations between students, Industry stakeholders and local inhabitants as was done in the course and book project "Question Waste: Experiments between ethnography and design" (Waltorp and Halse 2013, Dresner et al. 2013)

Energy futures anthropology methodologies are currently developing in the light of the need for new approaches to researching possible futures ethnographically, interdisciplinary and as part of stakeholder partnered projects, and driven by the impulse for intervention. This creates a dynamic field of activity which we expect to develop further as energy futures anthropology gains ground.

About *Energy Futures*, the book

This book was written collectively by a team of 24 authors spread across the world, during a global pandemic. It is structured into four key chapters, as outlined earlier, each of which was curated by one of the book's editors but co-authored with our collaborators. Each chapter addresses key issues and arguments relating to its respective area of focus. Importantly each chapter also pivots its discussion around a set of *ethnographic cases* each authored by the contributors to the book and based on their own fieldwork. The chapters can be read in any order or as single pieces of work.

References

- Abram, S., Weszkalnys, G. (2013). *Elusive promises: Planning in the contemporary world*. Berghahn Books.
- Abram, S., Winthereik, B. R. & Yarrow, T. (Eds). (2019). *Electrifying Anthropology. Exploring Electrical Practices and Infrastructures*. Bloomsbury Academic.
- Adams, S., Kuch, D., Diamond, L., Fröhlich, P., Henriksen, I. M., Katzeff, C., Ryghaug, M. & Yilmaz, S. (2021). Social license to automate: A critical review of emerging approaches to electricity demand management. *Energy Research & Social Science*, 80, 102210. <https://doi.org/10.1016/j.erss.2021.102210>
- Anand, N, Gupta, A. & Appel, H. (2018). *The Promise of Infrastructure*. Durham and London: Duke University Press.
- Appadurai, A. (2013). *The Future as a Cultural Fact: Essays on the Global Condition*. Verso.
- Baer, H., & Singer, M. (2014). *The Anthropology of Climate Change: An Integrated Critical Perspective*. Routledge.
- Baum, C.M. & Bartkowski, B. (2020). It's not all about funding: Fostering interdisciplinary collaborations in sustainability research from a European perspective. *Energy Research & Social Science*, 70, 101723.
- Blondeel, M., Bradshaw, M.J., Bridge, G. & Kuzemko, C. (2021). The Geopolitics of Energy System Transformation: A Review. *Geography Compass*, 15(7), 1-22. <https://doi.org/10.1111/gec3.12580>.
- Boyer, D. & Howe, C. (2019). *Wind and power in the Anthropocene*. Duke University Press.
- Bresnihan, P. & Brodie, P. (2020). New Extractive Frontiers in Ireland and the Moebius Strip of Wind/Data. *Environment and Planning E: Nature and Space* 0 (0). <https://doi.org/10.1177/2514848620970121>.

Brodie, P. (2020). Climate extraction and supply chains of data. *Media, Culture & Society*, 42(7–8), 1095–1114. <https://doi.org/10.1177/0163443720904601>

Bryant, R., & Knight, D. (2019). *The Anthropology of the Future*. Cambridge University Press.
Collins, S. G. (2008). *All Tomorrow's Cultures: Anthropological Engagements with the Future*. Berghahn.

Couldry, N., & Mejias, U. A. (2019). Data Colonialism: Rethinking Big Data's Relation to the Contemporary Subject. *Television & New Media*, 20(4), 336–349. <https://doi.org/10.1177/1527476418796632>

Cross, J. (2019). The solar good: Energy ethics in poor markets. *Journal of the Royal Anthropological Institute*, 25(S1), 47–66. <https://doi.org/10.1111/1467-9655.13014>
———. (2015). The Economy of Anticipation: Hope, Infrastructure, and Economic Zones in South India. *Comparative Studies of South Asia, Africa and the Middle East* 35(3): 424–437.

CSIRO (2013). *Change and Choice: the Future Grid Forum's Analysis of Australia's Potential Electricity Pathways to 2050*. Newcastle.

Daggett, C. N. (2019). *The Birth of Energy: Fossil fuels, thermodynamics and the politics of work*. Durham and London: Duke University Press.

DEEP (2018, November 18). The 4Ds Transforming the Energy Market. *Medium*. <https://medium.com/@d33p/the-4ds-transforming-the-energy-market-1fb61fba385e>.

Dahlgren, K, Pink, S, Strengers, Y, Nicholls, L, Sadowski, J. (2020). Digital energy futures: review of industry trends, visions and scenarios for the home. Emerging Technologies Research Lab. Monash University. https://www.monash.edu/__data/assets/pdf_file/0008/2242754/Digital-Energy-Futures-Report.pdf.

Dahlgren, K, Pink, S, Strengers, Y, Nicholls, L, Sadowski, J. (2021). Personalization and the Smart Home: questioning techno-hedonist imaginaries. *Convergence*. 27(5):1155-1169. doi:[10.1177/13548565211036801](https://doi.org/10.1177/13548565211036801).

Eubanks, V. (2018) *Automating Inequality: How High-Tech Tools Profile, Police, and Punish the Poor*. Picador, St Martin's Press

Ferry, E. (2016). Claiming Futures. *Journal of the Royal Anthropological Institute*, 22(S1), 181–188

Flipo, A., Sallustio, M., Ortar, N., & Senil, N. (2021). Sustainable Mobility and the Institutional Lock-In: The Example of Rural France. *Sustainability*, 13(4). <https://doi.org/10.3390/su13042189>
Flipo, A., Sallustio, M., Senil, N., Mao, P., & Ortar, N. (2022) *Expériences de recherche-action avec les partenaires*. Paris: ADEME.

Foulds, C. et al., (2020). 100 Social Sciences and Humanities priority research questions for energy efficiency in Horizon Europe. Cambridge: Energy-SHIFTS.

Fuchs, C. (2022). *Digital Capitalism: Media, Communication and Society Volume Three*. Routledge.

Furlong, K. (2021). Geographies of infrastructure II: Concrete, cloud and layered (in)visibilities. *Progress in Human Geography*, 45(1), 190–198. <https://doi.org/10.1177/0309132520923098>

Guyer, J. (2007). Prophecy and the near future: Thoughts on macroeconomic, evangelical and punctuated time. *American Ethnologist*. 34(3): 409-421.

Hacking, I. (1986). Making up People. In T. C. Heller, M. Sosna and D. E. Wellberry *Reconstructing Individualism: Autonomy, Individuality and the Self in Western Thought*. Stanford University Press: 222-36.

Harvey, D. (2004). The 'New' Imperialism: Accumulation by Dispossession. *Socialist Register* 40: 64-87.

High, M. M. & Smith J. M. (2019). Introduction: the ethical constitution of energy dilemmas. *Journal of the Royal Anthropological Institute* 25, 9–28.

Howe, C., Lockrem, J., Appel, H., Hackett, E., Boyer, D., Hall, R., ... Mody, C. (2015). Paradoxical Infrastructures. Ruins, Retrofit, and Risk. *Science, Technology & Human Values*. <http://doi.org/10.1177/0162243915620017>.

Hu, T.-H. (2015). *A Prehistory of the Cloud*. The MIT Press.

Johnson, A. (2019). Data Centers as Infrastructural Inbetweens. *American Ethnologist*, 46, 75–88.

Keck, F. (2016). "Preparedness." Theorizing the Contemporary, *Fieldsights*, September 30. <https://culanth.org/fieldsights/preparedness>

Knight D. & Argenti, N. (2015). Sun, Wind and the Rebirth of Extractive Economies: Renewable energy investment and metanarratives of the crisis in Greece. *Journal of the Royal Anthropological Institute*, 4(21), <http://doi/10.1111/1467-9655.12287>.

Law, J. (1986). On the Methods of Long Distance Control: Vessels, Navigation and the Portuguese Route to India. In Law, J., (ed.), *Power, Action and Belief: a new Sociology of Knowledge?* (pp. 234–263). Routledge and Kegan Paul.

Loloum, T., Abram, S., & Ortar, N. (2021). Introduction: Politicizing Energy Anthropology. In T. Loloum, S. Abram, & N. Ortar (Eds.), *Ethnographies of Power: A Political Anthropology of Energy* (pp. 1–23). Berghahn.

Maguire, J., Watts L., & Winthereik, B.R. (Eds.) (2021). *Energy Worlds in Experiment*. Mattering Press.

- Midttun, A. & Baumgartner, T. (1986). Negotiating Energy Futures: The politics of energy forecasting. *Energy Policy*, 14(3), 219-241.
- Miller, P. & Rose, N. (1990). Governing Economic Life. *Economy and Society*, 19,1-31.
- Nader, L. (1980). *Energy Choices in a Democratic Society*. National Academy of Sciences.
- Nader, L. (1981). Barriers to Thinking New About Energy. *Physics Today* 34(9), 99–104.
- Nader, L. (2004). The Harder Path-Shifting Gears. *Anthropological Quarterly*, 77(4), 771–791.
- Nader, L. (Ed.). (2010). *The Energy Reader*. Wiley-Blackwell.
- National Grid (2016) National Grid Stakeholder Feedback Document 2016: Future Energy Scenarios
<http://fes.nationalgrid.com/media/1156/fes-2016-stakeholder-feedback-document.pdf>
- Ourossof, A. (2010). *Wall Street at War: The Secret Struggle for the Global Economy*. Polity Press.
- Overland, I. & Sovacool, B.K. (2020). The misallocation of climate research funding. *Energy Research & Social Science*, 62. 101349.
- Pickren, G. (2017). The Factories of the Past are Turning into the Data Centers of the Future. *Imaginations: Journal of Cross-Cultural Image Studies*, 8(2), 22–29.
- Pink, S., Lanzeni, D. & Horst, H. (2018). Data anxieties: Finding trust in everyday digital mess. *Big Data & Society*. <https://doi.org/10.1177/2053951718756685>
- Pink, S. (2022a). *Emerging Technologies: life at the edge of the future*. Routledge.
- Pink, S. (2022b). *Digital Energy Futures*. Documentary film. Emerging Technologies Research Lab, Monash University, Australia.
- Pink, S., Berg, M., Lupton, D. & Ruckenstein, M. (Eds.) (2022). *Everyday Automation: Experiencing and Anticipating Emerging Technologies*. Routledge.
- Robinson, L., et al. (2020). Digital inequalities 3.0: Emergent inequalities in the information age. *First Monday*, 25(7). <https://doi.org/10.5210/fm.v25i7.10844>
- Robison, R. et al. (2020). *100 Social Sciences and Humanities priority research questions for smart consumption in Horizon Europe*. Cambridge: Energy-SHIFTS.
- Rose, N. (1991). Governing by Numbers: Figuring Out Democracy. *Accounting, Organisation and Society* 16(7): 673-692.

Ruppert, E. & S. Scheel. (2021). *Data Practices: Making Up a European People*. Goldsmiths Press. London. 2021.

Ryghaug, M. et al., (2020). *100 Social Sciences and Humanities priority research questions for transport and mobility in Horizon Europe*. Cambridge: Energy-SHIFTS.

Sadowski, J. (2020). The Internet of Landlords: Digital Platforms and New Mechanisms of Rentier Capitalism. *Antipode* 52(2), 562-580.

Silvestre, M. L. D., Favuzza, S., Sanseverino, E. R., & Zizzo, G. (2018). How Decarbonization, Digitalization and Decentralization are changing key power infrastructures. *Renewable and Sustainable Energy Reviews*, 93, 483–498. <https://doi.org/10.1016/j.rser.2018.05.068>

Starosielski, N. (2015). *The Undersea Network*. Duke University Press.

Stewart, J. (2016) 'Visual culture studies and cultural sociology: extractive seeing.', in *The Sage handbook of cultural sociology* (pp. 322-334). Sage.

Strengers, Y., Pink, S. & Nicholls, L. (2019). Smart energy futures and social practice imaginaries: forecasting scenarios for pet care in Australian homes. *Energy Research and Social Science*, 48: 108-115.

Szeman, I., and D. Boyer (ed). (2017). *Energy Humanities: An Anthology*. Johns Hopkins University Press.

Schwab, K.. (2016). *The Fourth Industrial Revolution*. World Economic Forum.

Silvestre, M. L., Favuzza, S., Riva Sanseverino, E., & Zizzo, G. (2018). How Decarbonization, Digitalization and Decentralization Are Changing Key Power Infrastructures. *Renewable and Sustainable Energy Reviews* 93, 483–98. <https://doi.org/10.1016/j.rser.2018.05.068>.

Taylor, A.R.E. (2022). Bunkers, Data, Preparedness: From the Mushroom Cloud to the Computing Cloud. *New Media & Society*.

———. (2021). Future-proof: Bunkered Data Centres and the Selling of Ultra-secure Cloud Storage. *Journal of the Royal Anthropological Institute*, 26(S1), 76–94.

Thatcher, J., O’Sullivan, D. & Mahmoudi, D. (2016). Data colonialism through accumulation by dispossession: New metaphors for daily data. *Environment and Planning D: Society and Space*. 34(6), 990-1006. doi,[10.1177/0263775816633195](https://doi.org/10.1177/0263775816633195)

Thylstrup, N.B. (2019). *The Politics of Mass Digitization*. MIT Press.

Tsing, A., Deger, J., Saxena, A., & Zhou, F. (2021). *Feral Atlas: the more-than-human Anthropocene*. Stanford University Press.

von Wirth, T. et al. (2020). *100 Social Sciences and Humanities priority research questions for renewable energy in Horizon Europe*. Cambridge: Energy-SHIFTS.

van Dijck, J., Poell, T. (2015). Social Media and the Transformation of Public Space. *Social Media + Society* July. doi:[10.1177/2056305115622482](https://doi.org/10.1177/2056305115622482)

Velkova, J. (2021). Thermopolitics of Data: Cloud Infrastructures and Energy Futures. *Cultural Studies*, 35(4-5), 663-683. <https://doi.org/10.1080/09502386.2021.1895243>

Vonderau, A. (2018). Technologies of Imagination: Locating the Cloud in Sweden's Global North. *Imaginations: Journal of Cross Cultural Image Studies*, 8(2), 8–21.

Waltorp, K., D. Lanzeni, S. Pink. forthcoming. Introduction: An Anthropology of Technologies and Futures. *An Anthropology of Technologies and Futures*. London and New York: Routledge.

Waltorp, K. and ARTlife Film Collective (2021). Isomorphic Articulations: Notes from collaborative film-work in an Afghan-Danish Film Collective. In F. L.D. Puppo Martinez, & M. D. Frederiksen. (Anthropological Studies of Creativity and Perception). *Peripheral Methodologies: Unlearning, Not-Knowing and Ethnographic Limits*. Pp. 115-130. London: Routledge.

Waltorp, K. (2021). Multimodal Sorting: The Flow of Images Across Social Media and Anthropological Analysis. in A. Ballesterio and B. R. Winthereik (eds), *Experimenting with Ethnography*. Pp. 133-150. Durham: Duke University Press.

Waltorp, K. (2020). *Why Muslim Women and Smartphones: Mirror Images*. London: Routledge.

Waltorp, K. (2017). Digital technologies, dreams and disconcertment in anthropological worldmaking. In Salazar, J., Pink, S., Irving, A. and Sjöberg, J. (eds.). *Anthropologies and Futures: Researching Emerging and Uncertain Worlds*. Pp. 117-133. London: Bloomsbury.

Waltorp, K & Halse, J. (2013). Introduction. In *Question Waste - Experimental tactics between ethnography and design*. Dresner, J., Halse, J., Johansson, V., Troelsen, R. S. & Waltorp, K (eds.). Copenhagen: The Royal Danish Academy of Fine Arts, School of Design.

Weszkalnys, G. (2016). A doubtful hope: resource affect in a future oil economy. *Journal of the Royal Anthropological Institute*, 22(S1), 127–146.

Witte, A. (2018). *An Uncertain Future—Anticipating Oil in Uganda*, Göttingen, Göttingen Series in Social and Cultural Anthropology.

Notes

¹ <https://www.worldenergy.org/publications/entry/world-energy-scenarios-composing-energy-futures-to-2050>

² <https://www.worldenergy.org/transition-toolkit/world-energy-scenarios>

³ <https://www.worldenergy.org/transition-toolkit/world-energy-scenarios/long-term-world-energy-scenarios>

⁴ https://www.worldenergy.org/assets/downloads/World-Energy-Scenarios_Composing-energy-futures-to-2050_Executive-summary.pdf

⁵ <https://www.iea.org/about/mission> 24.2.21)

⁶ <https://www.weforum.org/communities/gfc-on-energy-transition>

⁷ https://www3.weforum.org/docs/WEF_Energy_transition_known_and_unknown_2020.pdf

⁸ National Grid FES2021: <https://www.nationalgrid.com/uk/stories/journey-to-net-zero-stories/eso-future-energy-scenarios-next-30-years> (accessed 15 January 2022)

⁹ <http://www.csiro.au/en/About>

¹⁰ <https://aemo.com.au/about/who-we-are>

¹¹ <https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/nem-forecasting-and-planning/forecasting-and-planning-data/nem-electricity-demand-forecasts>

¹² https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/electricity-demand-forecasting-methodology-information-paper.pdf?la=en

¹³ The Digital Energy Futures project led by Yolande Strengers and Sarah Pink in Australia (discussed in chapter 2) has subsequently worked with forecasters to develop new forecasting methods which will accommodate ethnographic futures insights.

¹⁴ <https://acola.org/wp-content/uploads/2021/06/acola-2021-australian-energy-transition-plan.pdf#page=31>

¹⁵ <https://userstep.org/wp-content/uploads/2021/10/Social-License-to-Automate-October-2021.pdf>